TABLE OF CONTENTS

U.S. ARMY AEROMEDICAL EVACUATION
STANDARD MEDICAL OPERATING GUIDELINES (SMOG)

FY26 Version

Published 26 November 2025

INTRODUCTION

The FY 2026 SMOG will combine the **STANDARD MEDICAL OPERATING GUIDELINES & SUPPLEMENTAL HANDBOOK** into one document. All changes are a result of collaboration between Emergency Medicine professionals, experienced Flight Paramedics, Aeromedical Physician Assistants, Critical Care Nurses, Flight Surgeons across the Department of War (DOW) and feedback from the units. There is close coordination in the development of these protocols with the Joint Trauma System and the Defense Committees on Trauma ensuring the protocols being placed in the SMOG are corresponding to our other resources (i.e. CPG's). Our shared goal is to ensure the highest quality enroute care possible and to standardize care across all evacuation/emergency medical pre-hospital units.

The SMOG is intended for CCFPs and prehospital professionals who manage emergencies and treat patients in both garrison, humanitarian, and combat theater environments IAW the current H-60 Aircrew Training Manual (ATM) Task 2120 and Appendix F. Unit Medical Directors are expected to adjust these protocols to fit their unit's mission and medical air crews' training/experience. Medical Directors or designated supervising physicians will endorse the SMOG upon appropriate adjustments based on the individual unit's mission. They will also manage individual unit medical missions within their Critical Care Flight Paramedics, Enroute Critical Care Nurses, and advanced practice aeromedical providers' scope of practice. CCFPs should administer medications as listed in these protocols unless their Medical Director and/or supervising physician orders deviation. Other medications and protocols may be added to the SMOG. The Medical Director for that unit will add those medications/protocols to the SMOG prior to signing the approval page.

Any medical guideline/protocol that is out of date or has been found to cause further harm will be updated or removed immediately. The Department of Aviation Medicine (DAM) serves as the managing editor of the SMOG and is responsible for content updates, managing the formal review process, and identifying SMOG Charter members for annual review. Well-constructed feedback from the units is imperative for future changes.

The SMOG provides medical procedural guidance and is in compliment to other Department of War and Department of the Army policies, regulations, and doctrinal guidance. Nothing herein overrides or supersedes laws, rules, regulation, or policies of the United States, Department of War, or Department of the Army.

MEDICAL DIRECTOR / UNIT COMMANDER REVIEW AND APPROVAL PAGE

The Standard Medical Operating Guidelines specify standard medical treatment protocols to be used by all Flight Paramedics and Medical Providers performing medical care while serving in this unit in any environment.

This SMOG and any attached adjustments are hereby established as standard protocols for the following unit:

_____

Date of Certification and Approval by all of the below: _____

Unit Medical Trainer Review:

This document has been reviewed by the below noted individuals for accuracy and mission applicability:

Medical Standardization Instructor Signature: _____ Date: _____

Medical Training NCO Signature: _____ Date: _____

Authorization:

The Standard Medical Operating Guidelines have been reviewed and approved for use by the undersigned.

Medical Director/Supervising Physician*

Name: _____

Signature of Approval: _____ Date: _____

Unit Commander

Name: _____

Signature of Approval: _____ Date: _____

*Additional Medical Director comments/addenda will be attached with signatures of Medical Director and Unit Commander to be valid.

Table of Contents

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

Standard Medical Operating Guidelines are found at the following website:

https://intelshare.intelink.gov/sites/DeptAviationMedicine

Also available, along with all fillable evacuation forms and AARs, on the Joint Trauma System website: https://jts.health.mil/index.cfm/CPGs/cpgs

All comments and / or recommendations should be sent to: SMOGWorkingGroup@army.mil with the subject line "CCFP-SMOG"

Editors' Note

As the FY26 SMOG was developed, structure and transparency were paramount. Throughout the year and a half since the last revision, we at the Department of Aviation Medicine have created processes and procedures to ensure the SMOG is revised, created, and distributed appropriately. More importantly, the processes have been built to create continuity and ensure that the SMOG can continue to be published efficiently without having to "recreate the wheel" after all previous editors have left the organization.

Throughout this document, references have been added to most protocols. The CPGs are the primary reference, but in cases where there is no CPG, an alternate reference has been added. All medication doses and information have been updated through an approved list of sources, which will be available for your review. This is to ensure that you, the end reader, are able to see where we derived the information in this document. Please use these references to do your own research. If there are mistakes or missing information, please contact us.

The SMOG will continue to be published on the JTS website. However, with the sunset of MilSuite, a new location needed to be found for DAM to post documents outside of just the SMOG. Intelink will be the new location for all documentation that DAM produces. This will include the Drug Quick Reference Card, that has been updated for ease of use, readability, and printability. The templates for protocols and medication cards will also be made available, so unit specific requirements may allow for additions to the SMOG. Future additions to Intelink will be based on internal decisions as well as recommendations from you.

Our goal at the end of the day is to create and provide a product that you are confident in to assist you in making critical medical decisions. Please help us in achieving that goal. DUSTOFF!

UNIVERSAL PATIENT CARE

Patient History

- Age of the patient
- Chief complaint
- Timing of events / event factors
- Other symptoms or complaints
- Patient's past medical history
- Other pertinent SAMPLE, OPQRST questions

Key Concepts

- Use MARCHES for trauma patients
  - Massive bleeding control
  - Airway
  - Respiratory
  - Circulation
  - Hypothermia care
  - Eye injuries
  - Spinal motion restriction
- Focused primary exam for non-traumatic illness / injury

Treatment / Actions

- Scene safety
  - Maintain situational awareness
  - Utilize appropriate PPE
- Initial assessment
  - Treat obvious and emergent life threats
  - MARCHES or Focused Primary Exam
  - Utilize BLS, ALS, and/or PALS guides as necessary
- Consider spinal immobilization
  - Dangerous MOI
  - Low risk MOI but unable to rotate neck 45°
  - Does not apply to situations where imminent danger exists
- Record vital signs and make appropriate transport decision
- Initial interventions
  - Supplemental O2
  - IV/IO (saline lock) as applicable
  - Medication/fluid administration (as indicated)
- Secondary assessment
  - 12 Lead EKG (as applicable)
  - ETCO2 (as applicable)
  - Secondary interventions
  - Pain management

Notes, Cautions, Warnings

- All patient encounters should be recorded on appropriate care documentation sheets per theater policies, unit SOPs and / or in accordance with JTS Documentation CPG at end of a patient encounter
- Any mishaps / errors should be brought to attention of the medical control ASAP
- Contact medical control for any necessary assistance when feasible
- Consider spinal immobilization if:
  - Fall from height (versus fall from standing)
  - Axial load to head
  - High speed collision, rollover, or ejection from any motorized vehicle
  - Explosion or blast injury
  - Trauma resulting in temporary amnesia/loss of consciousness

TACTICAL EVACUATION

Ground "Pick – Up" Phase

- Attempt to gain info prior to landing
- Ensure 360-degree scene security
- Collect medical information and patient documentation
- Triage casualties
- Treat all preventable causes of death IAW TCCC
- Package and secure patients for transport
- Brief and guide litter teams to aircraft
- Load and secure patients

Ground "Pick – Up" Phase (cont.)

- Goal on ground time < 5 min prior to wheels up
- If military working dogs (MWD) are present (injured or uninjured), subdue / muzzle MWD first, then treat all human casualties before treating injured MWDs

"In – Flight" Phase

- Triage casualties as required: reassess patients and interventions
- Hemorrhage control
  - Check / add tourniquet, pack / dress wound, pressure dressing, hemostatic dressing
  - Initiate blood (DCR)
- Airway / vent management
  - Reposition airway, nasopharyngeal airway, RSI (intubation / BIAD), cricothyroidotomy
  - Target SPO2 90-96%
- Chest trauma
  - Vented occlusive dressing, needle thoracostomy, finger thoracostomy, chest tube
- Hypothermia management
- Head injury / altered mental status
  - Monitor and treat for signs and symptoms of ICP (elevate head, 3% hypertonic saline, target ETCO2)
  - Monitor BGL
- Pain management
- Consider antibiotic therapy
- Document care

Notes, Cautions, Warnings

- Damage control resuscitation (DCR) order of precedence:
  - Control hemorrhage if able
  - Administer blood products
  - Consider TXA 2 g, over 10 min, < 3 hrs from injury
  - Calcium administration during or after 1st unit and after every 4th unit of blood (Calcium may be given before TXA)
  - Consider pressors (as a last resort)
- Replace any limb tourniquets placed over the uniform with one applied directly to the skin, 2-3 inches above the wound
- Maximize blood / fluid therapy prior to considering pressor administration
- At any time, if patient becomes pulseless and apneic go to **TRAUMATIC ARREST PROTOCOL**
- If tactical situation allows, load deceased patients on a separate transport
- Consider full RSI prior to advanced airway managements to prevent aspiration

MASCAL TRIAGE

Triage Principles

- Priorities change based on time from injury
- Activities in first hour are CRITICAL
- Don't waste time with formal triage tools
- Extricate/stop threat, stop external bleeding, clear airway
- Need for transfusion and ventilator support within the first hour identify a resource-intensive patient
- Damage control surgery has little impact after the first hour
- (COMBAT) Assume minimal will stay armed/engaged if no mental status-altering meds are given for pain
- Expectant category is ONLY used in combat operations and/or when the requirements to adequately treat these patients exceed the available resources. In peacetime, it is generally assumed that all patients have a chance of survival.

METHOD 1

Each Patient Triage Assessment Should be Completed in Less Than 60 Seconds

Category	Examples
Category I: Immediate (red chemlite)	• Any MARCH issue • Airway obstruction • Flail / open chest wound • Tension pneumothorax / hemothorax • Massive hemorrhage • 20 – 70% Burns • Unstable vital signs • Severe TBI (unconscious alive patient)
Category II: Delayed (green chemlite)	• Open fractures with PMS intact • Soft tissue injuries • Moderate TBI (stable vital signs) • Open abdominal wounds
Category III: Minimal (no chemlite) *remain armed, continue to engage	• Minor abrasions, burns, sprains, lacerations • Moderate / mild anxiety • Fractures / dislocations with PMS • Mild TBI
Category IV: Expectant (blue chemlite)	• Massive head or spinal injury • Third degree burns > 70% TBSA • Injuries incompatible with life

METHOD 2

START TRIAGE: Assess, Treat (use bystanders)
When you have a color: STOP – TAG – MOVE ON

MINOR	Move walking wounded		
DECEASED	No respirations AFTER head tilt		
IMMEDIATE	Breathing but unconscious		
	Respirations over 30		
	Capillary refill > 2 sec or no radial pulse *control the bleeding		
	Mental Status: unable to follow simple commands		
DELAYED	Otherwise		

Remember:
Respirations – 30
Perfusion – 2
Mental Status – Can Do

Reference: CPG ID 91 (Prolonged Casualty Care Guidelines)

AIRWAY (ADULT / PEDIATRIC)

Signs and Symptoms of Distress and / or Failure

- SPO2 decreasing < 90%, with / without supporting signs / symptoms of:
  - Tachypnea
  - Tachycardia
  - Fever
  - Cough
  - Adventitious breath sounds
  - Shock
- Difficulty breathing or excess work of breathing as demonstrated by:
  - Pursing lips
  - Accessory muscle involvement
  - Cyanosis
  - Dysphasia
  - Diaphoresis

Signs and Symptoms of Distress and / or Failure (cont.)

- Airway obstruction due to
  - Trauma
  - Edema
  - Excess secretions
  - Foreign body
  - Tongue
- Apnea
- Decreased LOC (GCS < 8)
- Pediatric patients are defined as < 12 years of age

Treatment

- Reposition airway via Jaw Thrust or Head Tilt Chin Lift. Provide shoulder padding for PEDs if required
  - Sweep (NOT BLIND) and suction as needed
  - ABD thrust or back slaps (for infants) if indicated
- Assess the need for an advanced airway (suspected deterioration, SpO2 < 90%, Burns with TBSA >40%, TBI with decreased LOC, TBI with suspected herniation, respiratory failure from disease/ infection/ injury)
- SpO2 < 90%
  - Start supplemental O2
  - Place NPA / OPA PRN if no contraindications
  - BVM or assist with respiration PRN
  - Recheck q 5 minutes
- Consider direct laryngoscopy to visualize foreign body obstruction; If present remove, suction, and / or provide abdominal compressions or back slaps for pediatric patients
- Establish an advanced airway per procedure in the following sequence (move to the next procedure per individual competencies, contraindications, and/or attempt failures)
  - Endotracheal intubation
  - Blind Insertion Airway Device (BIAD)
  - Cricothyroidotomy
- After first failed airway attempt
  - Reassess interventions
  - Restart protocol
  - Consider other causes
- Continuous monitoring of ETCO2, SPO2, and ventilatory waveforms and pressures
  - Repeat sedative, analgesic, and paralytic per dose and time guidelines
- **In the event of 2 failed airway attempts conduct the following**:
  - If adequate ventilation with BVM possible; continue BVM
  - If adequate ventilation with BVM is **NOT** possible; perform cricothyroidotomy

PEARLS

- If able to ventilate with a BVM, insert NPA or OPA dependent on contraindication and continue ventilating with BVM
- Ventilate patient per age-appropriate respiratory rate to maintain minute ventilation

Reference: CPG ID: #12 (Burn Care); #39 (Airway Management of Traumatic Injuries); #80 (Airway Management in PFC)

RAPID SEQUENCE INTUBATION

History

- Airway compromise or inability to protect airway
- Respiratory failure (Hypoxic, Hypercapnic)
  - > 40% TBSA burns, severe sepsis, TBI with AMS, etc.
- Patient or crew safety
  - Combative, prolonged in critically sick

Contraindications

- High likelihood of failure (distorted anatomy)
- Penetrating neck trauma

Procedure

- Make a plan, prepare patient and equipment
- Conduct seven “P” mnemonic (7Ps) below
- SALAD technique (suction assisted laryngoscopy and airway decontamination)

Medications

- Induction Agents:
  - Ketamine 1-2 mg/kg IV/IO
  - Etomidate 0.3 mg/kg IV/IO
  - Propofol 1-2.5 mg/kg IV/IO
  - Midazolam 0.01-0.05 mg/kg IV/IO
- Paralytics
  - Rocuronium 1 mg/kg IV/IO
  - Vecuronium 0.1 mg/kg IV/IO
  - Succinylcholine 1.5 mg/kg IV/IO
- Maintenance
  - Ketamine 0.5-2 mg/kg IVP or 0.5-2 mg/kg bolus then 1-3 mg/kg/hr.
  - Propofol 5-75 mcg/kg/min
  - Midazolam 0.01 - 0.1 mg/kg/hr. (Best when used with Fentanyl 0.5 - 1 mcg/kg/hr.)
- Push Dose Epi
  - Epinephrine (0.1mg/ml) 5-10 mcg IV/IO

Prepare

- Suction: available, check for function
- Oxygen: Pre-Oxygenation + Apneic Oxygenation
- Airways: ETT, SGA (iGel, King, etc.), Cricothyrotomy
- Pharmacology: Induction, Paralysis, Post-intubation Sedation
- Monitor: BP, HR, RR, SpO2%, ETCO2 capnography, 4-lead
- Equipment: Bougie, Laryngoscope, Video Laryngoscope, Cric Kit
- Evaluate Cricothyrotomy landmarks & assess procedural difficulty

Pre-Oxygen

- Preoxygenate / Denitrogenate ≥ 3 minutes or 8 Vital Capacity Breaths with 15 LPM NRB or BVM + PEEP, and NC 4-6 LPM, Oxygenated ≥ 90% if able

Positioning

- 30° head-up for pre-oxygenation, ear-to-sternal notch for intubation, C-spine consideration

Pretreat

- 3-5 minutes prior to sedative/paralytic
- Resuscitate with IVF or blood products. Consider push dose pressors (Epi) to ensure SBP > 100
- Consider Fentanyl 0.5-1 mcg/kg slow IVP to prevent hypertension in head injury, cardiac ischemia, or aortic dissection

Sedate/Paralyze

- Push sedative first before paralytic push
- Apneic oxygenate (utilize BVM if SPO2 falls below 90%)
- Monitor SPO2 and ETCO2 wait for adequate paralysis

Pass Tube

- SALAD
- Visualize cords, pass tube, inflate bulb, and begin bagging

Post-Tube Management

- Verify tube placement with ETCO2 waveform capnography and secure tube
- Place patient on post-intubation maintenance sedation

VENTILATOR MANAGEMENT

Clinical Indications	Contraindications
• Patient received from transferring facility, intubated, and requires ventilator support • Patient requiring intubation in the field and subsequent respiratory support	• Equipment malfunction / failure

Procedure

- Turn on ventilator and ensure that machine is functional and battery is charged
- Attach ventilator circuit, O2 hose to machine / O2 supply, ETCO2 and any required attachments

If Patient "Newly" Placed on Ventilator, INITIAL Settings:

Volume Controlled	Parameter	Pressure Controlled
14 (CMV+, AC, or SIMV)	RATE	14 (P-AC or PCV)
6 cc/kg	TIDAL VOLUME	See NOTE 3
5 cmH2O	PEEP	5 cmH2O
1:2	I:E	1:2
100%	FiO2	100%

- **NOTE 1:** After a few minutes on initial settings, adjust settings PRN to maintain appropriate clinical parameters
- **NOTE 2:** Patients "newly" on ventilator will start on volume mode unless patient pathology requires pressure mode
- **NOTE 3:** Set pressure to target VTE 6 cc/kg IBW (Pressure <30 cmH2O). Recommend starting 15-20 cmH2O.
- **NOTE 4:** IBW calculation:
  - MEN: [(Height in inches – 60) x 2.2] + 50
  - WOMEN: [(Height in inches – 60) x 2.2] + 45.5

If Patient is a "Transfer" and Already on Ventilator Settings:

- Match / maintain ventilator settings from medical treatment facility initially
- See Ventilator Transfer Procedure below

Normal Parameters:

- Respiratory Rate: 10-30
- Tidal Volume: 4-8 mL/kg IBW
- FiO2: 21-100%*
- PEEP: 5-20 cmH2O*
- I:E: 1:2 – 1:4
- SPO2: 90-96%

*NOTE: FiO2 / PEEP should be adjusted in concert per the chart below if patient has ARDS or if desaturation is gradual and presumed to be caused by patient pathology.
To achieve oxygenation goals, set FiO2 to 30% and start titrating FiO2 and PEEP in concert based on the chart. Go up every 5-10 minutes, quicker if low SPO2 sats develop.

Lower PEEP/Higher FIO2 Titration Table – ARDSNet ARMA Trial

PEEP	5	5	8	8	10	10	10	12	14	14	14	16	18	18	20	22	24
FiO2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.7	0.8	0.9	0.9	0.9	1	1	1	1

<---------- Move across table to keep SaO2 92-96% ---------->

Patients failing in shaded area are not necessarily too sick for flight, but risks and benefits should be considered as described in the CPG

*NOTE: Hypotensive patients (MAP <70 or SBP <90) may respond negatively to increased PEEP due to decreased venous return. Monitor for increasing hypotension and tachycardia

(Alternate) Higher PEEP/Lower FIO2 Titration Table – ARDSNet ARMA Trial

PEEP	5	8	10	12	14	14	16	16	18	20	22	22	22	24
FiO2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5-0.8	0.8	0.9	1.0	1.0

VENTILATOR MANAGEMENT (cont.)

Oxygenation Goals:

- Normal: PaO2 80 – 100 mmHg or SPO2 90-96% (SAVEO2)
- ARDS: PaO2 55 – 80 mmHg or SPO2 88-95%

Plateau Pressure Goal: ≤ 30 cmH2O

- Check Pplat (0.5 second inspiratory pause), at least every 4 hours and after each change in PEEP or VT

Peak Inspiratory Pressure Goal:

- ≤ 35 mmHg, ideally below 30 mmHg

Alarm Settings

- High Pressure Alarm: 10 cmH2O above peak airway pressure
  - Alternate: 50% above baseline PIP (1.5 x current PIP)
- Low Pressure Alarm: 5 cmH2O below peak airway pressure
  - Alternate: 50% below baseline PIP (0.5 x current PIP)

Pressures will be determined by placing patient on ventilator for ~1-2 minutes and determining intrinsic PIP (Labeled as PEAK on 754 ventilator [top right]; labeled as Ppeak on Hamilton T1 [top left])

Monitor waveform on machine and patient to ensure no breath stacking occurs. If this occurs, a high-pressure alarm may sound. However, if breath stacking is suspected even in absence of an alarm, disconnect tubing and allow exhalation. Increase I:E.

Troubleshooting

Airway Compromise or Lost Airway In-Flight

- If at any time patient begins to desaturate or develop respiratory problems, immediately disconnect ventilator and ventilate patient with BVM (with PEEP valve if available) and 100% O2 while correcting issues utilizing the D.O.P.E. algorithm:
  - **Displacement:** verify that ETT is in place, patient not extubated/tube did not move during transfer. If advanced – pull back to original length and attempt to bag; if tube has pulled further out of the trachea, DO NOT ATTEMPT TO ADVANCE IT without placement of bougie to verify tracheal placement. When advancing the bougie, feel for tracheal rings or carina stop. If in doubt, pull tube and attempt to BVM. If this fixes the problem, continue to bag the patient. Upon stabilization, consider alternative advanced airways (supraglottic airway or cricothyroidotomy). If ETT moves freely, assess for ETT bulb rupture via cuff manometer.
  - **Obstructions:** Assess for secretions in ETT. Suction if indicated.
  - **Pressure:** Ensure that a tension pneumothorax / hemothorax has not developed (if chest tube is in place, ensure it is properly suctioning, not kinked or clamped). Auto PEEPing or breath stacking can mirror development of tension pneumothorax (disconnect circuit and gently squeeze chest for full exhalation and adjust settings. See below for further description). Assess the need for escharotomy if circumferentially burned. Consider additional paralysis and sedation if patient does not tolerate ventilation. Consider abdominal compartment syndrome, pulmonary edema, pulmonary contusion, ascites, pneumonia, pleural effusion, ARDS as other causes.
  - **Equipment:** Ensure ventilator did not fail; O2 tank not empty. If ventilator is operational, trace all tubes to the patient connection (airway tube, transducer line, exhalation line) ensuring patency and connections.

VENTILATOR MANAGEMENT (cont.)

Troubleshooting (cont.)

Additional Troubleshooting

- **High Pressure Alarms / Peak Airway Pressure Alarms (Peak Pressure > 35cm H2O):** Correct problems causing increased airway resistance and decreased lung compliance, including pneumothorax or pulmonary edema. Check ventilator to make sure prescribed tidal volume is being delivered. Check for kinked / crushed tubing.
- **Air Leaks Causing Low Pressure Alarms / Volume Loss:** Assess, correct air leaks in ETT, tracheostomy cuff, ventilator system; recheck ventilator to make sure prescribed tidal volume is delivered.
- **Ventilator Desynchrony:** Agitation and respiratory distress that develop in a patient on a mechanical ventilator who has previously appeared comfortable represents an important clinical circumstance that requires a thorough assessment and an organized approach. The patient should not always be automatically re-sedated but must instead be evaluated for several potentially life-threatening developments that can present in this fashion.
- **Lung Hyperinflation / Air Trapping / Auto-PEEP:** Dynamic hyperinflation is associated with positive end-expiratory alveolar pressure, or auto-PEEP. The physiological effects include decreased cardiac preload because of diminished venous return into the chest. The reduced cardiac output that results from the reduction in preload can lead to hypotension and, if severe, to Pulseless Electrical Activity and cardiac arrest. Dynamic hyperinflation can also lead to local alveolar overdistention and rupture. Manage lung hyperinflation by decreasing tidal volume, changing inspiratory and expiratory phase parameters, switching to another mode, and correcting physiological abnormalities that increase airway resistance.

Ventilator Transfer Procedure

1. Ensure ETT is secure, document size and position of ETT at the teeth. Clamp tube immediately before disconnecting patient from ventilator to maintain PEEP if conducting recruitment maneuvers or PEEP is 10 or higher, then unclamp only after connected to new ventilator circuit.
2. Ventilator settings should be coordinated with the transferring physician, anesthesia provider, or respiratory therapist. Verify settings, review ABG analysis, and current SPO2 and ETCO2 readings. Place those settings on transport ventilator and place patient on transport ventilator early to verify patient tolerance and compatibility.
3. ABG should be done within 30 minutes of flight. If time allows, patient should be on transport ventilator for at least 15 minutes prior to transport.
4. Ventilator settings for en-route care team should initially be matched to those of the transferring facility. Adjust settings as needed in order to maintain appropriate clinical parameters listed on the first page of ventilator management protocol or transferring physician orders.
5. Ensure adequate sedation and analgesia medications are on hand.

Ventilator Calculations

- **Target ETCO2:**
  - (Current Rate x Current ETCO2) / Desired ETCO2 = New Rate
  - **NOTE:** You may incur a pressure limitation alarm after adjusting to new rate for ETCO2 targeting on Hamilton T1 Ventilator due to Peak pressure increase.
- **Vent Adjustments Due to Abdominal / Thoracic Pressure:**
  - Current Minute Ventilation / New Rate (New Rate = Current Rate + 1 or 2) = New Tidal Volume. Now set new rate and new tidal volume.
  - **NOTE:** Pressure alarm may not go away and may need to recalculate after several minutes if SPO2 has not improved
- **Minute Ventilation (VE):**
  - Rate x Tidal Volume = VE
- **Ideal Body Weight (IBW):**
  - **Men:** [(Height in inches – 60) x 2.2] + 50
  - **Women:** [(Height in inches – 60) x 2.2] + 45.5
- **Driving Pressure (ΔP):**
  - Plateau Pressure (Pplat) – PEEP = Driving Pressure
  - Hamilton T1 Plateau Pressure Calculation: Pplateau = (VTE mL / Cstat mL/cmH2O) + PEEP cmH2O. This is needed to calculate driving pressure on a Hamilton T1

Reference: CPG ID: #48 (Mechanical Ventilation During Critical Care Air Transport); #92 (Mechanical Ventilation Basics)

BLOOD AND COMPONENT USE

IMMEDIATE Indications in Trauma Patients With Serious Injury

- Systolic BP < 100 or weak / absent radial pulse
- Tachycardia > 100
- Amputation(s), penetrating chest / abdomen injury, truncal / junctional injury

Clinical Indications

- Significant trauma
- Evidence of hemorrhagic shock
- Altered mental status in the absence of brain injury
- Severe hypothermia associated with blood loss
- Clinical signs of coagulopathy (tachycardia, tachypnea, fever, altered mentation, hypoxemia)
- Positive FAST exam (especially if two or more regions are positive)
- Lactate > 4 mmol/L, base deficit > 6 mEq/L (base excess < -6 mEq/L), pH < 7.25, INR ≥ 1.5

Treatment

- Maximize hemorrhage control, treatment of suspected tension pneumothorax, patent airway or airway control, IV / IO access, hypothermia prevented and / or treated
- **Blood Product Order of Precedence**
  - Whole Blood
  - Plasma, RBCs, Platelets in a 1:1:1 Ratio (no particular order)
  - Plasma and RBCs in 1:1 Ratio
  - Plasma (thawed, liquid, reconstituted) alone or RBCs alone
- Document all items on the SF 518 (only authorized document for blood products aboard Army aeromedical evacuation platforms)
  - Two-person verification of patient and blood products given matching SF 518
- Examine units of blood (look for gas, discoloration, clots, and sediment) and verify that the Safe-T-Vue is white
- Initiate large bore IV (18G min, 14G preferred) or IO access (Lidocaine 2% (2-3 mL) flush in IO site provides analgesia and increases compliance)
- Blood and blood products must be administered through Y-tubing with filter, flushed with NS prior to use
- Transfuse blood through an approved fluid warming device if available
  - Rapid transfusion can be achieved via pressure bag up to 300 mmHg; a 60 mL syringe or manual pressure can also be utilized in the event a pressure infuser is not available
- Consider slowing all other concurrent infusions unless they are TXA or RFVIIa
- **Resuscitation Goal**: until palpable radial pulse, improved mental status, or SBP > 100 (> 110 w/ head injury) and MAP > 60 mmHg
- 30 mL of 10% Calcium Gluconate or 10 mL of 10% Calcium Chloride IV / IO should be given to patients in hemorrhagic shock during or immediately after transfusion of the first unit of blood product and with ongoing resuscitation after every 4 units of blood products. Ionized calcium should be monitored, and calcium should be administered for ionized calcium levels less than 1 mmol/L
- Monitor patient every 5 minutes and document any patient signs and symptoms consistent with transfusion reaction (monitor core temperature)
  - If a transfusion reaction occurs, see the **TRANSFUSION REACTION PROTOCOL**.

Reference: CPG ID #18 (Damage Control Resuscitation), CPG ID #26 (Frozen and Deglycerolized Red Blood Cells), CPG ID #73 (Damage Control Resuscitation – Prolonged Field Care), CPG ID #82 (Prehospital Blood Transfusion)

BLOOD TRANSFUSION REACTIONS

Treatment

- **STOP THE TRANSFUSION!**
- If a blood transfusion reaction is suspected
  - Apply O2 (if hypoxic), IV / IO, and cardiac monitor
  - Establish advanced airway per individual competencies, contraindications, and / or attempt failures. Maintain SPO2 > 93%
- Anaphylaxis
  - Epinephrine 0.3 mg IM (0.3 mL of 1:1000)
  - Diphenhydramine 25 mg IV / IO / IM
  - Maintain airway
  - Administer IV fluids as needed
  - Consider Methylprednisolone 125 mg IV / IO
- Acute Hemolytic Reaction (AHTR)
  - Diphenhydramine 25 mg IV / IO / IM
  - Consider osmotic diuresis
    - 20 g Mannitol 20% or 250 mL 3% NaCl
- Febrile Non-Hemolytic Transfusion Reaction (FNHTR)
  - Consider Acetaminophen 500 mg PO or 1 g IV
- Continue to reassess the patient and ensure to document on SF 518
- Notify blood bank of all transfusion reactions

Notes, Cautions, Warnings

- General rules
  - Stop the transfusion
  - Keep the intravenous line open with saline
  - Identify and treat cause of the reaction
  - Re-institute the transfusion only if it is deemed to be clinically essential
- Before initiating IVF bolus, ensure IV tubing is new. DO NOT USE existing Y-tubing from blood administration set
- **The most common transfusion reaction is a febrile, non-hemolytic transfusion reaction**. These are mostly benign with no lasting sequelae. Treatment consists of antipyretics
- **TRALI** is the leading cause of transfusion-related mortality; a concern in patients who have undergone recent surgery, massive transfusion, or have an active infection. Goal of treatment is supportive: maintain oxygenation, reduce respiratory distress
- **TACO** is essentially pulmonary edema secondary to congestive heart failure occurring in elderly, small children, and those with compromised cardiac function. Large volumes of fluid given rapidly is a common precursor. Goal is diuresis and treating underlying condition. Both TACO and TRALI require immediate resuscitation

Reference: CPG ID #18 (Damage Control Resuscitation), CPG ID #82 (Prehospital Blood Transfusion)

IV / IO

• Assess need for IV
  ○ Emergent or potentially emergent medical or trauma condition
• Peripheral IV x 2
  ○ Catheter ≥ 18 ga
  ○ Two failed attempts or > 90 seconds, proceed to IO
	• IO device for life / limb threatening conditions
	• IO should only be considered first if patient is deemed difficult to gain IV access
	• If IV / IO access unsuccessful, consider External Jugular (EJ) cannulation

• Sternal IO device by precedence:
  ○ Fast-1
  ○ EZ T.A.L.O.N
  ○ EZ-IO
• Locations for EZ T.A.L.O.N and EZ IO by precedence:
  ○ Bilateral proximal humerus
  ○ Bilateral proximal or distal tibia
  ○ Bilateral distal femur
	• Correct needle size for EZ-IO
	  ○ Yellow – 45 mm for adult (> 40 kg) humerus
	  ○ Blue – 25 mm for adult (> 40 kg) tibia
	  ○ Pink – 15 mm for pediatrics (3-39 kg) and adult tibia

Notes, Cautions, Warnings

- Gain vascular access where available based upon patient.
- Any pre-hospital fluids or medications approved for IV use may be given through an IO line, including blood products.
- All trauma patients or potentially ill patients should have at least two functioning IV/IO lines whenever possible.
- Upper extremity IV sites are preferable to lower extremity IV sites.
- Pressure infusion bag is recommended for IO starting at 300 mmHg.
- Following IV attempt failure and IO attempt failure, external jugular lines can be attempted for life threatening events with no peripheral access.
- Ensure open and functioning fluid bolus per specific protocol. At a minimum, maintain a slow “to-keep-open” (TKO) drip.

PAIN MANAGEMENT

History

- Patient vocalizes and / or signals pain
- Tachycardia
- Diaphoresis
- Elevated blood pressure

Treatment

(Continued from **UNIVERSAL PATIENT CARE PROTOCOL** or **TACTICAL EVACUATION PROTOCOL**)

- **Minor Pain** (0-3 pain scale)
  - Acetaminophen
    - PO: 1 g q 6-8 hrs PRN (max 4 g in 24 hrs)
- **Moderate to Severe Pain** (4-10 pain scale)
  - **Ketorolac**: Adults < 50kg
    - IV: 15 mg q 6 hrs (max 60 mg)
    - IM: 15-30 mg q 6 hrs (max 60 mg)
  - **Ketorolac**: Adults > 50kg
    - IV / IM: 15-30 mg q 6 hrs (max 120 mg)
  - **Morphine**: Chest Pain/AMI
    - IV / IO: 1-5 mg
  - **Morphine**: Acute pain
    - IV/IO: 2.5-10 mg q 1-4 hrs PRN
  - **Ketamine**:
    - IV / IO: 0.1-0.3 mg/kg q 10-30 min PRN
    - IM / IN: 0.5-1.0 mg/kg q 10-30 min PRN
  - **Hydromorphone**:
    - IV / IO: 0.5 mg (range 0.25-2mg) q 1-6 hrs PRN
  - **Fentanyl**:
    - IV / IO: 0.5-1 mcg/kg q 30-60 min PRN
    - IM / IN: 1 mcg/kg (if IN max 100 mcg/dose, max 50 mcg per nostril)

Notes, Cautions, Warnings

- Ensure vital sign monitoring on all patients receiving pain medications.
- Recommend starting with low dosage of pain medications and titrate upward to desired effect.
- PO medications should not be used in any patient with altered mental status or anyone in whom surgery is anticipated, unless directed by transferring provider

ABDONMIAL INJURY

Signs and Symptoms

- Altered mental status
- Tachycardia
- Absence of palpable pulses
- Pale, moist, mottled skin
- Poor peripheral pulses
- Hypotension
- Hematuria
- Pain, tenderness, distention, dissymmetry
- Absent / diminished bowel sounds
- Grey-Turner sign
- Cullen sign
- Kehr's sign

Treatment

- Blunt abdominal / pelvic injury
  - Serial physical exams / reassessment
  - Pelvic binder
  - Conduct FAST exam if possible**
  - Focus on resuscitation
- Penetrating abdominal / pelvic injury
  - Hemostatic dressing
  - Abdominal / pressure dressing
  - Direct pressure
  - Pelvic binder
  - AAJT- uncontrolled pelvic bleed
- Damage Control Resuscitation
  - Consider implementation of DCR if indications are met (SBP < 100, HR > 100, penetrating chest / abdominal injuries, amputations, pelvic injury)

**FAST exam cannot reliably exclude significant injury but may provide indication of intra-abdominal injury

Notes, Cautions, Warnings

- Pregnant patient
  - Increased risk of aspiration and gastric acidity
  - Patient should receive max O2 due to increased O2 consumption and depleted reserves
  - Consider warm LR before crystalloids to better restore fetal oxygenation
  - > 20 weeks gestation, tilt at least 15 degrees to prevent Vena Cava Syndrome
  - Presence of pregnant uterus should be determined. Some changes can mimic shock (heart rate can increase by 20 BPM, blood volume increases by 50% during mid-pregnancy and can experience relative anemia from hemodilution.) Due to the increase in blood flow to the uterus, risk of massive blood loss is greatly increased with trauma to the bony pelvis
- Lateral contusions (seatbelt sign) associated with a 20% occurrence of internal injury

Reference: TCCC Guidelines; CPG ID #09 (Blunt Abdominal Trauma, Splenectomy, and Post-Splenectomy Vaccination); CPG ID #34 (Pelvic Fracture Care)

BURNS / ELECTRICAL INJURY

Call the Burn Center:
DSN: 312-429-2876 (429-BURN)
Comm: 210-916-2876 or 210-222-2876
STOP the burning process / remove patient from electrical source. Ensure your safety first!

History

- How long ago was the injury?
- Any signs of airway involvement?
- How big/small of a space was the patient in during the incident? (inhalation / carbon monoxide / cyanide toxicity)
- Are there other traumatic injuries associated?
- Any spinal immobilization needed? (fall from height, blast etc.)

Differential Diagnosis

- Cardiac arrest
- Environmental exposure
- Seizure
- Burns (chemical, electrical, thermal, radiation)
- Multiple trauma
- Carbon monoxide toxicity

Treatment

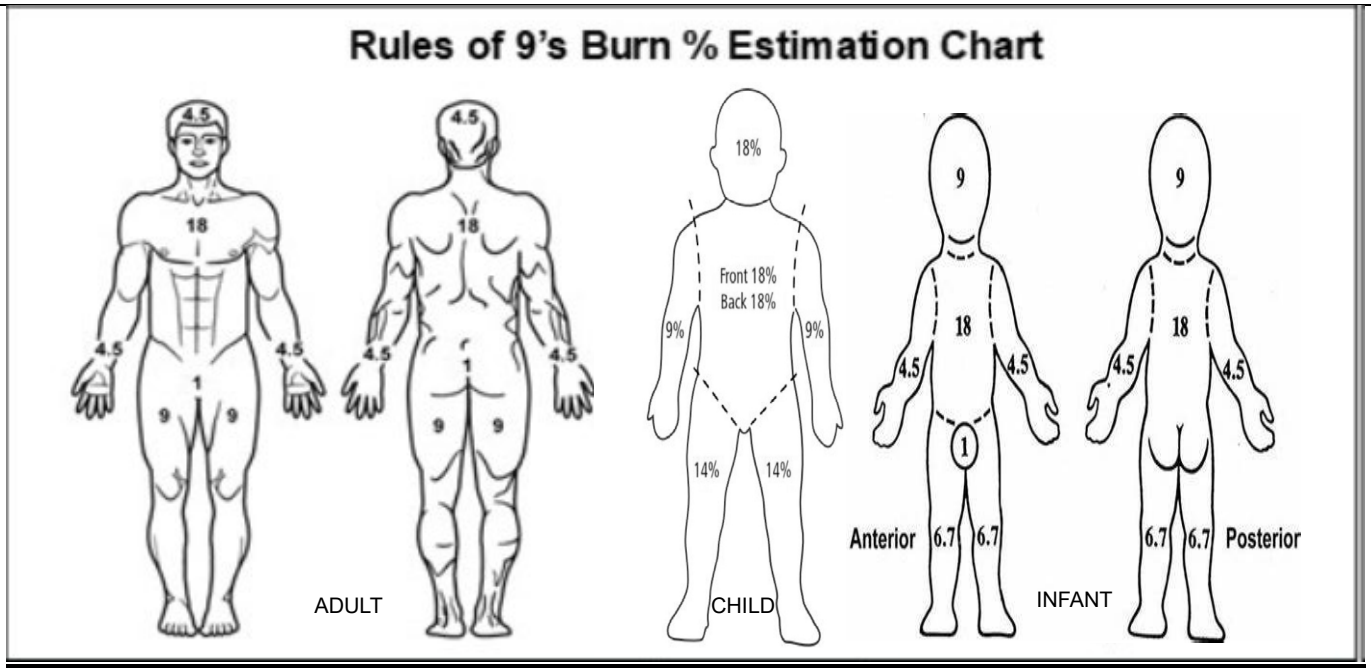
- Assess for additional injuries and treat life threats first (DO NOT overlook TRAUMA), IV / IO, O2, and monitor (electrical injuries must have 12 lead EKG completed to access for arrythmias)
- **Electrical:** If arrythmia is present, go to appropriate cardiac protocol
- Remove any constricting items (i.e., rings and bracelets). Consider elevating burned extremities if able
- Assess airway, if suspected airway involvement move to **AIRWAY PROTOCOL**
  - Indications for endotracheal intubation include comatose patient, symptomatic inhalation injury, deep facial burns, and burns over 40% Total Body Surface Area (TBSA). Requires ETT (8.0 minimum) in adults
- **Thermal / Electric Burn:** If able, remove burning / charred clothing and cover with dry, sterile sheets / dressings
- **Chemical Burn:** Brush off dry chemicals, cut off contaminated clothing, flush area with saline 10-15 minutes
  - Eyes: flush with saline for 30 minutes
  - Hydrofluoric acid - after thorough irrigation, apply a CaGlu gel (3:1 ratio of KY Jelly to 10% CaGlu) for 30 minutes
  - Tear Gas - rinse skin and eyes with NS
  - Alkali Burns to eye - 1-2 L of NS each eye for 30 minutes
- Determine / start fluid replacement for burn fluid resuscitation
- Manage pain and prevent hypothermia. KEEP WARM!
- Monitor urinary output, if able

Notes, Cautions, Warnings

- Urinary output is the MOST reliable guide for adequate resuscitation
  - Adult: 30-50 mL/hr (75-100 mL/hr electrical burns)
  - Pediatrics < 40 kg: 0.5-1 mL/kg/hr
- Edema after burn injury causes most supraglottic airway devices to be inadequate
- Ventricular fibrillation (in AC) and asystole (in DC) are the most common dysrhythmias seen with electrical shock

Reference: CPG ID #20 (Burn Care)

BURN FLUID RESUSCITATION



Adult > 40 kg

- **Burns:** 10 mL/hr x % TBSA; patient's weighing more than 80 kg, add 100 mL/hr to IV fluid rate for each 10 kg over 80 kg. Re-evaluate every 1 – 2 hours. Adjust IV rate to UOP goal of 30 – 50 mL/hr
  - Adjust IV rate up or down by 20% based on UOP
- **High Voltage Injury:** 10 mL/hr x % TBSA (estimate to nearest 10%); patient's weighing more than 80 kg, add 100 mL/hr to IV fluid rate for each 10 kg over 80 kg. Re-evaluate every 1 – 2 hours. Adjust IV rate to UOP goal of 75 – 100 mL/hr
  - Adjust IV rate up or down by 20% based on UOP

Pediatric < 40 kg

- **Burns:** 3 x %TBSA x body weight (kg) gives the volume for initial 24 hrs. One half is given in first 8 hours. Monitor urine output and adjust IV rate to UOP goal of 0.5 to 1 mL/kg/hr.
- **High Voltage Injury:** Adjust IV rate to UOP goal 1-2 mL/kg. Adjust IV rate up or down by 20% based on UOP.
- Administer a maintenance rate of D5LR to children < 20 kg. Utilize the 4-2-1 rule: 4 mL/kg for the first 10 kg + 2 mL/kg for the 2nd 10 kg + 1 mL/kg over 20 kg. This maintenance rate is in addition to the isotonic infusion calculated for burn resuscitation and is not titrated.

Notes, Cautions, Warnings

- TBSA > 20%, may require acute fluid resuscitation in prehospital: LR (best) > NS (2nd best)
- **Over Resuscitation**: Avoid a runaway resuscitation by using a fluid adjunct during the resuscitation.
  - When to consider: projected fluid requirements > 250 mL/kg within the first 24 hours, crystalloid infusion rate exceeds 1.5 L/hr, vasopressor use despite ongoing fluid administration.
  - Treatment: Fresh Frozen Plasma transfused 0.5 to 1 unit per hour, depending on severity and resources available.
- It is worth your time and effort to accurately estimate burn surface area, body weight, then calculate and administer appropriate fluids while the patient is under your care.
- **Oral Resuscitation:** in hemodynamically stable patients, WHO oral rehydration solution packets (or commercially available rehydration salts) can be mixed with water to give fluids by mouth or NGT if IVF are not available or in limited supply.

Reference: CPG ID #12 (Burn Care)

CHEST TRAUMA

Signs and Symptoms

- Difficulty breathing
- Rapid respirations with SPO2 decreasing or < 90% (In flight and on O2)
- Flail chest
- Unequal rise and fall
- Open wound / impalement over the thorax
- Penetrating abdominal wound
- Bruising across chest or base of neck
- Subcutaneous emphysema or deviated trachea

Treatment

- Penetrating chest wound
  - Open
    - Seal open wound with occlusive chest seal (vented)
  - Impalement
    - Stabilize
    - High index of concern for hemo-pneumothorax
  - Signs of hemo-pneumothorax
    - Needle thoracostomy
  - Goal: SPO2 ≥ 90%; improved RR; equal rise / fall
- Blunt chest trauma
  - Flail chest
    - Administer pain control
    - Consider endotracheal intubation, positive pressure ventilation
  - Signs of hemo-pneumothorax
    - Needle thoracostomy
  - Goal: SPO2 ≥ 90%; improved RR; equal rise / fall

Notes, Cautions, Warnings

- Needle thoracostomy may need to be repeated
- Failure to improve after needle thoracostomy
  - Controlled descent as able
  - Consider finger / tube thoracostomy
- Consider spinal immobilization for chest trauma patients
- Maintain high index of suspicion for intra-abdominal and retro-peritoneal bleeding in all chest injuries

Reference: TCCC Guidelines; CPG ID #74 (Wartime Thoracic Injuries)

CRUSH SYNDROME

History

- Entrapped extremity (as little as 1hr)
- Erythema, ecchymosis, abrasion
- Swelling, tense muscle compartment

History (Complications)

- Hyperkalemia
- Hypocalcemia
- Compartment syndrome
- Rhabdomyolysis
- Arrhythmia
- Hypotension

Treatment

- Prior to extraction
  - Consider tourniquet placement for crush injuries if the length of entrapment exceeds 2 hours and crush injury protocol cannot be initiated immediately
  - Apply two tourniquets side by side and proximal to the site of entrapment immediately prior to extraction
- Initiate crush injury protocol before extrication if possible and before loosening tourniquets (if tourniquet conversion indicated)
- IV / IO Protocol
  - Initiate aggressive fluid administration of IV / IO crystalloids 2 L initial bolus; followed by infusion rate: 1 L/hr. Adjust to urine output (UOP) goal of > 100-200 mL/hr (via Foley or improvised graduated cylinder)
- Monitor for life-threatening hyperkalemia (PVC's, bradycardia, peaked T-waves, decreased peripheral pulse strength, hypotension)
  - If PVCs become more frequent, the patient develops bradycardia, peripheral pulse strength decreases, or potassium levels are > 5.5 mEq/L or rising, treat urgently for hyperkalemia
    - Calcium: administer 10 mL (10%) Calcium Gluconate or Calcium Chloride IV over 2–3 minutes
    - Insulin and Glucose: administer 10 units of regular insulin followed immediately by 50 mL of D50; titrate PRN
    - Albuterol: administer 12 mL of albuterol sulfate inhalation solution, 0.083% (2.5 mg / 3 mL) in nebulizer
- If no signs of hyperkalemia develop, continue fluid administration and continuously monitor

Notes, Cautions, Warnings

- Crush syndrome can occur in as little as 1 hour of entrapment
- Tourniquets may mitigate life - threatening complications in situations where fluid resuscitation and treatment cannot be immediately initiated
- Aggressive fluid resuscitation for crush injury in the setting of noncompressible hemorrhage may increase hemorrhage. Balance the risk of uncontrolled hemorrhage against cardiotoxic effects of hyperkalemia

Reference: CPG ID #58 (Crush Syndrome – Prolonged Field Care)

EXTREMITY TRAUMA

Signs / Symptoms	Signs / Symptoms
• Pain / swelling • Deformity • Altered sensation / function • Diminished pulse / capillary refill • Decreased temperature • Bleeding • Amputation	• Abrasion • Contusion • Polytrauma • Fracture • Dislocation • Laceration • Sprain / strain

Treatment

- Heavy active bleeding
  - Check / add tourniquet (TQ)
    - Add deliberate TQ if hasty is in place
  - Pack and dress wound
  - Pressure dressing
  - Hemostatic dressing
- Amputation
  - Follow heavy active bleeding (above)
  - Wrap amputation in sterile dressing with NS
  - Transport amputated limb with patient (if able)
  - Clean amputated limb
- Convert limb / junctional; TQ as soon as possible if:
  - No presence of shock
  - Able to monitor wound closely for bleeding
  - Not placed to control hemorrhage on amputated extremity
  - Every effort should be made to convert in less than 2 hours if patient is not in shock
- Wound care / protection
  - Bandage / cover injuries
  - Immobilize extremity

Notes, Cautions, Warnings

- After bleeding controlled:
  - Treat for signs / symptoms of hypotension / shock
- Follow DCR protocols regarding hierarchy of fluid administration
- Carefully evaluate and document neurovascular status in all fractures / dislocations
- Never attempt to reduce an open fracture unless you have a confirmed loss of pulse
- A pelvic binder is indicated in cases of severe lower extremity injury and may be utilized in conjunction with a traction splint
- Blood loss can be severe and concealed in long bone fractures, especially the femur
- TQs should be used without hesitation to control major bleeding
- Use only CoTCCC approved TQs

Reference: TCCC Guidelines, CPG ID #62 (Acute Traumatic Wound Management)

EYE INJURY / PAIN

History

- Pain, swelling, blood
- Decreased visual acuity / blindness
- Deformity / contusion
- Foreign body
- Excessive tearing

History (Complications)

- Abrasion / laceration
- Globe rupture / orbital fracture
- Retinal detachment
- Chemical / thermal burns
- Infection / iritis
- CNS event
- Glaucoma
- Retinal vessel occlusion

Treatment

- **Without Known Injury**
  - Evaluate pupils
  - Consider unrecognized chemical exposure. See below for chemical injury
- **With Known Injury**
  - If not isolated, move to appropriate protocol to treat life threats
  - Assess orbital stability / pupils
- **Chemical Injury**
  - Irrigate with minimum 2 L NS, LR, water, or neutral irrigation solution; may require up to 10 L
- **Traumatic Injury**
  - Remove loose debris with NS irrigation. Do not attempt to remove impaled objects or contacts
  - Cover with rigid eye shield. Do not place any dressing / padding underneath the eye shield
  - If laceration, penetration, or rupture globe give:
    - Levofloxacin 750 mg IV / PO q 24 hrs plus Vancomycin 15-20 mg/kg IV q 8-12 hrs **OR**
    - Moxifloxacin 400 mg IV / PO q 24 hrs
- Treat for nausea and vomiting aggressively with Ondansetron 4-8 mg IV
- Provide sedation and analgesia PRN (maintain patient comfort)

Notes, Cautions, Warnings

- Assess and document visual acuity for each eye if possible
- Antiemetics are essential to prevent increased ICP. Consider benzodiazepines for anxiety
- Use rigid eye shields, not pads, for traumatic injuries
- Patching both eyes to decrease sympathetic movement has not been shown to improve visual outcome but may increase anxiety and will render patient unable to move independently
- If globe is out of socket, do not attempt to replace. Cover with saline soaked gauze
- Copious irrigation is the cornerstone of treatment for chemical eye injuries. Some chemical injuries can require up to 10 L. 30 minutes is the minimum amount of time to irrigate. Utilize a Morgan Lens if available
  - The use of a nasal cannula across the bridge of the nose attached to 1 L of NS will also work

Reference: CPG ID #03 (Eye Trauma: Initial Care)

HEAD INJURY / TBI

Signs and Symptoms

- Head pain, swelling, bleeding
- Head deformity, ecchymosis
- Altered mental status
- Respiratory distress / failure
- Vomiting
- Spinal injury
- Skull fracture

Signs and Symptoms (cont.)

- Epidural / subdural hematoma
- Subarachnoid hemorrhage
- Abuse
- Definitions
  - Mild TBI: GCS 13-15
  - Moderate TBI: GCS 9-12
  - Severe TBI: GCS 3-8

Treatment

- Consider spinal immobilization (minimize compression of neck veins)
- Resuscitate, follow **TACTICAL EVACUATION PROTOCOL**
- TXA 2 g IV / IO over 10 minutes in moderate to severe TBI
- Levetiracetam (Keppra) 1500 mg IV / IO over 15 min in severe TBI (seizure prophylaxis for transport)
- Airway compromise
  - Establish airway (**AIRWAY PROTOCOL)** with supplemental O2
  - Monitoring goals
    - SPO2 > 95%
    - ETCO2 35-45 mmHg (normo-ventilation)
- No obvious airway compromise
  - Jaw thrust, NPA
  - Supplemental O2 via BVM (SPO2 > 95%)
  - Low threshold to RSI if deteriorating GCS / mental status
- Evidence of elevated ICP
  - Elevate head of bed 30-45 degrees
  - 3% Hypertonic Saline, 250 mL IV / IO over 10-20 minutes followed by infusion of 50-100 mL/hr
  - Target vital signs
    - SBP > 110
    - SPO2 > 95%
    - ETCO2 35-45 mmHg (normo-ventilation, do not hyperventilate)
    - CCP > 60 (CCP = MAP – ICP)
- Evidence of impending herniation [e.g. unilateral / bilateral dilated or fixed pupil, and / or presence of Cushing's Triad (Cushing's Triad = (relative) bradycardia, hypertension / widening pulse pressures, irregular respirations)]
  - Continue elevated ICP treatment as above
  - Target ventilation to an ETCO2 of 35 mmHg (normo-ventilation; avoid hyperventilation) for no more than 20 minutes. Request online medical control for further guidance in prolonged flight

Notes, Cautions, Warnings

- Ensure continuous monitoring q 5-10 min
- Active seizures: Lorazepam or Midazolam, see **SEIZURE PROTOCOL**
- Mannitol given as boluses: 1 g/kg bolus followed by 0.5 g/kg bolus every 3 hours
- Keep SBP > 110; consider NS bolus
- Avoid hypo / hypercapnia through dedicated closely managed ventilation
- **Sedation:** Ketamine is preferred over Propofol due to hemodynamic effect of Propofol. Monitor SBP
- **Paralysis:** Not preferred in head injury if avoidable; Vecuronium preferred; ensure pain control / sedation is adequate to avoid increased ICP

References: CPG ID # 30 (TBI Management and Basic Neurosurgery in the Deployed Environment); CPG ID #63 (TBI Management in PFC)

HYPOTENSION / SHOCK

Signs and Symptoms

- Altered mental status (AMS)
- Weakness / dizziness
- Tachycardia
- Pale, cool, clammy skin
- Delayed capillary refill
- Bleeding
- Dehydration
- Nausea / vomiting

Differential Diagnosis

- Congenital heart disease
- Cardia arrhythmia
- Pulmonary embolism
- Tension pneumothorax
- Medication overdose
- Vasovagal episode
- Shock: hypovolemic, cardiogenic, septic, neurogenic, anaphylactic

Treatment

- Shock due to hemorrhage / trauma:
  - Control hemorrhage
  - Optimize homoestasis (See Notes, Warnings, Cautions)
  - Optimize hypothermia management
  - TXA 2 G IV / IO
  - Maintain SBP > 100 (> 110 TBI), move to appropriate protocol for continued treatment (i.e. **BLOOD AND COMPONENT USE PROTOCOL)**
- Shock due to Non-Traumatic / Non-Cardiac:
  - 1 L or 30 mL/kg IVF bolus PRN, additional crystalloid based on reassessment of clinical indication.
  - Maintain SBP > 90, MAP > 65
  - If inadequate BP
    - Norepinephrine: 5 - 15 mcg/min infusion IV / IO
- Shock due to Cardiac
  - Treat per appropriate Cardiac Guideline:
    - **ADULT BRADYARRHYTHMIA PROTOCOL**
    - **ADULT TACHYARRHYTHMIA PROTOCOL**
    - **ADULT ACUTE CORONARY SYNDROMES PROTOCOL**
    - **ADULT POST-CARDIAC ARREST CARE PROTOCOL**
  - Non-Invasive PPV (BVM) vs. Advanced Airway
  - 500 mL IVF Bolus
  - If inadequate BP:
    - Norepinephrine 5 - 20 mcg/min infusion IV / IO

Notes, Warnings, Cautions

- Optimize Homeostasis:
  - Hemorrhage trauma with NO significant Head Injury: Should target maintaining SBP >100.
  - Casualties able to maintain SBP >100 do not need immediate fluid resuscitation.
  - Hemorrhage trauma WITH significant Head Injury: Should target maintaining SBP >110.

Reference: CPG ID #83 (Sepsis Management in PFC), CPG ID #23 (Hypothermia: Prevention and Management), CPG ID #18 (Damage Control Resuscitation), CPG ID #73 (Damage Control Resuscitation – Prolonged Field Care), American Red Cross (ARC) ALS guidelines

TRAUMATIC ARREST

History	History (Differential)
• Evidence of trauma without a pulse • Unresponsive to external stimuli	• Medical cause of arrest preceding trauma • Tension pneumothorax • Hypovolemia • Cardiac tamponade

Treatment

- Determine if injuries are incompatible with life
  - Do not resuscitate if injuries are incompatible with life
- Address all known points of hemorrhage
  - Initiate transfusion with 1 unit of blood product (avoid resuscitation with crystalloid)
  - TXA 2 g IV / IO within 3 hrs of injury
- Begin CPR
  - CPR should not be done at the expense of life saving care to other casualties
- Place advanced airway
  - Start supplemental O2
- Bilateral needle thoracostomy
- Consider advanced procedures
  - Finger thoracostomy
  - Tube thoracostomy
  - Pericardiocentesis
- Place monitor on patient; prepare defibrillator
  - Determine rhythm; pulse return?
- ROSC not achieved
  - Continue CPR
  - Continue blood / IV fluids
  - Reduce long bone fractures
  - Reduce pelvic fracture
  - Reassess known hemorrhage points
- ROSC achieved
  - Return to **TACTICAL EVACUATION PROTOCOL** or previous protocol

Notes, Cautions, Warnings

- Injuries obviously incompatible with life include decapitation, massively deforming head or chest injury, traumatic hemi-corpectomy or total body disruption, incineration, lividity / rigor mortis
- Casualties with torso trauma or polytrauma who have no pulse or respirations during Tactical Field Care should have bilateral needle decompression performed to ensure they do not have a tension pneumothorax prior to discontinuation of care
- If unsure if arrest is due to trauma or medical cause, initiate ALS guideline for any arrhythmias following optimization of hemostasis (in trauma patients, volume loss must be corrected first, consider blood administration above all else)
- CPR without addressing massive hemorrhage, blood volume resuscitation, tension pneumothorax, and pericardial tamponade will be ineffective
- Consider severe hypocalcemia if blood products have recently been transfused due to calcium chelation and evidence of poor cardiac activity / contractility

Reference: TCCC Guidelines, CPG ID #82 (Prehospital Blood Transfusion), CPG ID #20 (Emergent Resuscitative Thoracotomy)

ALLERGIC REACTION

Signs and Symptoms

- Itching or hives
- Cough / wheeze / respiratory distress
- Chest / throat tightness
- Difficulty swallowing
- Hypotension or shock
- Edema
- Nausea / vomiting

Differential Diagnosis

- Urticaria (rash only)
- Anaphylaxis (2 or more symptoms)
- Shock (other than anaphylactic)
- Angioedema
- Aspiration / airway obstruction
- Asthma or COPD
- Pulmonary edema / CHF

Rule out MOI as a differential diagnosis. **UNIVERSAL PATIENT CARE PROTOCOL,** O2 (if hypoxemic), **IV / IO PROTOCOL,** cardiac monitor (ASAP)

Adult

- **Hives / rash only, no respiratory complaint**
  - Diphenhydramine 25 mg PO; 10-50 mg IV / IM
  - Methylprednisolone 125 mg IV / IO
- **Shock / unresponsive or respiratory distress / failure**
  - Epi-Pen or Epinephrine 1 mg/mL; 0.3-0.5 mg IM
  - 500 mL IVF if not previously started
  - Albuterol 90 mcg 2-3 puffs MDI or 2.5-5 mg via nebulizer
  - Diphenhydramine 25-50 mg IV / IO
  - Methylprednisolone 125 mg IV /IO
- **Worse or unstable**
  - Epinephrine IV infusion at 15 mcg/min (see **EPINEPHRINE INFUSION CHART**)

Pediatric

- **Hives / rash only, no respiratory complaint**
  - Diphenhydramine
    - 2 - < 6 y/o 6.25 mg PO
    - 6 - 12 y/o 12.5-25 mg PO
    - > 12 y/o 25-50 mg IV / IM / PO
  - Methylprednisolone 2 mg/kg IV
- **Shock / unresponsive or respiratory distress / failure**
  - Epi-Pen Jr for < 30 kg or Epinephrine 1 mg/mL; 0.01 mg/kg SQ / IM (max 0.3 mg)
  - 20 mL/kg IVF Bolus
  - Albuterol metered-dose inhaler
    - 4-8 inhalations q 20 min (max 3 doses)
  - Albuterol by nebulizer
    - 0.15 mg/kg q 20 min (max single dose 5 mg; max 3 doses)
  - Diphenhydramine 25-50 mg IV / IO / IM / PO
  - Methylprednisolone 1-2 mg/kg IV; maximum daily dose 125 mg

Notes, Cautions, Warnings

- Use caution prior to giving epinephrine IV to patients > 50 y/o, pregnant, have a history of cardiac disease, or have HR > 150. Epinephrine can precipitate dysrhythmias / ischemia – all patients should be on monitors and have 12-lead ECG
- Epinephrine can precipitate dysrhythmias / ischemia – all patients should be on monitors and have 12-lead ECG
- The shorter the interval from contact to symptoms, the more severe the reaction
- **Arrhythmia:** See appropriate pediatric cardiac guidelines
- **Non-Arrhythmia:** See **HYPOTENSION PROTOCOL** or **RESPIRATORY DISTRESS PROTOCOL**

ALTERED MENTAL STATUS

Signs and Symptoms	Differential Diagnosis
• Any signs of head trauma / injuries? • Any AMS? • Any pertinent medical conditions or medical history? • Are there any bystanders that can provide information about the patient? • Is this abnormal behavior?	• Head trauma / psychiatric disorders • Thyroid dysfunction • Hyper / hypoglycemia • Diabetic ketoacidosis / toxic Ingestion • Environment (hyper / hypothermia) • Hypoxia

Safety of the helicopter / crew / other patients takes PRIORITY!

Treatment

- Does the patient have a head injury, unable to protect their airway (GCS < 8), violent behavior, and / or AMS?
  - Refer to **HEAD INJURY PROTOCOL**, **AIRWAY PROTOCOL** if applicable
  - Determine blood glucose, if < 70 or > 250 go to **HYPO / HYPERGLYCEMIA PROTOCOL**
- If patient is an EPW or potential hostile, consider security escort and/or physical restraints
- Attempt to calm and reassure the combative patient and use physical restraints if needed
- Medications can be used to help calm the patient. Ensure that patient has their ETCO2 monitored after administration
  - Ketamine 4-5 mg/kg IM / IN or 0.5-1 mg/kg IV / IO can repeat q 10 min
  - Lorazepam 2-4 mg IV / IM (can use alone).
  - Midazolam 2.5-5 mg IV / IM q 15-30 min PRN (larger patients may need 10 mg if using IM route)
- If patient is still combative after the use of medications, consider **RSI PROTOCOL**

Notes, Cautions, Warnings

- Physical restraints such as tying down patient hands to prevent pulling lines, etc., should be limited to the least amount necessary to accomplish treatments / prevent injuries (Kerlix gauze can be a useful restraint)
  - **Do not jeopardize the patient's airway!** – Avoid hog tying, lying prone in restraints, sandwiching between spine boards, etc.
  - Check Vitals, SpO2, Pulse and Cap Refill every 5 minutes
- Combative patients present a very real threat to the safety of themselves, the medic, and the aircrew during flight. For this reason, any patient with altered mental status and the potential for combativeness that would threaten aircrew safety or themselves should be prophylactically sedated and/or paralyzed and intubated for the flight.
- Use of sedative medications adds risk of decreasing respiratory drive and should be used with caution. However, meds should be titrated to adequate dosage to control patient. Be prepared for airway interventions / vomiting if used. Cardiac arrest in patients with excited delirium / extreme agitation following restraint is well documented. Capnography in addition to cardiac monitoring is essential.

Reference: CPG ID #29 (Pain, Anxiety, and Delerium); CPG ID #39 (Airway Management in Traumatic Injuries); CPG ID #61 (Analgesia and Sedation Management during PFC); CPG ID #63 (TBI Management in PFC)

ALTITUDE ILLNESS

Signs and Symptoms

Acute Mountain Sickness (AMS)	High Altitude Cerebral Edema (HACE)	High Altitude Pulmonary Edema (HAPE)
• Headache • Nausea / Vomiting • Lethargy • Weakness / Dizziness • Anorexia	• Presence of AMS • Ataxia • Altered mental status	• Tachycardia • Tachypnea • Crackles / wheezing • Central Cyanosis • Cough • Dyspnea at rest • Pink frothy sputum

Treatment

- **For all:**
  - O2 (100% FiO2), IV / IO Access, Cardiac monitor
  - Descend as soon as possible (Consider Gamow bag if unable)
  - Hypothermia prevention
  - Note to aircrew – fly lowest allowable altitude
- **HAPE - Pulmonary Symptoms**
  - Nifedipine (extended release) 30 mg PO q 12 hrs
    OR
    Nifedipine (immediate release) 20 mg PO q 8 hrs
  - Consider assisted ventilation
- **HACE - Headache with altered mental status or ataxia**
  - Dexamethasone 8 mg IV / IO / PO x1, then 4 mg q 6 hrs until asymptomatic
    - Pediatric: 0.15 mg/kg IM / IV / PO q 6 hrs (max dose: 4 mg/dose)
  - Acetazolamide 250 mg PO q 12 hrs
- **AMS - Headache without altered mental status or ataxia**
  - Acetazolamide 250 mg PO q 12 hrs (avoid with sulfa allergy/sickle cell)
    - Pediatric: 2.5 mg/kg PO q 12 hrs (max dose: 250 mg/dose)
  - Severe AMS: Add Dexamethasone 4 mg IV / IO / PO
- **For altitude-related headache** (in isolation or with AMS / HACE) consider
  - Acetaminophen 650-100 mg PO
  - Ibuprofen 600-800 mg PO

Notes, Warnings, Cautions

- The treatment of choice for all altitude-related illnesses is supplemental O2 and descent - at least 300 - 1000 m. If unable to descend, a hyperbaric bag (Gamow bag) can be utilized if available.
- HAPE and HACE are severe and cases should be hospitalized. AMS may be managed well with outpatient treatment.
- HAPE patients may have crackles / fever / hypoxia. Be prepared to consider asthma, PE, pneumonia or other diagnoses as well.
- HACE patients have AMS and may have tremors, HACE may occur along with HAPE.
  - ANY altered mental status / confusion / abnormal gait should be presumed to have cerebral edema and descent should be undertaken immediately.
  - *Descent should be done with the least amount of patient exertion possible to prevent worsening of the condition.

Reference: CPG ID #95 (Altitude Emergencies in the Prehospital Environment)

ANIMAL AND INSECT BITES / STINGS

Signs and Symptoms

- Rash, skin break, wound, retained stinger
- Pain, swelling, erythema
- Bleeding or discharge
- Shortness of breath / wheezing / throat tightness
- Hypotension or shock

Treatment

- **UNIVERSAL PATIENT CARE PROTOCOL**
- Supplemental O2 (if hypoxemic)
- IV / IO in non-affected limb
- Cardiac monitor
- Position patient supine
- Elevate bitten extremity
- Wash wound with soap and water
- Mark suspected bite area (circle area affected to monitor for spreading)
- Ice / cold packs for swelling and pain
- Follow local policy / surgeon policy / CPG
- Allergic reaction
  - **ALLERGIC REACTION PROTOCOL**
- If needed **PAIN MANAGEMENT PROTOCOL**
- Spider bite, scorpion sting, or snake bite
  - **GLOBAL SPIDER ENVENOMATION PROTOCOL**
  - **GLOBAL SNAKE ENVENOMATION PROTOCOL**
  - **GLOBAL SCORPION ENVENOMATION PROTOCOL**
  - Confirm receiving facility has adequate supply of the appropriate regionally specific antivenoms

Notes, Cautions, Warnings

- Never attempt to capture / transport a live animal / insect
- Anaphylactic reactions should be treated as soon as recognized (**ALLERGIC REACTION PROTOCOL**)
- Review country environmental concerns before deployment or visitation
- All animals should be considered rabid outside the U.S. until proven otherwise. This excludes rodents, which do not carry rabies.
- DO NOT apply constricting bandages or tourniquets as these may worsen local tissue injury and increase the risk of permanent disability
- DO NOT cut, suck, electrocute, burn, or use chemicals on the envenomation site

BACK / NECK PAIN

Signs and Symptoms

- Pain
- Swelling
- Pain with motion
- Weakness / numbness
- Bowel / bladder dysfunction

Differential Diagnosis

- Muscle spasm / strain
- Degenerative disc disease
- Fracture
- Kidney stone / infection
- Abdominal aortic aneurysm
- Pneumonia / PE
- Cauda equina syndrome
- Tumor / mass / infection
- Thoracic pain: thoracic or abdominal aortic aneurysm

Rule out MOI as a differential diagnosis. **UNIVERSAL PATIENT CARE PROTOCOL,** O2 (if hypoxemic), **IV / IO PROTOCOL** (PRN), Cardiac monitor (PRN)

Injury Treatment

- Mechanisms that increase suspicion of possible spinal cord injury:
  - Blunt trauma to head or neck
  - Injury associated with high energy transfer (e.g., blast, motor vehicle)
  - Fall from greater than standing height
  - Fall directly onto head / neck
  - History of back / neck arthritis plus any trauma
- **HEAD INJURY PROTOCOL**

Medical Treatment

- Suspicion of AAA
  - Severe acute back pain
  - Pulsatile abdominal mass
  - Hypotension (likely ruptured; consider blood products)
- Suspicion of ACS / chest pain
  - **ACS PROTOCOL**
- Arrhythmia
  - **ADULT BRADYCARDIA PROTOCOL**
  - **ADULT TACHYCARDIA PROTOCOL**
  - **CARDIAC ARREST PROTOCOL** (VF / Pulseless VT or Asystole / PEA)

Notes, Cautions, Warnings

- EXAMINE: mental status, HHENT, neck, chest, abdomen, back, extremities and neurologic.
- Abdominal Aortic Aneurysm is a concern in hypertensive / diabetic / > 50 y/o populations - feel for pulsatile abdominal mass. Symptoms may mimic kidney stones.
- Patients with trauma and midline tenderness should be immobilized.
- Any bowel / bladder incontinence, saddle paresthesia, and bilateral numbness / weakness in lower extremities is significant and may represent a true medical emergency.

Reference: CPG ID #15 (Cervical & Thoracolumbar Spine Injury, Surgical Management, and Transport)

DECOMPRESSION SICKNESS

History

- Recent history of SCUBA diving
- Hypobaric chamber training
- High altitude parachutist training / operations > 18,000 ft (HALO, HAHO)
- High altitude exposure

Signs and Symptoms

- The Bends (Type 1)
  - Pain in the joints, muscles, and related tissues. Initially mild and/or intermittent but can become deep, gnawing, and eventually severe
  - Pain tends to be progressive and becomes worse during ascent
  - Larger joints such as the knees and shoulders are most frequently affected. The hands, wrists, and ankles also are commonly involved
  - Unusual, generalized fatigue, headache, malaise (constitutional bends)
- Skin Manifestations (Type 1)
  - Paresthesia tingling, itching, and cold and warm sensations
  - A mottled red rash might appear on the skin
  - Rarely a welt might appear and be accompanied by a burning sensation
  - Bubbles might develop just under the skin and cause localized swelling
  - Affected regions with excess fat beneath the skin, soreness and abnormal fluid accumulation might be present for 1 or 2 days
- Chokes (Type 2)
  - Symptoms occurring in the thorax caused in part by innumerable small bubbles that block smaller pulmonary vessels
  - Burning sensation under the sternum
  - As the condition progresses, a stabbing pain is felt, chest tightness, and inhalation becomes rapid and markedly difficult
  - Uncontrollable desire to cough. Cough is ineffective and nonproductive
  - Difficulty taking a deep breath may trigger uncontrollable coughing
  - Cyanosis
- CNS (Type 2)
  - Brain or spinal cord is affected by nitrogen bubble formation
  - Visual disturbance (lights are flashing/flickering when they are steady)
  - Dull to severe headache
  - Partial paralysis / one-sided numbness and tingling
  - Loss of orientation, and Inability to hear or speak
  - Inner ear disturbance's (vestibular DCS) vertigo, nausea, vomiting. More likely associated with diving than altitude exposure

Treatment

- If DCS occurs while in flight descend to a lower altitude or to the ground level.
- Place patient on 100% O2 (for denitrogenating)
- Monitor vital signs and conduct a Neuro exam. Note any changes
- Minimize any reactor movement
- Start IV. Manage circulatory collapse with IV fluids (LR or NS)
- Definitive treatment is to bring patient to a HYPERbaric chamber
  - Contact a flight surgeon for coordination
  - Transport patient to closest HYPERbaric chamber; lowest possible profile flight (below 1,000ft)

Notes, Cautions, Warnings

- Onset can occur as long as 48 hours after exposure to altitudes above 18,000 ft
- De-nitrogenation (nitrogen concentration is reduced by breathing 100% O2. This allows no new nitrogen into the body while existing nitrogen is removed from the lungs eliminating much of the nitrogen dissolved in body tissues.)
- All types of DCS should be treated as an emergency

DENTAL PROBLEMS

Signs / Symptoms	Differential Diagnosis
• Bleeding • Fever • Pain • Swelling • Missing / fractured tooth	○ Dental Caries ○ Infection ○ Fracture ○ Avulsion ○ Abscess / cellulitis ○ Gingivitis

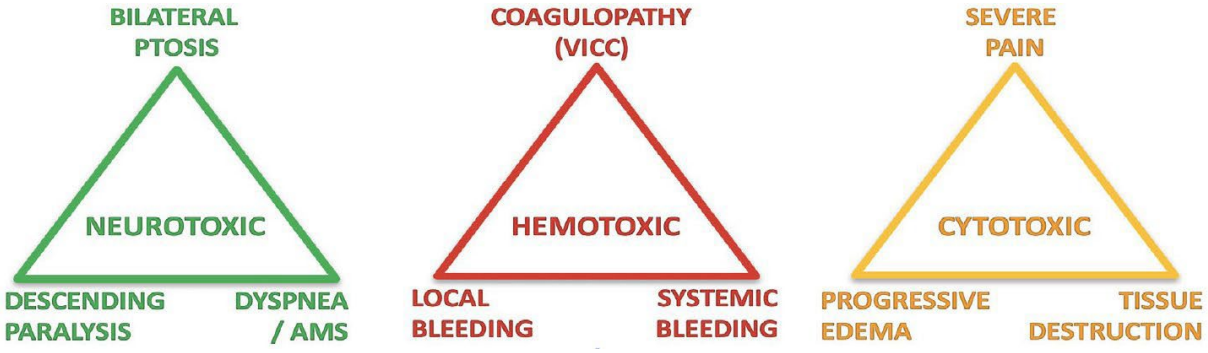
- **TACTICAL EVACUATION PROTOCOL**
- **UNIVERSAL PATIENT CARE PROTOCOL**
- Control Bleeding
- Tooth Avulsion
  - If < 1 hr, attempt to replace tooth in socket (**See Notes, Cautions, Warnings**)
  - Place tooth in NS (milk, if available)
- **PAIN MANAGEMENT PROTOCOL**

Notes, Cautions, Warnings

- Significant soft tissue swelling to face / mouth can represent cellulitis or an abscess
- Avulsion (complete avulsion only)
  - Gently rinse (do not scrub) tooth with NS and attempt to re-implant with firm pressure into the socket. **Never perform this in children with primary teeth**
  - As able and without obstructing airway, place bulky dressing over tooth and use as a soft bite block to stabilize tooth. Instruct to bite down gently, do not move jaw
- Subluxation (tooth displaced in socket)
  - Treatment not always required
  - For obviously loose or displaced tooth consider placing bulky dressing over tooth and use as a soft bite block to stabilize tooth. Instruct to bite down gently, do not move jaw
- Occasionally, cardiac chest pain can radiate to the jaw
- Patients with dental abscess may experience significant pain at altitude due to gas volume expansion at lower atmospheric pressure. Consider flying at lower altitude and refer to **PAIN MANAGEMENT PROTOCOL**

GLOBAL SNAKE ENVENOMATION

There are 3 major clinical syndromes of snakebite envenomation worldwide and 3 major signs and symptoms of each. All dangerous snakes capable of injuring or killing a human will produce at least one sign or symptom from at least one of the 3 major snakebite syndromes (neurotoxic, hemotoxic, and cytotoxic). Specific antivenoms required will vary regionally but the major triads are applicable globally.



- **NEUROTOXIC SYNDROME:** Anticipate the need for aggressive airway management with intubation and prolonged ventilation in all patients presenting with neurotoxic envenomation.
  - With cholinergic crisis: Consider **Atropine 0.5 mg IV / IO** titrated by auscultation to dry up bronchial and oral hypersecretions.
  - Without cholinergic crisis: Consider **Atropine 0.5 mg IV / IO** followed by **Neostigmine 1.0 mg IV / IO** to temporarily reverse neuromuscular weakness and delay the need for intubation.
- **HEMOTOXIC SYNDROME:** All internal and external active bleeding should cease within 30-60 minutes of antivenom administration once the appropriate dose has been given.
  - Packed red blood cell or whole blood transfusion can be considered if the patient is in hemorrhagic shock.
  - Platelets, fresh frozen plasma, cryoprecipitate, TXA, and other agents are not effective in these cases due to the mechanism of the venoms.
- **CYTOTOXIC SYNDROME:** Separately mark the leading edge of both pain (dashed line) and edema (solid line) with a permanent marker and record time of observation next to each line.
  - It is important to keep the limb significantly elevated (> 60º is ideal) whenever possible to limit dependent edema and swelling.

TRANSPORT FACTORS

If the patient is being medically evacuated from the field or between roles of care, confirm that the receiving facility has an adequate supply of the appropriate regionally specific antivenoms.

****NOTE:** Evacuation is not an alternative to antivenom administration. A patient whose snakebite warrants evacuation will require antivenom. The earlier it is given the greater the chance of full recovery without permanent disability.

****DO NOT** delay administration of antivenom in the field if available to a patient with an envenomation.

GLOBAL SNAKE ENVENOMATION (cont.)

INITIAL ANTIVENOM TREATMENT			
Antivenom dosing, preparation, and administration recommendations vary by product.			
Simplified universal diagnosis and treatment criteria for snakebite worldwide			
	Neurotoxic	**Hemotoxic**	**Cytotoxic**
Mild	Local S/Sx (paresthesia; neuropathic pain; piloerection; muscle spasm, fasciculations)	Coagulopathy ± persistence of local bleeding from bite	Severe pain; edema below elbow or knee; limited blistering within several inches of the bite wound
Moderate	Systemic S/Sx (bilateral ptosis GI symptoms; visual, auditory, or other sensory disturbances; widespread hyperesthesia)	Moderate systemic bleeding (old scabs, gingival bleeding, epistaxis, etc.); bruising distant from the bite wound	Edema above elbow or knee but not beyond shoulder or hip; moderate local blistering along bitten limb segment
Severe	Difficulty speaking; altered mental status; respiratory muscle weakness causing difficulty breathing; shock or otherwise unstable patient	Active GI bleed (usually hematemesis) or other internal bleeding; severe anemia; altered mental status; shock or otherwise unstable patient	Progressive edema beyond shoulder or hip; severe necrosis or widespread blistering; symptomatic bite to head, neck, or torso; altered mental status; shock or otherwise unstable patient
Criteria for additional AV doses at hours 2, 4, 6, 12, 24 (as needed)	Additional doses if: persistence or worsening of systemic neurotoxic S/Sx. Continue to re- administer 2 vial boluses as needed at hours 2, 4, 6, 12, and 24 until indications of improvement begin to appear (↑SBC, ↑LOC, ↑strength, etc.)	Additional doses if: persistence, resumption, or new onset of any active external or internal bleeding OR S/Sx of active venom confirmed by secondary recurrence of abnormal WBCT	Additional doses if: significant increase in edema (such as beyond major joint) OR significant increase in pain (severity of pain and/or how far pain radiates up the bitten limb)

GLOBAL SNAKE ENVENOMATION (cont.)

SUDDEN COLLAPSE SYNDROME TREATMENT PROTOCOL:

Patient presents within 30 minutes of the bite with rapid onset shock ± angioedema, altered mental status, systemic bleeding, and diarrhea.

1. Stabilize with IM or IV epinephrine and fluids as per anaphylaxis protocols:
   a. First line treatment of anaphylaxis is rapid administration of Epinephrine (1:1000) 0.5mg IM
2. Intubate for airway edema not rapidly responsive to Epinephrine.
3. Follow Epinephrine immediately with a high dose of the appropriate regional antivenom given by rapid IV or IO push during the resuscitation.
4. Maintain blood pressure with IV or IO fluids and Epinephrine until antivenom has taken effect to reverse the hypotension.

****Notes / PEARLS****

- Don't try to ID the snake. Snake identification is unreliable and should not be purposely attempted. DO NOT attempt to catch or kill the snake
- Snakebite treatment should always be determined by the clinical presentation and evolution of signs and symptoms in the patient rather than the identity of the snake
- DO NOT apply constricting bandages or tourniquets as these may worsen local tissue injury and increase the risk of permanent disability
- Establish a timeline and trend changes over time. Serial assessments and documentation are essential. Snakebites are clinically dynamic emergencies and can change dramatically until control has been achieved.
- Anaphylactic reactions or hypovolemic shock should be treated as soon as recognized

Reference: CPG ID #81 (Global Snake Envenomation)

GLOBAL SPIDER ENVENOMATION

While many spiders produce venom, the vast majority lack sufficiently large or strong enough fangs to penetrate human skin and cause clinically significant effects. However, spiders venomous to humans can be found throughout much of the world. The chart below provides information regarding clinically significant venomous spider species.

Clinically Significant Venomous Spider			
	Widow Spiders *(Lactrodectus spp.)* *Black Widow* *Red Widow* *Brown Widow*	**Violin Spider** (Laxosceles reclusa) Brown Recluse Fiddleback Spider	**Funnel Web Spiders (Atrax)** **Australian Funnel Web Spider**
Africa	**X**	**X**	
Asia	**X**	**X**	
Australia	**X**	**X**	**X**
Europe	**X**		
North America	**X**	**X**	
South America	**X**	**X**	
Picture			 
Antivenom Available	**Yes**	**No**	**Yes**
Treatment	**•Supportive Care** -Benzodiazepines for muscle spasm -Tetanus prophylaxis **•Pain Management** -Acetaminophen -NSAIDs -Opioids **•Antivenom** -Monitor for indications of anaphylaxis	**•Supportive Care** -Wound Management -Tetanus prohylaxis **•Pain Management** -Acetaminophen -NSAIDs -Opioids **•Antipruritics PRN** **•Treat significant hemolysis with blood transfusions**	**•Elastic Crepe Bandage** -Tight enough to limit lymphatic spread -DO NOT restrict blood flow -DO NOT remove until antivenom is available

PEARLS

- Review country environmental concerns before deployment or visitation
- **WIDOW SPIDER ONLY.** Fatal cases due to antivenom anaphylaxis have been reported in patients with asthma. Antivenom is not indicated in patients with otherwise manageable symptoms, particularly those that may be at higher risk (i.e. history of asthma).
- **FUNNEL SPIDER ONLY.** Venom is one of the few animal venoms to undergo local inactivation. Transport to nearest MTF and do not remove elastic crepe bandage until antivenom is ready to be administered.
- **DO NOT** cut, suck, electrocute, cauterize, or use chemicals on the envenomation site

Reference: CPG ID #84 (Global Spider and Scorpion Envenomation Management)

GLOBAL SCORPION ENVENOMATION

Scorpions envenomate humans by stinging them with the telson on their tail. The majority of medically significant envenomation occurs in the Middle East, tropics (e.g., Southwest Asia, India, Central and South America), and North Africa. Scorpions are nocturnal, hibernate in winter, and are active in the warm seasons. Humans are frequently envenomated by scorpions hiding in dark, hidden locations such as inside shoes and small crevices.

Antivenom is available for some species; data regarding the benefits and risks of many of these antivenoms are significantly limited. In patients with moderate to severe symptoms refractory to analgesics and benzodiazepines, antivenom, if available, may be indicated. Due to the high risk of immediate or delayed allergic reactions to these antivenoms administration should be done at a controlled clinical location and prehospital treatment should be focused on supportive care. Intravenous histamine antagonists (i.e. diphenhydramine), steroids, and epinephrine should be immediately available prior to antivenom administration.

Clinical Grade and Treatment of Scorpion Stings		
Grade	Effects	Treatment
1	Local Effects Only	Analgesia
2	Mild/Moderate Autonomic Excitation (i.e. tachycardia, hypertension)	Benzodiazepines
	Agitation and Anxiety	Benzodiazepines
	Pain and Paresthesia Remote to Sting Site	Analgesia
3	Pulmonary Edema	Antivenom, noninvasive or mechanical ventilation
	Hypotension or Cardiogenic Shock	Antivenom, vasopressors
	Neuromuscular excitation, somatic neuromuscular dysfunction, or cranial nerve dysfunction (associated with Centruroides species)	Antivenom, benzodiazepines
4	Multiorgan failure, coma, seizures, end-organ damage secondary to hypotension, somatic neuromuscular dysfunction and cranial nerve dysfunction (associated with Centruroides species)	Antivenom, vasopressors, sedation (benzodiazepines, propofol, phenobarbital), mechanical ventilation

****Notes / PEARLS****

- Anaphylactic reactions should be treated as soon as recognized.
- For clinically significant envenomation, management is supportive and focused on the patient's symptoms and graded 1-4.
- Patients graded 3 & 4 will require antivenom, evacuate to an MTF able to administer antivenom.
- Administer Benzodiazepines aggressively to ensure symptom control
- For significant neuromuscular spasm, oral secretions, sedation, or other threats to the patient's airway, perform endotracheal intubation to prevent aspiration and ensure adequate ventilation.
- Pulmonary edema should be managed with noninvasive or invasive ventilation in combination with optimization of cardiac output.
- Direct acting vasopressors (epinephrine and norepinephrine) are recommended to treat bradycardia and hypotension
- DO NOT cut, suck, electrocute, cauterize, or use chemicals on the envenomation site

Reference: CPG ID #84 (Global Spider and Scorpion Envenomation Management)

HOT / COLD WEATHER INJURY

HOT Weather Signs & Symptoms

- Altered Mental Status (AMS)
- LOC
- Pale or clammy skin
- Hypotension or shock
- Seizure
- Nausea or Vomiting

COLD Weather Signs & Symptoms

- Cold, Clammy skin
- Shivering or lack of shivering
- Mental status change
- Extremity pain or numbness
- Bradycardia or Arrhythmia
- Hypotension or Shock

HOT Weather Treatment

- Remove from heat source/ loosen or remove clothing.
- If AMS, move to **ALTERED MENTAL STATUS PROTOCOL**
  - Assess glucose. If outside normal limits, move to **HYPERGLYCEMIA / HYPOGLYCEMIA PROTOCOL**
- Consider intubation if needed.
- 1L IV bolus or PO fluids
- Monitor 12 lead EKG for arrhythmias.
- If seizure develops move to **SEIZURE PROTOCOL**
- AMS & core temp > 40C /104F
  - Start aggressive cooling (Tepid water to skin and fanning / Ice packs in groin, axilla, and neck. Discontinue once temp <40 C /104 F)
  - Consider benzodiazepines to block/stop shivering & rebound hypothermia.
    - Midazolam 0.1 mg/kg
- AMS & core temp < 40C/104F
  - Tepid water or room temp water to skin
- Continuous monitoring

COLD Weather Treatment

- Remove wet clothing
- Assess: mental status, rectal temperature, glucose
- Core Temp < 96F (Non Core Temp < 97F)
  - HPMK kit / Hypothermia blankets
  - Dry clothing
  - Hot Packs to groin, axilla, abdomen (avoid burning pt)
  - Warmed IV fluids
    - Up to 150 mL/min to allow for proper warming through device
    - Must be used in conjunction with HPMK / hypothermia blankets
- Monitor 12-lead EKG

Notes, Warnings, Cautions

HOT Weather

- Best method to cool pt is sublimation-sprinkling w/ water + fanning to evaporate on skin
- Elevated risk groups: elderly, very young, highly active
- Sweating does not exclude heat stroke / heat illness

COLD Weather

- “No patient is dead until they are warm and dead”
- Hypothermia is defined as core temp <96F (Non Core Temp < 97)
- Pulse may be very slow in hypothermia patient – wait at least one minute to feel pulse

Reference: CPG ID #23 (Hypothermia: Prevention and Management)

HYPERGLYCEMIA / HYPOGLYCEMIA

Hyperglycemia S / S **BLOOD GLUCOSE > 250 mg/dL**	Hypoglycemia S / S **BLOOD GLUCOSE < 70 mg/dL**
• Polyuria • Polydipsia • Weakness / fatigue • Nausea / vomiting • Change in LOC • Hypotension • Tachycardia • Seizures / coma • Fruity breath odor	• Diaphoresis • Pallor • AMS • Tremor • Palpitations • Anxiety

Treatment
• Place patient on cardiac monitor
• Obtain blood glucose
  ○ Blood glucose > 250 mg/dL
  ▪ Initiative IV or IO Access
  ▪ Administer 1000 mL .09% NS (10-20 mL/kg)
  ▪ Monitor blood glucose every 30 min
• Consider intubation for patients with AMS
• Nausea or vomiting present, administer
  ○ Promethazine 12.5-25 mg IV
  OR
  ○ Ondansetron 4-8 mg IV
	Treatment
	• Place patient on cardiac monitor
	• Obtain blood glucose
	  ○ Blood glucose < 70 mg/dL
	  ▪ Initiate IV or IO access
	  ○ Patients with AMS:
	  ▪ Administer 10-25 g IV Dextrose (40-100 mL of 25% solution or 20-50 mL of 50%)
	  ▪ If IV access unobtainable, administer Glucagon 1 mg IM. Repeat after 15 min PRN
	  ○ Patients with No AMS:
	  ▪ Administer 15-20 g oral glucose gel or equivalent until glucose level is > 70 mg/dL (> 100 mg/dL in neurological injury)

Notes, Cautions, Warnings • Too rapid drop in blood glucose can cause hypoglycemia • Rapid drop in blood glucose levels can lead to shifts extracellular osmolality which can lead to cerebral edema • If insulin required, follow medical direction from transferring provider	**Notes, Cautions, Warnings** • If administering Dextrose, obtain blood glucose sample from contralateral arm • Hypoglycemia may be detrimental to patients at risk for cerebral ischemia, such as victims of stroke, cardiac arrest, and head trauma • Hypoglycemic patients must be alert enough to swallow and protect airway

LOWER RESPIRATORY DISTRESS

Signs and Symptoms	Potential Causes
• Shortness of breath • Pursed lip breathing • Decreased ability to speak • Tachypnea / hyperpnea • Wheezing / rhonchi / rales • Use accessory muscles • Fever / cough • Tachycardia • Absent breath sounds	• Asthma • Anaphylaxis / allergy • Aspiration • COPD • Pleural effusion • Pneumonia • Congestive heart failure / cardiac • Pulmonary embolus • Pneumothorax • Pericardial tamponade • Hyperventilation • Toxic inhalation (e.g., cyanide, CO)

ADULT	PEDIATRIC

Wheezes
• Monitor O2 and ETCO2
• Place on 100% oxygen via NRB
• Administer Albuterol 2-3 actuations (90 mcg MDI) PRN or 2.5-5 mg nebulized
• Monitor for allergic reactions
  ○ Consider Epinephrine 1 mg/mL 0.3-0.5 mg IM (EPI PEN)
• Initiate IV / IO Access
• Administer Methylprednisolone 125 mg IV
• Consider Magnesium Sulfate 2 g IV over 20 mins. Dilute in 50-100 mL NS or D5W
	Wheezes
	• Place on 100% oxygen via NRB
	• Administer Albuterol 2-4 actuations q 4-6 hrs (90 mcg MDI) or 2.5-5 mg nebulized q 20 min (Max 3 doses)
	• Monitor for allergic reactions
	  ○ Consider Epinephrine (1:1000)
	  ○ 15-30 kg give 0.15 mg IM (EPIPEN JR)
	  ○ > 30 kg give 0.3 mg IM (EPIPEN)
	  OR
	  ○ 0.01 mg/kg IM (max 0.3 mg)
	• Administer Methylprednisolone 2 mg/kg IV (See drug card for maintenance dose)
	• Administer Magnesium Sulfate 25-50 mg/kg IV over 15-30 min (Max 2 g) diluted in 50-100mL NS

Rales / CHF
• Monitor O2 and ETCO2
• Provide PPV / NIPPV (CPAP / BIPAP) with 100% oxygen support
• Initiate IV / IO Access
• Administer Nitroglycerin SL 0.4 mg q 5min if SBP > 90
• Failure to improve:
  ○ Administer Furosemide 40 mg IV over 1-2 min, place foley if possible
	Rales / CHF
	• Monitor O2 and ETCO2
	• Provide PPV (if tolerated) with 100% oxygen support
	OR
	• 100% NRB if PPV is not tolerated
	• Failure to improve
	  ○ Administer Furosemide 1 mg/kg IV slow push, place foley if possible

Notes, Cautions, Warnings

- SPO2 < 90% or respiratory status continues deteriorate, consider definitive airway control
- Albuterol can be administered with spacer or short (6") section of ventilator tubing to increase delivery if patient unable to perform action appropriately.
- Lack of abnormal breath sounds does not always signify improvement. As respiratory status worsens, there may be inadequate air movement to produce these sounds.

Reference: ARC PALS (2020)

UPPER RESPIRATORY DISTRESS

Signs and Symptoms	Potential Causes
• Shortness of breath • Pursed lip breathing • Decreased ability to speak • Tachypnea / hyperpnea • Wheezing / rhonchi / rales • Use of accessory muscles • Fever / cough • Tachycardia • Absent breath sounds	• Asthma • Anaphylaxis / allergy • Aspiration • COPD • Pleural effusion • Pneumonia • Congestive heart failure / cardiac • Pulmonary embolus • Pneumothorax • Pericardial tamponade • Hyperventilation • Toxic inhalation (e.g. cyanide, CO)

ADULT	PEDIATRIC

• View for obstructions (jaw-thrust for C-spine injury) sweep and suction PRN
• Monitor O2 and ETCO2
• Place on 100% oxygen via NRB
• Administer Albuterol 90 mcg/actuation MDI, 2-3 actuations PRN or 2.5-5 mg nebulized
• Monitor for allergic reactions:
  ○ Consider Epinephrine 1 mg/mL 0.3 mg IM (EPI PEN)
• Initiate IV / IO access
• Administer Methylprednisolone 125 mg IV
	• View for obstructions (jaw-thrust for C-spine injury) sweep and suction PRN
	• Monitor O2 and ETCO2
	• Place on 100% oxygen via NRB
	• Administer Nebulized Racemic Epinephrine 0.25-0.5 mL of 2.25% solution diluted in 3 mL NS
	• Monitor for allergic reactions
	  ○ Consider Epinephrine
	  ○ 15-30 kg: 0.15 mg IM (EPIPEN JR)
	  ○ > 30 kg: 0.3 mg IM (EPIPEN)
	  OR
	  ○ Epinephrine 1 mg/mL, 0.01 mg/kg IM (max 0.3 mg)
	• Administer Methylprednisolone 2 mg/kg IV (See drug card for maintenance dose)

Notes, Cautions, Warnings

- SPO2 < 90% or respiratory status continues deteriorate, consider definitive airway control
- Albuterol can be administered with spacer or short (6”) section of ventilator tubing to increase delivery if patient unable to perform action appropriately.
- Lack of abnormal breath sounds does not always signify improvement. As respiratory status worsens, there may be inadequate air movement to produce these sounds

SEIZURE

Signs and Symptoms

- Decreased mental status
- Seizure activity
- Somnolence
- Incontinence
- Evidence of trauma
- Loss of consciousness
- Oral injuries (e.g., tongue, buccal)

Initial Treatment

- Provide oxygen support
- Consider airway control (definitive if necessary)
- Initiate IV / IO access
- Place on cardiac monitor
- Monitor blood glucose

Adult

- Active Seizure
  - Administer Midazolam 5 mg IV / IO or 10 mg IM
    OR
  - Lorazepam 4 mg IV / IM
    OR
  - Diazepam 5 mg IV / IM
    - May repeat anticonvulsants q 5 min if seizure has not stopped
  - Pregnancy considerations:
    - Administer Magnesium Sulfate 4-6 g IV over 15 min (monitor for hypotension)
- Blood Glucose < 70 mg/dL
  - Administer 50% Dextrose 25 g IV
    OR
  - Glucagon 1 mg IV / IM

Pediatric

- Active Seizure
  - Administer Lorazepam 0.1 mg/kg IV (max 4 mg)
    - May repeat once in 5-10 min
    OR
  - Midazolam 0.2 mg/kg IN q 15 min or 0.1-0.15 mg/kg IM once (max dose 10 mg)
  - TBI: Levetiracetam (Keppra) 60 mg/kg, single dose.
- Blood Glucose < 70 mg/dL
  - Infants: 10% Dextrose 5-10 mL/kg IV
  - Children: 25% Dextrose 2-4 mL/kg IV (max 25 g/dose)
    OR
  - Glucagon 0.5 mg IM (< 20 kg); 1 mg IM (> 20 kg). May repeat in 15 min

Notes, Cautions, Warnings

- For seizure prophylaxis consider Levetiracetam (Keppra) 1500 mg IV over 15 min, followed by maintenance dose of 1000 mg q 12 hrs
- Status epilepticus defined as seizure > 15 min or two or more continuous seizures without a period of consciousness / recovery. This is a real emergency requiring rapid airway control, treatment, and transport to the nearest suitable medical treatment facility
- Paralysis for airway control does not stop seizure activity – only hides it. A seizure is a CNS electrical phenomenon and damage is still being done even when no muscular activity seen due to paralysis
- In pregnant patients, Magnesium should be first line to abort non-epileptic seizures. Midazolam should only be used if this fails
- Be prepared to assist with ventilations with the use of Midazolam / Lorazepam

Reference: CPG ID #30 (TBI Management & Basic Neurosurgery in a Deployed Environment), CPG ID #63 (TBI Management in PFC)

SEPSIS / FEVER

History

- Wound(s) with signs of infection
- Warm, flush > 100.4°F / 38°C
- Diaphoretic, chills < 96.8°F / 36° C
- Capillary refill time > 3 seconds
- Abnormal vital signs
  - HR > 90
  - SBP < 90
  - RR > 20/min
- Altered mental status
- Decreased urine output
- Rash(es), purpura
- Immunosuppressed

Definition

- Life-threatening organ dysfunction caused by a dysregulated host response to infection
- Septic shock is a form of distributive shock
- Keys to Success
  - Early recognition
  - Identification of the cause of shock
  - Early, decisive treatment of the cause and initiation of cause-specific resuscitation.

Treatment

- Initiate Monitoring: ECG, NIBP, SPO2, ETCO2, Temp
- Supplemental O2, goal > 93% room air
- Check glucose (< 70 mg/dL **HYPOGLYCEMIA PROTOCOL**)
- Attain a minimum of 2 IV / IO sites
- Initiate IV / IO crystalloid therapy – 1000 mL bolus NS / LR achieve goal of SBP > 90 or MAP > 65 or 30 mL/kg
- Initiate / monitor foley. UOP 0.3 - 0.5 mL/kg/hr
- Temperature > 100.4°F / 38°C consider Acetaminophen 1 g PO / IV (if not provided in the last 6 hours)
- Persistent or refractory hypotension after 2 L NS / LR, unable to maintain SBP > 90 or MAP > 65
  - Administer Norepinephrine 5-15 mcg/min IV SBP < 90 or MAP < 65
- Add Epinephrine (0.1 mg/mL) 2-10 mcg/min
- Consider antibiotic therapy Ceftriaxone 2 g in 250 mL NS over 5 min or Ertapenem 1 g IV / IO daily
- Contact Medical Control for further guidance if able

Notes, Cautions, Warnings

- Monitor overall respiratory status. Many patients who are critically ill with sepsis will need ventilatory support at some point in their management
- Record urine output if foley in place. Decreased urine output is an indicator of patient deterioration
- Fever may not be present in immunocompromised, elderly, or those on immunosuppressive drugs
- All fever is not due to infection – evaluate for environmental / thyroid / toxic etiology
- In trauma sepsis, blood is preferred
- Caution in over-resuscitation > 0.5 mL/kg/hr UOP, wet lungs, increased work of breathing

Reference: CPG ID #83 (Sepsis Management in PFC)

SUBMERSION INJURY

Signs and Symptoms

- Unresponsive
- Change to Mental Status
- Hypoxia
- Cyanosis
- Hypothermia
- Vomiting
- Coughing

History (Complications)

- Head Injury
- Intoxication
- Arterial gas embolism (medical / trauma)
- Scuba diving (see **DECOMPRESSION SICKNESS PROTOCOL**)

Treatment

- If initiating water rescue
  - Utilize flotation devices and tow / hoist patient to safety. Rescuer in water is a last resort.
  - Administer 5 rescue breaths only if there is a delay in water extrication
- Once on land / in aircraft
  - Airway
    - Assess patency of airway, remove sand, seaweed, etc if visible.
    - Consider early intubation for obtunded patients
  - Breathing
    - If unconscious and not breathing, immediately perform 5 rescue breaths
    - If spontaneous breathing, immediately apply O2 at 15 LPM via NRB
    - Support ventilation with BVM, PEEP, oxygen, etc to goal O2 saturation of 92-96%
    - Place patient in recovery position as soon as able to reduce risk of aspiration
  - Circulation
    - If no pulses, focus on quality CPR. Move to **ADULT CARDIAC ARREST PROTOCOL / PEDIATRIC CARDIAC ARREST PROTOCOL**
    - Obtain IV access when able. See **IV / IO PROTOCOL**
    - Consider warmed IV fluids in hypotensive or hypothermic patients
  - Disability / Environment
    - Assess GCS
    - Maintain glucose 80-140 mg/dL. See **HYPERGLYCEMIA / HYPOGLYCEMIA PROTOCOL**
    - If event unwitnessed and persistent LOC, consider other etiologies besides hypoxemia
    - Dry and insulate patient. Treat hypothermia, move to **HOT / COLD WEATHER INJURY PROTOCOL**
    - Consider placement of NG / OG tube
- Terminating resuscitation efforts
  - In non-hypothermic patient, efforts may be stopped after 30 min of CPR without ROSC
  - In hypothermic patient, continue until patient is rewarmed to 30-34º C (86-93º F), then continue CPR. Efforts may be stopped if patient remains asystolic for > 20 min

Notes, Warnings, Cautions

- No in-water routine c-spine precautions or chest compressions
- Rescue breaths and CPR represent significant risk of emesis in drowning victims
- Due to the increased pulmonary airway pressures required for ventilating drowning patients, the use of supraglottic airways is discouraged
- Head down positioning or abdominal thrusts increases risk of aspiration. Heimlich maneuver is NOT recommended for drowning
- Initial 5 rescue breaths are used as a recruitment maneuver. Drowning patients without circulatory arrest will often respond to rescue breaths alone
- Many ALS interventions are ineffective with low core body temp. Antiarrhythmics should be withheld for core temp < 30º C (86º F)

Reference: CPG ID #64 (Drowning Management)

TOXIC INGESTION

POISON CONTROL NUMBER (IN US): 1-800-222-1222
WEBSITE: https://www.poison.org

Signs and Symptoms

- Mental status changes
- Hypotension / hypertension
- Respiratory depression
- Tachycardia / arrythmias
- Seizure

Differential Diagnosis

- Cyclic Antidepressants
- Acetaminophen
- Depressants
- Stimulants
- Anticholinergic
- Cardiac medications
- Solvents / cleaners

Adult

- Blood sugar < 70 mg/dL: **AMS PROTOCOL**
  - D50 25 g in 500 mL NS
    OR
  - Glucagon 1 mg IM
- Blood sugar > 70 mg/dL:
  - Activated Charcoal 25-100 g PO
    (If alert and < 1hr from ingestion)
- Beta blocker overdose:
  - Glucagon 2-10 mg IV; may repeat bolus after 10-15 min if no response
- Opiates:
  - Naloxone 0.4 – 2 mg IV / IO / IN
    - Watch for Respiratory Depression
- Tricyclic anti-depressant:
  - 12 Lead
  - QRS > 100 or hypotensive
    - Sodium Bicarbonate 1-2 mEq/kg
- Organophosphate:
  - Atropine 2 mg IV / IM q5 + 2-PAM 600 mg IV / IM
    OR
  - Atropine 20 mg in 250 mL NS; titrate to dry respiratory secretions
- Seizure
  - Midazolam 5 mg IV; 10 mg IM

Pediatric

- Blood Sugar < 70 mg/dL:
  - D25 2 mL/kg IV
    OR
  - Glucagon 0.5 mg IM (< 20 kg); 1 mg IM (> 20 kg)
- Blood Sugar > 70 mg/dL:
- Activated Charcoal: refer to **DRUG CARD**
- Beta Blocker Overdose:
  - Infants and Children
    - Glucagon 0.5 mg/kg IV; may repeat after 10-15 min if no response
  - Adolescent
    - Glucagon 5-10 mg IV
- Opiates:
  - < 20 kg: Naloxone 0.1 mg/kg IV / IO / IN
  - > 20 kg: Naloxone 0.4-2 mg IV / IO / IN
  - **AIRWAY PROTOCOL**
- Tricyclic anti-depressant:
  - 12 Lead
  - QRS > 100 or hypotensive?
    - Sodium Bicarbonate 1-2 mEq/kg
- Organophosphate:
  - Atropine 0.05-0.1 mg/kg q 5-10 min
- Seizure:
  - Lorazepam 0.1 mg/kg IV; may repeat in 5-10 min (max dose 4 mg/dose)

Notes, Cautions, Warnings

- Anticholinergic: altered mental status, hyperthermia, mydriasis, flushing, anhidrosis, full bladder
  - Follow Tricyclic dosing
  - Lorazepam for agitation and seizures
- Beta blockers watch for hypoglycemia
- Calcium channel blockers watch for hyperglycemia
- Cyclic anti-depressants signs: hypotension, depressed mental status, respiratory depression, and cardiac arrythmias
- Opioid signs: depressed mental status, pinpoint pupils, N / V, respiratory depression, hypotension
- Organophosphate signs: salivation, lacrimation, urination, diarrhea, emesis, altered mental status

Reference: CPD ID #69, 93, 101 (CBRN Series)

VOMITTING & DIARRHEA

Signs and Symptoms

- Pain
- Abdominal distention
- Constipation
- Diarrhea
- Anorexia
- Fever
- Rash

Differential Diagnosis

- CNS injury / infection
- Myocardial infection
- Drugs / toxins
- Pregnancy
- Gastroenteritis
- Appendicitis
- Bowel obstruction

Adult

- IV - O2 - Monitor
- Blood Glucose < 70 mg/dL w/ evidence of alcohol abuse
  - Thiamine 100 mg IV / IM
  - 50% Dextrose 25 g IV
    OR
  - Glucagon 1 mg IM
- If Glucose is outside < 70 mg/dL start over
- Nausea / vomiting
  - Promethazine 12.5mg IV
    OR
  - Ondansetron 4 – 8 mg IV

Pediatric

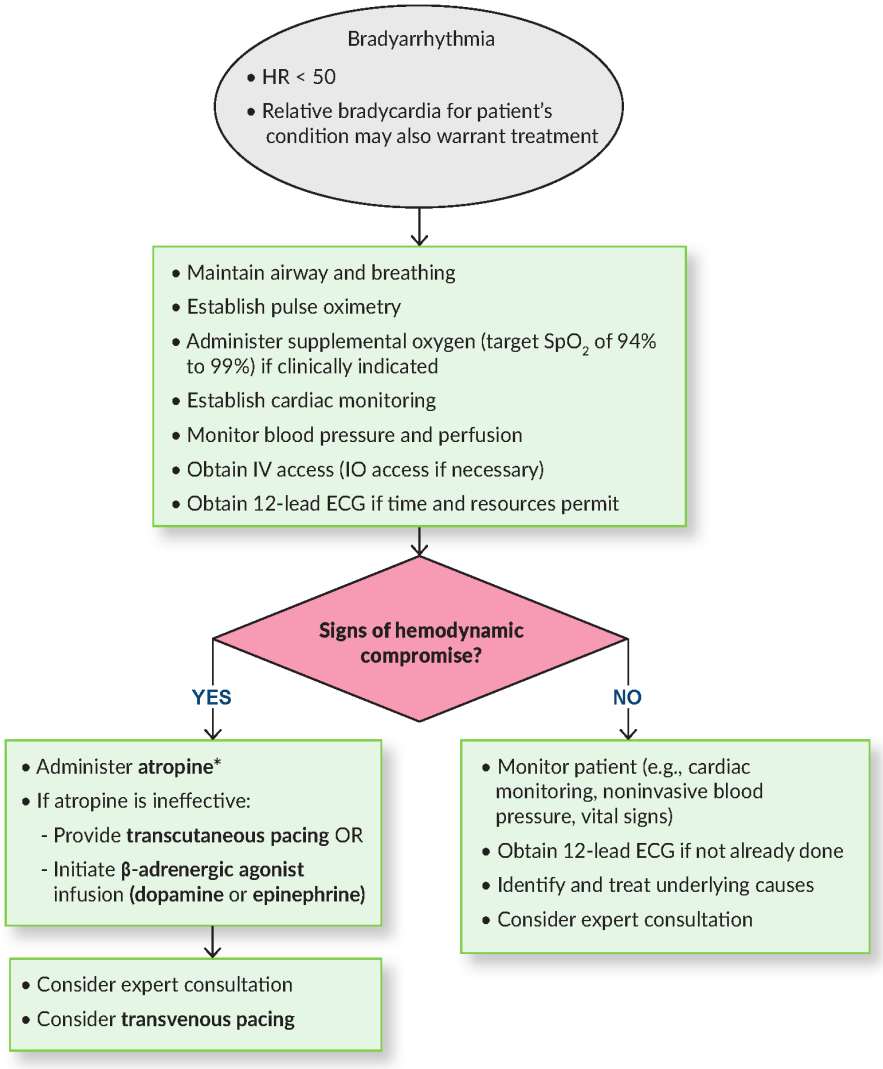
- IV - O2 - Monitor
- Blood Glucose < 70 mg/dL w/ evidence of malnourishment?
  - Infant Thiamine 0.35-0.5 mg/kg IV / IM per day (max dose 1.2 mg)
  - Children Thiamine 1.2 mg IV / IM per day
  - 25% Dextrose 2 mL/kg IV
    OR
  - < 20kg: Glucagon 0.5 mg IV / IM
  - > 20 kg: Glucagon 1 mg IV / IM
- Nausea / Vomiting:
  - Promethazine (if > 2yr old) 0.25-0.5 mg/kg IV (max dose 12.5 mg/dose)
  - Ondansetron (1 mo-12y/o) 0.15-0.3 mg/kg IV (max dose 8 mg)
  - Ondansetron (> 12 y/o): 4-8 mg IV

Notes, Cautions, Warnings

- Suspicions of underlying conditions should prompt immediate referral to appropriate protocol
- In pregnant patients with Nausea / Vomiting - substitute D5 1/2NS or D5NS in place of NS
- Fluid of choice for vomiting is NS. Fluid of choice for diarrhea is LR
- Continually monitor for any decompensation

ADULT BRADYARRHYTHMIA

ALS - 2020 VERSION



Medications
Atropine • 1 mg IV bolus every 3 to 5 min, up to a max dose of 3 mg
Dopamine • 5 to 20 mcg/kg/min titrated to effect
Epinephrine • 2 to 10 mcg/min titrated to effect

Signs of Hemodynamic Compromise
• Changes in mental status • Ischemic chest discomfort • Hypotension • Signs of shock • Acute heart failure

*Consider implementing transcutaneous pacing or β-adrenergic agonist therapy immediately for patients with second-degree AV block type II or third-degree AV block. Consider implementing transcutaneous pacing immediately if vascular access is difficult to achieve.

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ADULT CARDIAC ARREST

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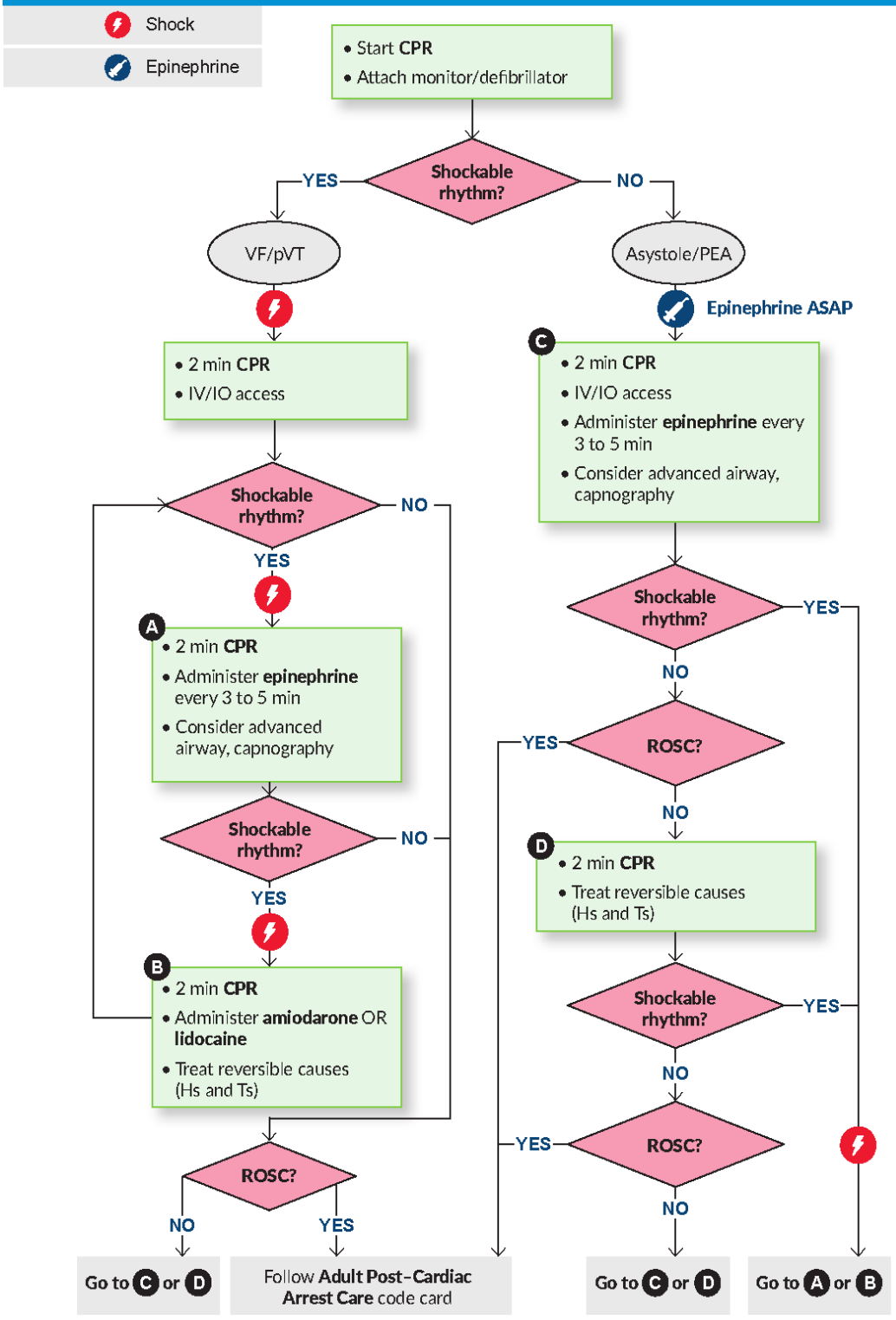

Defibrillation Energy Doses

Biphasic: Per manufacturer's recommendations (e.g., 120 to 200 J) or if unknown, max available; subsequent doses equal to or greater than first dose
Monophasic: 360 J for all doses

Medications

Epinephrine
- 1 mg IV/IO bolus every 3 to 5 min

Amiodarone
- First dose: 300 mg IV/IO bolus
- Second dose: 150 mg after 3 to 5 min

Lidocaine
- First dose: 1 to 1.5 mg/kg IV/IO
- Subsequent doses: 0.5 to 0.75 mg/kg IV/IO every 5 to 10 min, up to a max dose of 3 mg/kg

High-Quality CPR

- Compress at a rate of 100 to 120 compressions per min and a depth of at least 2 inches (5 cm); allow for full chest recoil
- Minimize interruptions to chest compressions to less than 10 sec
- Avoid excessive ventilations. Each ventilation should last about 1 sec and make the chest begin to rise
- **Without advanced airway:** 30 compressions: 2 ventilations
  With advanced airway: continuous compressions; deliver 1 ventilation every 6 sec without pausing compressions
- Rotate compressor every 2 min
- Monitor CPR quality with $ETCO_2$ or arterial blood pressure (if available)

What Is ROSC?

- Pulse and blood pressure
- Sudden and sustained increase in $ETCO_2$
- Arterial pulse waveform on an a-line when no compressions are being delivered
- Additional signs, including patient movement, normal breathing or coughing, may be present

Hs and Ts

- Hypovolemia
- Hypoxemia
- Hydrogen ion excess (acidosis)
- Hyperkalemia/hypokalemia
- Hypothermia
- Hyperglycemia/hypoglycemia
- Tamponade (cardiac)
- Tension pneumothorax
- Thrombosis (pulmonary embolism)
- Thrombosis (myocardial infarction)
- Toxins

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ADULT ACUTE CORONARY SYNDROMES

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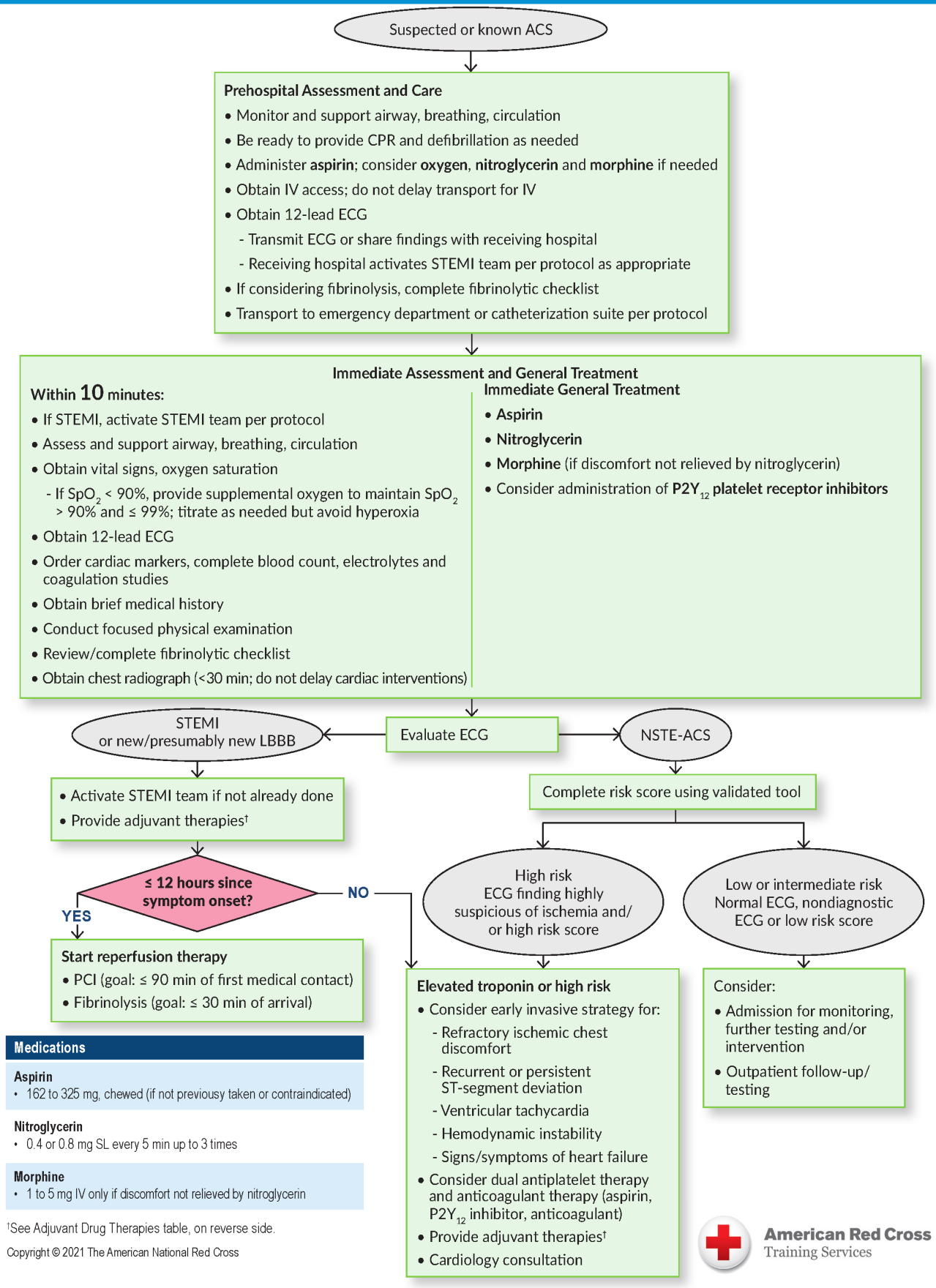

ADULT ACUTE CORONARY SYNDROMES

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ECG Findings in Acute Coronary Syndromes

STEMI (ST-segment elevation or new or presumably new LBBB)	NSTE-ACS	
	High Risk (ST-segment depression, dynamic T-wave inversion or transient ST-segment elevation strongly suspicious of ischemia)	**Intermediate or Low Risk (normal or nondiagnostic ST-segment or T-wave changes)**
• New ST-segment elevation at the J point in leads V2 and V3 of: - ≥ 0.2 mV (≥ 2 mm) in men > 40 years - ≥ 0.25 mV (≥ 2.5 mm) in men ≤ 40 years - ≥ 0.15 mV (≥ 1.5 mm) in women • New ST-segment elevation ≥ 0.1 mV (≥ 1 mm) in two or more contiguous leads other than V2 and V3 • New or presumed new left bundle branch block (LBBB)	• Changes suggestive of ischemia, such as ST-segment depression or T-wave inversion, in two or more contiguous leads • Transient ST-segment elevation ≥ 0.05 mV (≥ 0.5 mm) lasting < 20 min	• No ECG changes, or nondiagnostic ST-segment or T-wave changes • ST-segment deviation < 0.05 mV (0.5 mm) in either direction or T-wave inversion ≤ 0.2 mV (2 mm)

Normal or nonspecific ECG findings do not rule out the possibility of acute coronary syndromes. Always evaluate ECG findings in the context of the patient's overall clinical presentation.

Clinical Presentation of Acute Coronary Syndromes

Consider in all patients presenting with chest pain or discomfort:

- Retrosternal pressure, squeezing, tightness, aching or heaviness
- May radiate to one or both arms or shoulders, the back, neck, jaw or epigastric region
- Persistent (more than 3 to 5 min); may be intermittent

Other possible signs and symptoms:

- Dizziness, light-headedness or syncope
- Sudden, unexplained dyspnea, which may occur without chest pain or discomfort
- Nausea or vomiting
- Pale, ashen or slightly cyanotic skin, especially on the face and fingers
- Diaphoresis
- Anxiety or a feeling of impending doom
- Extreme fatigue
- Loss of consciousness

Note: Women, patients < 40 years or > 75 years, and those with medical conditions may present with atypical symptoms of ischemia (e.g., patients with diabetes may experience ischemia without pain, or "silent ischemia").

Adjuvant Drug Therapies

Drug Class	Use
• $P2Y_{12}$ platelet receptor inhibitors - Clopidogrel - Ticagrelor	For use in combination with aspirin for PCI for high-risk patients, or for patients with aspirin allergy
Glycoprotein IIb/IIIa inhibitors	For patients allergic or intolerant of $P2Y_{12}$ inhibitors, or undergoing PCI in combination with $P2Y_{12}$ inhibitors and high risk for thrombus, and for aspirin allergy
• Anticoagulants - Unfractionated heparin - Enoxaparin - Fondaparinux	For anticoagulation therapy following fibrinolytic therapy or PCI
Bivalirudin	An alternative to combination therapy with heparin and a glycoprotein IIb/IIIa inhibitor for anticoagulation after PCI
β-Blockers	Initiate within the first 24 hours unless there are contraindications (e.g., acute heart failure, low cardiac output)
Intravenous nitroglycerin	For recurrent or refractory chest pain, pulmonary edema or hypertension accompanying STEMI

ADULT POST–CARDIAC ARREST CARE

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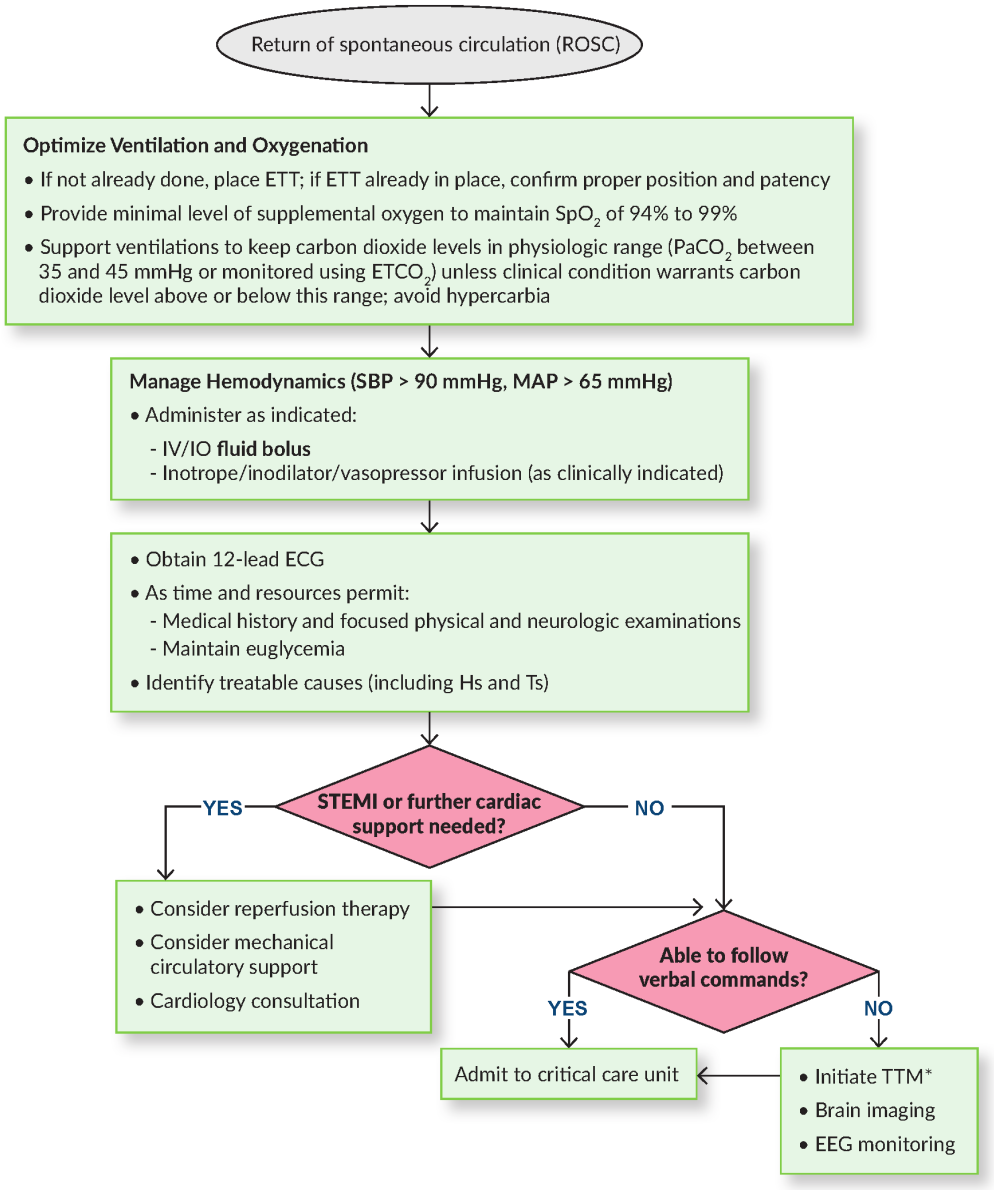

Medications	Ventilation and Oxygenation Goals	Hs and Ts	Targeted Temperature Management*
IV/IO fluid bolus • 1 to 2 L NS or LR solution **Dopamine** • 5 to 20 mcg/kg/min IV/IO **Epinephrine** • 2 to 10 mcg/min IV/IO **Norepinephrine** • 0.1 to 0.5 mcg/kg/min IV/IO	**Ventilation** • Start at 10 breaths/min; adjust as needed • $PaCO_2$: 35 to 45 mmHg **Oxygenation** • Provide minimal level needed to maintain SpO_2 of 94% to 99%	• **H**ypovolemia • **H**ypoxemia • **H**ydrogen ion excess (acidosis) • **H**yperkalemia/hypokalemia • **H**ypothermia • **H**yperglycemia/hypoglycemia • **T**amponade (cardiac) • **T**ension pneumothorax • **T**hrombosis (pulmonary embolism) • **T**hrombosis (myocardial infarction) • **T**oxins	Maintain core body temperature 32° C to 36° C for at least 24 hours **Methods include:** • Ice-cold IV fluid bolus (30 mL/kg) • Endovascular catheters • Surface-cooling strategies (e.g., cooling blankets, ice packs) Continuously monitor core temperature via esophageal, rectal or bladder catheter Monitor for negative consequences of hypothermic temperature

*Providers should not initiate TTM in the prehospital setting. The evidence for TTM is constantly evolving. Defer to institutional protocols and clinician judgment based on the latest evidence.

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ADULT POST–CARDIAC ARREST CARE

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Prognostication Following Return of Spontaneous Circulation (ROSC)		
Clinical management	TTM (if indicated)	0 to 30 hours post-ROSC
	Rewarming (if indicated)	30 to 54 hours post-ROSC
	Minimize sedation and analgesia as possible; controlled normothermia	54 to 72+ hours post-ROSC
Multimodal prognostication in the post–cardiac arrest period should not be determined before 72 hours after ROSC and following return to normothermia.		
Modality	**Predictor**	**Timeframe Post-ROSC**
Imaging	Brain computed tomography (CT) • Gray-to-white matter ratio (GWR)	0 to 24 hours
	Brain diffusion-weighted MRI (DWMRI) • Apparent diffusion coefficient (ADC)	24 to 72+ hours
Electrophysiology	Somatosensory evoked potentials (SSEPs) • Bilaterally absent N20 SSEPs	24 to 72+ hours
	Electroencephalography (EEG) • Seizure activity • Burst suppression	72+ hours
Clinical examination	Myoclonus or status myoclonus*	24 to 72 hours
	Pupillary light reflexes	72+ hours
	Quantitative pupillometry	72+ hours
	Corneal reflexes	72+ hours
Serum biomarkers	Serum neuron-specific enolase (NSE)	24 to 72 hours

*Obtain EEG with myoclonic jerks.

ADULT ACUTE STROKE

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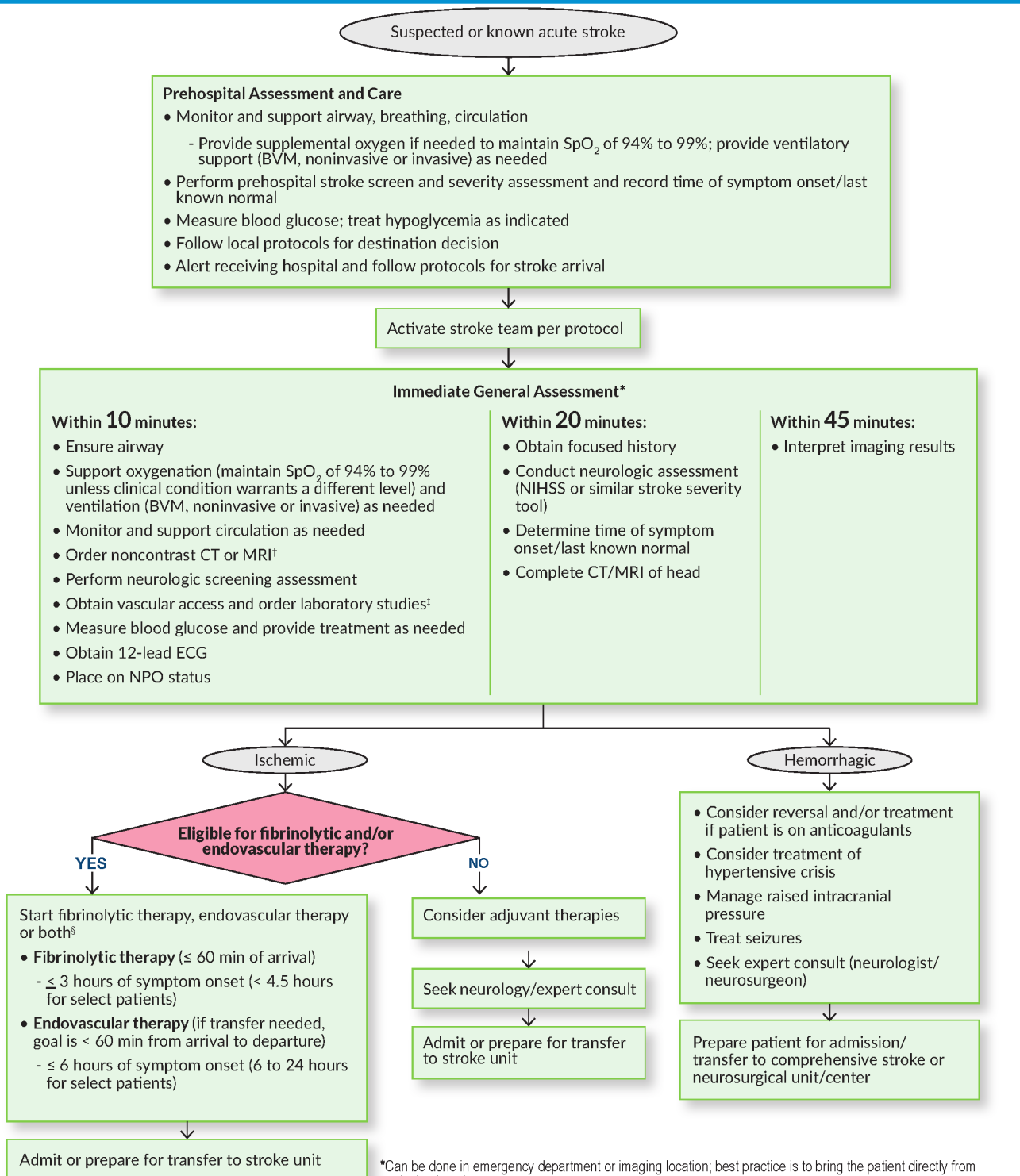

*Can be done in emergency department or imaging location; best practice is to bring the patient directly from arrival to imaging.

†CTA with CTP or MRA with diffusion-weighted MRI with or without MR perfusion may be used for selected patients.

‡Serum electrolyte panel with renal function tests, complete blood count, cardiac markers, prothrombin time, international normalized ratio, activated partial thromboplastin time

§Discontinue therapy with anticoagulant or antiplatelet agents for 24 hours after rtPA administration.

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ADULT ACUTE STROKE

ALS - 2020 VERSION

Signs and Symptoms of Stroke

- Acute-onset mental status changes or confusion
- Sudden weakness or numbness on one side of the body
- Sudden difficulty with language (e.g., difficulty speaking, difficulty understanding, garbled speech)
- Sudden loss of vision in one or both eyes
- Difficulty with walking, balance or coordination
- Sudden severe headache

Cincinnati Prehospital Stroke Scale (CPSS)

An abnormal finding in any one of the following three areas is associated with a 72% probability of stroke.

Facial Droop (ask patient to show teeth/smile)
- Normal: both sides of face move equally
- Abnormal: one side of the face does not move as well as the other side

Arm Drift (ask patient to close eyes and extend both arms straight out with the palms up for 10 seconds)
- Normal: both arms move the same, or both arms do not move at all
- Abnormal: one arm does not move, or one arm drifts downward as compared with the other

Abnormal Speech (ask patient to say "You can't teach an old dog new tricks")
- Normal: patient uses correct words without slurring
- Abnormal: patient uses incorrect words, slurs words or is unable to speak

Eligibility Criteria for Intravenous rtPA Administration in Patients with Acute Ischemic Stroke

Treatment Timing	Inclusion Criteria	Absolute Exclusion Criteria	Relative Exclusion Criteria
Within 3 hours of symptom onset or patient last known well or at baseline state	• Ischemic stroke diagnosis • Measurable neurologic deficit • ≥ 18 years of age	• Significant head trauma or stroke within last 3 months • Symptoms suggestive of subarachnoid hemorrhage • Arterial puncture at noncompressible site within last 7 days • History of intracranial hemorrhage, intracranial tumor, AVM or aneurysm • Recent intracranial or intraspinal surgery • Hypertension (systolic blood pressure > 185 mmHg or diastolic blood pressure > 110 mmHg) • Active internal bleeding • Risk factors for acute bleeding, including but not limited to: - Low platelet count (< 100,000/mm³) - Heparin administration within the last 48 hours, resulting in an aPTT value greater than the upper limit of normal - Current use of an anticoagulant with an INR > 1.7 or a PT > 15 sec - Current use of direct thrombin inhibitors or direct factor Xa inhibitors with elevated results on sensitive laboratory tests (e.g., aPTT, INR, platelet count or ECT; TT or appropriate factor Xa activity assays) • Low blood glucose level (< 50 mg/dL or 2.7 mmol/L) • Multilobar infarction on CT	• Minor or rapidly improving stroke symptoms (clearing spontaneously) • Pregnancy • Seizure at onset • Major surgery or serious trauma within past 14 days • Gastrointestinal malignancy or recent gastrointestinal or urinary tract hemorrhage within past 21 days • Recent acute myocardial infarction within past 3 months
Within 3 to 4.5 hours of symptom onset* or patient last known well or at baseline state	• Ischemic stroke diagnosis • Measurable neurologic deficit	In addition to the exclusion criteria for treatment within 3 hours of symptom onset: • Current anticoagulant therapy (INR > 1.7) • History of ischemic stroke within previous 3 months	• Patients ≥ 80 years of age with a history of both diabetes mellitus and prior stroke

*Intravenous rtPA administration may also be considered for a patient with acute ischemic stroke who awakens with stroke symptoms or who has an unclear time of symptom onset greater than 4.5 hours from the last known well or baseline state who has a DW-MRI lesion smaller than one-third of the MCA territory and no visible signal change on FLAIR.

Blood Pressure Management

Patients who have elevated blood pressure and are otherwise eligible for treatment with intravenous rtPA (or mechanical thrombectomy) should have their blood pressure carefully lowered so that their systolic blood pressure (SBP) is less than 185 mmHg and their diastolic blood pressure (DBP) is less than 110 mmHg before intravenous fibrinolytic therapy is initiated.

Management of blood pressure for a patient otherwise eligible for emergency reperfusion therapy except that blood pressure is greater than 185/110 mmHg

Labetalol
- 10 to 20 mg IV over 1 to 2 min, may repeat 1 time OR

Nicardipine
- 5 mg/h IV, titrate up by 2.5 mg/h every 5 to 15 min (maximum 15 mg/h); when desired blood pressure reached, adjust to maintain proper blood pressure limits OR

Clevidipine
- 1 to 2 mg/h IV, titrate by doubling the dose every 2 to 5 min until desired blood pressure reached (maximum 21 mg/h)

Other agents (e.g., hydralazine, enalaprilat) may also be considered. If blood pressure is not maintained at less than or equal to 185/110 mmHg, do not administer rtPA.

Management of blood pressure during and after rtPA or other emergency reperfusion therapy to maintain blood pressure at less than or equal to 180/105 mmHg

Monitor blood pressure every 15 min for 2 h from the start of rtPA therapy, then every 30 min for 6 h, and then every hour for 16 h.

If SBP > 180 to 230 mmHg or DBP > 105 to 120 mmHg:

Labetalol
- 10 mg IV followed by continuous IV infusion 2 to 8 mg/min OR

Nicardipine
- 5 mg/h IV; titrate up to desired effect by 2.5 mg/h every 5 to 15 min (maximum 15 mg/h) OR

Clevidipine
- 1 to 2 mg/h IV; titrate by doubling the dose every 2 to 5 min until desired blood pressure reached (maximum 21 mg/h)

If blood pressure is not controlled or DBP > 140 mmHg, consider IV sodium nitroprusside.

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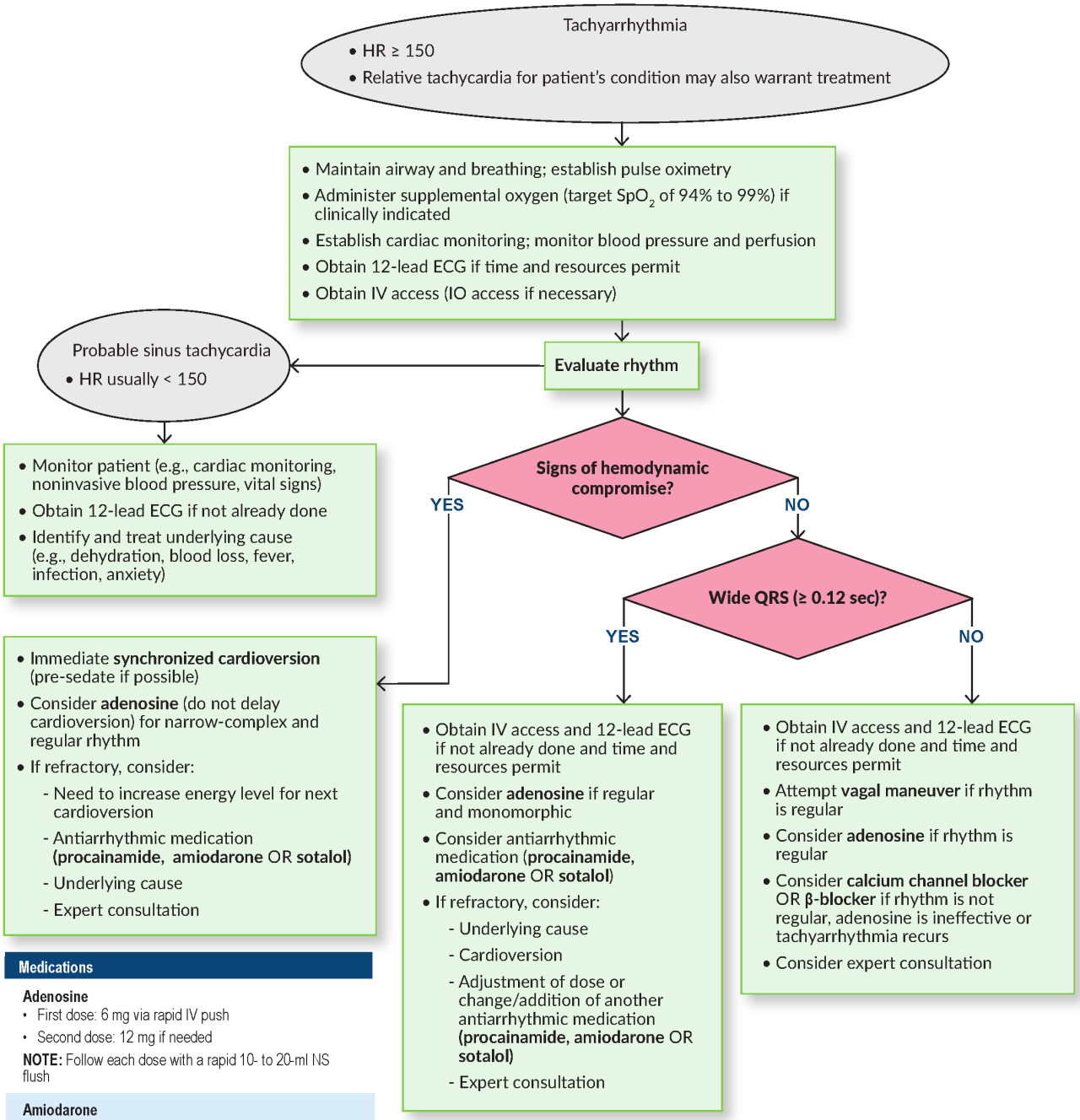
ADULT TACHYARRHYTHMIA

ALS - 2020 VERSION



Medications

Adenosine
- First dose: 6 mg via rapid IV push
- Second dose: 12 mg if needed

NOTE: Follow each dose with a rapid 10- to 20-ml NS flush

Amiodarone
- 150 mg IV over 10 min; repeat as needed if arrhythmia recurs
- Maintenance infusion: 1 mg/min for first 6 hours

Procainamide (avoid if prolonged QT or congestive heart failure)
- 20 to 50 mg/min until arrhythmia is suppressed, hypotension develops, QRS duration increases by more than 50% or max dose of 17 mg/kg is given
- Maintenance infusion: 1 to 4 mg/min

Sotalol (avoid if prolonged QT)
- 100 mg (1.5 mg/kg) over 5 min

Synchronized Cardioversion Energy Doses

Follow device manufacturer's recommendations for energy doses

Vagal Maneuvers

- Valsalva maneuver
- Cold stimulus
- Gagging
- Carotid massage (use with caution in those with vascular disease, older adults)

Signs of Hemodynamic Compromise

- Changes in mental status
- Ischemic chest discomfort
- Hypotension
- Signs of shock
- Acute heart failure

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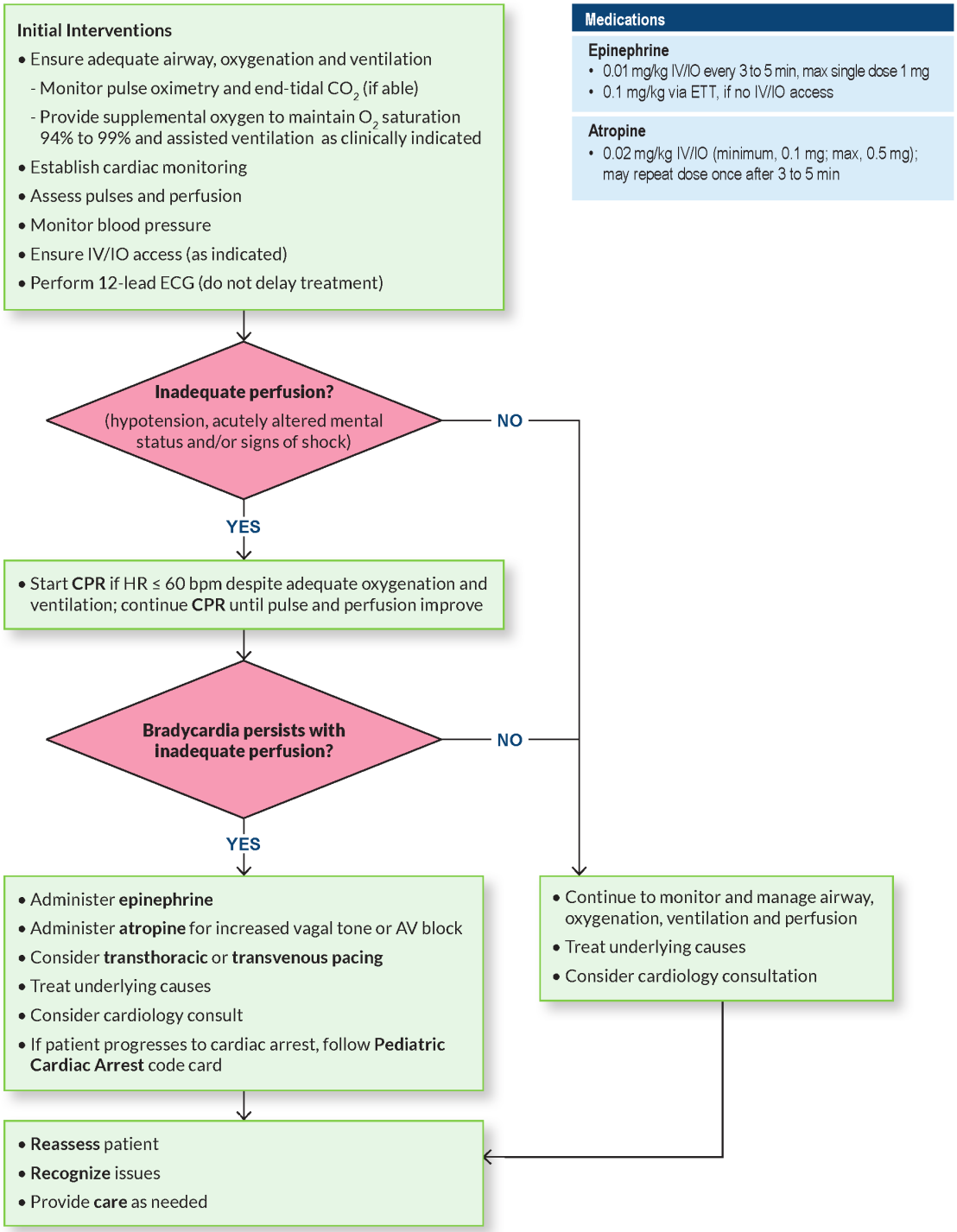
PEDIATRIC BRADYCARDIA WITH A PULSE

PALS - 2020 VERSION



PEDIATRIC BRADYCARDIA WITH A PULSE

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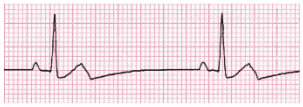
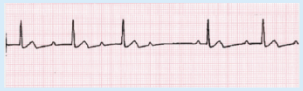
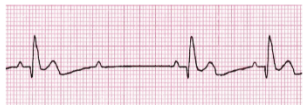
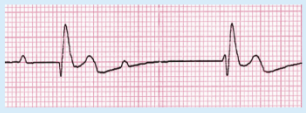
Age Group	Awake Heart Rate (Beats per Minute)
Newborn	100–200
Infant (1 to 12 months)	100–180
Toddler (1 to 2 years)	90–140
Preschooler (3 to 5 years)	80–130
School Age (6 to 12 years)	70–120
Adolescent (13 to 17 years)	60–100

Bradyarrhythmia	ECG Features	
Sinus bradycardia	Sinus origin, but HR lower than normal for age	
Second-degree AV block type I	Repeated pattern of progressively delayed atrial conduction (prolonged PR interval) followed by completely blocked conduction (dropped beat)	
Second-degree AV block type II	Some atrial impulses conducted and others not, but no progressive delays; blocked impulses may occur in a pattern (e.g., 2:1; 3:1 or 4:1 in high-grade block)	
Third-degree AV block	No atrial impulses conducted to ventricles (AV dissociation)	

PEDIATRIC CARDIAC ARREST

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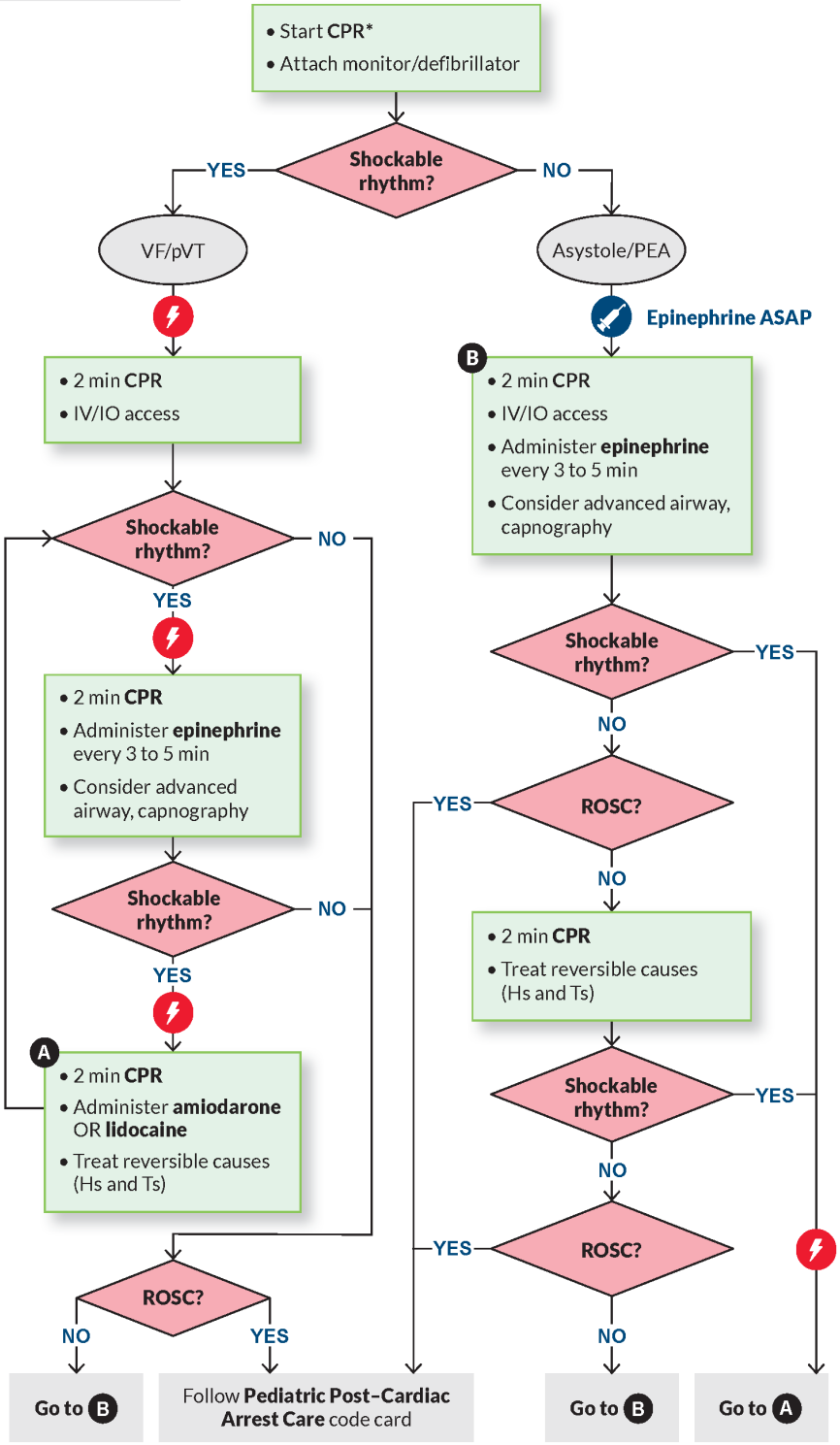
Shock

Epinephrine



Defibrillation Energy Doses

- First shock: 2 J/kg
- Second shock: 4 J/kg
- Subsequent shocks: ≥ 4 J/kg, max, 10 J/kg or adult dose

Medications

Epinephrine
- 0.01 mg/kg IV/IO every 3 to 5 min, max single dose 1 mg
- 0.1 mg/kg via ETT, if no IV/IO access

Amiodarone
- 5 mg/kg IV/IO bolus (max single dose, 300 mg)
- May repeat initial dose two additional times (3 total doses, max 15 mg/kg, adolescent max 2.2 g) for refractory VF/pulseless VT

Lidocaine
- Initial dose: 1 mg/kg loading dose IV/IO
- Maintenance dose: 20 to 50 mcg/kg per min infusion (repeat bolus dose if infusion initiated > 15 min after initial bolus therapy)

High-Quality CPR

- Compress at a rate of 100 to 120/min and a depth of about 2 inches (5 cm) for children and about 1 1/2 inches (3.8 cm) for infants; allow for full chest recoil after each compression
- Minimize interruptions to chest compressions to less than 10 sec
- Avoid excessive ventilations; each ventilation should last about 1 sec and make the chest begin to rise
- **Without advanced airway:** Single provider, 30 compressions: 2 ventilations; multiple providers 15 compressions: 2 ventilations
  With advanced airway: Continuous compressions at 100 to 120/min and deliver 1 ventilation every 2 to 3 sec without pausing compressions
- Rotate compressor every 2 min
- Monitor CPR quality with $ETCO_2$ or arterial blood pressure (if available)

What Is ROSC?

- Pulse and blood pressure
- Sudden and sustained increase in $ETCO_2$
- Arterial pulse waveform on an a-line when no compressions are being delivered
- Additional signs, including patient movement, normal breathing or coughing, may be present

Hs and Ts

- Hypovolemia
- Hypoxemia
- Hydrogen ion excess (acidosis)
- Hyperkalemia/hypokalemia
- Hypothermia
- Hypoglycemia
- Tamponade (cardiac)
- Tension pneumothorax
- Thrombosis (pulmonary embolism)
- Thrombosis (myocardial infarction)
- Toxins

*For an adolescent in cardiac arrest, follow adult CPR guidelines. See **Adult Cardiac Arrest** code card

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PEDIATRIC TACHYCARDIA WITH A PULSE

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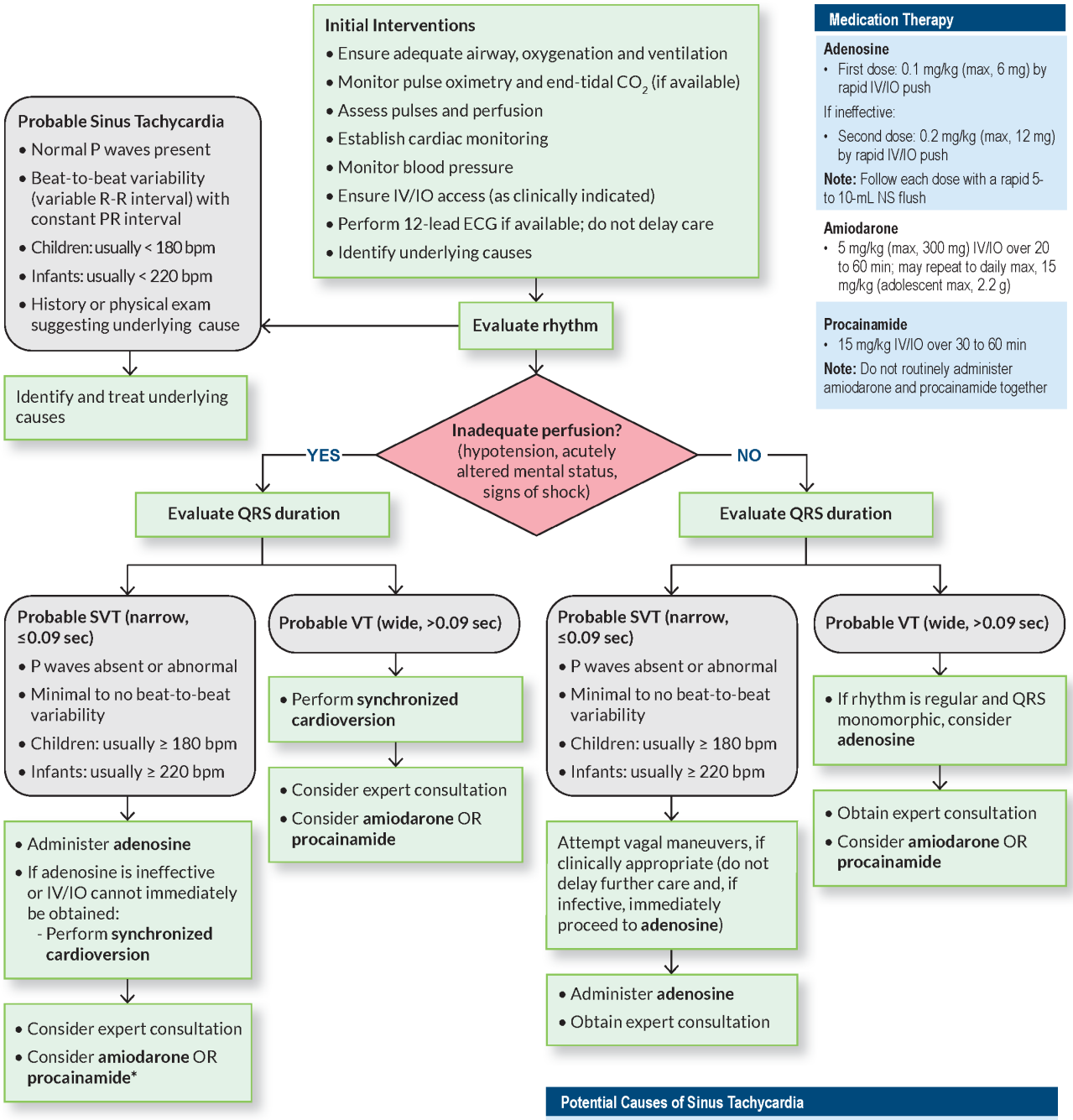

Synchronized Cardioversion

- Begin with 0.5 to 1 J/kg.
- If ineffective, repeat at 2 J/kg. (Providers may increase the dosage more gradually.)
- Provide sedation and analgesia if it does not delay care. Selection of agents should account for risk of hemodynamic effects.

Potential Causes of Sinus Tachycardia

- Vigorous physical activity
- Anxiety
- Pain
- Infection and fever
- Tissue hypoxia
- Hypovolemia (caused by fluid or blood loss)
- Anemia
- Congestive heart failure/heart disease
- Medications (e.g., catecholamines)
- Illicit drugs (primarily stimulants)
- Metabolic issues
- Pulmonary embolism
- Tension pneumothorax
- Pericardial tamponade

*For older patients, consultant may recommend verapamil.

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PEDIATRIC RESPIRATORY DISTRESS OR FAILURE

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Support Airway

- Ensure adequate airway
  - Provide proper positioning as indicated (head-tilt-chin lift or modified jaw thrust); if child is responsive, allow them to find a comfortable position; use airway adjuncts as appropriate
  - Suction as needed
  - Use foreign body airway obstruction clearing techniques as indicated
  - Consider advanced airway if clinically indicated; consult with advanced airway specialist such as an anesthesiologist or otolaryngologist for difficult airway
- Consider pharmacologic management as appropriate

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Support Breathing

- Assess ventilation rate, depth, rhythm and effort; auscultate breath sounds
- Establish pulse oximetry; provide humidified supplemental oxygen to maintain O_2 saturation 94% to 99%
- Establish capnography in intubated patients and, if available, in nonintubated patients
- Assist ventilation as needed (BVM, noninvasive or invasive)
- Perform needle decompression and/or tube thoracostomy, if needed
- Consider pharmacologic management as appropriate

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Support Circulation

- Assess central and peripheral pulses and perfusion; monitor blood pressure and heart rate; establish cardiac monitoring
- Provide chest compressions if indicated
- Establish IV/IO access as appropriate*
- Consider fluid resuscitation and pharmacologic management as appropriate
- Treat arrhythmias as indicated
- Consider interventions to reduce metabolic demand (temperature management, sedation, mechanical ventilation)

IDENTIFY AND TREAT SPECIFIC TYPE OF RESPIRATORY PROBLEM (In addition to general care above)

Partial Upper Airway Obstruction	Lower Airway Obstruction	Lung Tissue Disease	Neurological and Metabolic Disorders of Ventilation
• **Croup:** Consider **nebulized epinephrine, corticosteroids, heliox**	• **Bronchiolitis:** Provide **suctioning** and **supportive care**; consider a trial of **nebulized epinephrine** or **albuterol**; if no response discontinue. If response, consider continued bronchodilator therapy. If previously diagnosed with asthma, consider asthma management.	• **Pneumonia/pneumonitis:** Administer **antibiotics** as indicated; assess for type of pneumonia to guide antibiotic therapy; initiate **bronchodilator** treatment as needed.	• **Disordered control of respiration (increased ICP):** Ensure adequate CPP (head midline, pharmacologic therapy for ICP, avoid hypotension, aggressively treat fever)
• **Anaphylaxis:** Consider **epinephrine, albuterol, corticosteroids, antihistamines;** if hypotensive, initiate **fluid resuscitation** (20-mL/kg crystalloid fluid bolus rapidly; repeat as needed)	• **Asthma (bronchospasm):** Administer **albuterol** with or without **ipratropium**; consider **corticosteroids, magnesium sulfate, epinephrine, terbutaline**	• **Pulmonary edema (cardiogenic):** Consider **inotrope, inodilator and/or vasoactive agent** therapies as needed; consider **diuretics**; provide **ventilatory support with PEEP** as needed (noninvasive and invasive).	• **Toxin/poisoning/overdosage:** Contact poison control center; administer **antidotes** (e.g., **naloxone**)
• **Foreign body aspiration:** Provide **patient positioning** and **ventilatory support**; arrange for speciality consultation		• **Pulmonary edema (non-cardiogenic):** Manage oxygenation and ventilation according to protocols for PARDS; correct hypoxemia with **ventilation strategies** and **PEEP**; consider permissive hypercapnia, as indicated	• **Neuromuscular disease:** Provide **suctioning** and **ventilatory support** (noninvasive and invasive) as needed
			• **Metabolic disorders:** Consider reversal of metabolic derangements

*To avoid agitating the patient, may opt to defer vascular access in spontaneously ventilating patients who do not require IV therapy or who are not exhibiting signs of deterioration.

PEDIATRIC RESPIRATORY DISTRESS OR FAILURE

PALS - 2020 VERSION

Differentiating Severity of Respiratory Compromise

Stage	Description	Signs and Symptoms	
Respiratory distress	Earliest stage of respiratory compromise; patient maintains adequate oxygenation and ventilation via compensatory mechanisms; can progress to respiratory failure	• Tachypnea • Increased work of breathing (accessory muscle use, nasal flaring) • Varying degrees of airway obstruction (as evidenced by stridor, drooling, wheezing) • Abnormal breath sounds • Grunting	• Tachycardia • Irritability or anxiety • Assuming position of comfort (e.g., tripod positioning) • Pallor • Cyanosis which resolves with supplemental oxygen
Respiratory failure	Patient unable to maintain adequate oxygenation (hypoxic) or ventilation (hypercapneic) to meet metabolic demands; usually requires ventilatory support; will lead to respiratory arrest if not quickly addressed	• Slowed respiratory rate (may initially be very rapid) • Poor or absent air movement • Diminished breath sounds • Lack of chest movement • Low oxygen saturation or low PaO_2 • High $ETCO_2$ or high PCO_2	• Bradycardia • Altered mental status (e.g., lethargy, somnolence), including loss of consciousness • Central cyanosis (may not resolve with supplemental oxygen) • Pallor • Hypotension
Respiratory arrest	Complete cessation of breathing effort; leads to cardiac arrest after a very short time	• Absent breath sounds • Lack of chest movement • Bradycardia	• Hypotension • Loss of consciousness • Cyanosis

"Key" Potential Assessment Findings by Respiratory Problem Type

Assessment	Partial Upper Airway Obstruction	Lower Airway Obstruction	Lung Tissue Disease	Neurologic and Metabolic Disorders of Ventilation
Airway	• Stridor (inspiratory; may be expiratory) • Trouble swallowing, drooling/difficulty managing secretions • Voice (or cry) changes (e.g., hoarseness/"hot potato" voice) • Unmaintainable airway (late) • Sudden-onset signs of airway obstruction and respiratory compromise (foreign body aspiration)	• Unmaintainable airway (late)	• Unmaintainable airway (late)	• Unmaintainable airway due to altered mental status • Impaired swallowing, drooling (neuromuscular diseases) • Ineffective airway clearance
Breathing: respiratory rate	• Tachypnea • Bradypnea or apnea (late)	• Tachypnea • Bradypnea or apnea (late)	• Tachypnea • Bradypnea or apnea (late)	• Tachypnea, bradypnea or apnea • Irregular breathing pattern (e.g., Cheyne-Stokes breathing)
Breathing: work of breathing	• Retractions • Nasal flaring	• Retractions • Nasal flaring	• Retractions • Nasal flaring	• Normal, increased or irregular
Breathing: air movement	• Decreased	• Decreased • Prolonged exhalation	• Decreased	• Variable
Breathing: abnormal sounds	• Stridor (inspiratory; may be expiratory)	• Wheezing • Grunting • Rhonchi (bronchiolitis) • Crackles	• Grunting • Decreased breath sounds (pneumonia) • Localized crackles (pneumonia) • Generalized crackles and wheezes (pulmonary edema)	• None
Other	• Barking or brassy cough (croup)	• Unable to talk in full sentences • Wet, "junky" cough (bronchiolitis)	• Shallow respirations • Cough	• Ineffective cough (neuromuscular diseases) • Cushing's triad (abnormal breathing, hypertension and bradycardia; associated with increased ICP)
Circulation	• Tachycardia • Pallor, cyanosis	• Tachycardia (bradycardia with hypoxia and respiratory failure) • Pulsus paradoxus • Pallor, cyanosis	• Tachycardia • Pallor, cyanosis (late)	• Tachycardia • Hypertension • Bradycardia • Cyanosis (apnea)
Disability	• Restless, anxious, irritable, unable to get comfortable • Assuming a position of comfort (e.g., tripod positioning) • Agitation, somnolence or unconsciousness (late)	• Restless, anxious • Reluctance to lie flat • Agitation, somnolence or unconsciousness (late)	• Restless, anxious • Agitation, somnolence or unconsciousness (late)	• Altered mental status (CNS conditions, toxins, metabolic conditions) • Pupillary changes (CNS conditions, toxins) • Global muscle weakness, hypotonia in infants (neuromuscular diseases) • Posturing (CNS conditions)
Exposure *(possible findings)*	• Skin reactions (rashes) • Increased or decreased temperature • Toxic appearance • Swelling (anaphylaxis, infection or abscess)	• Increased or decreased temperature	• Increased or decreased skin temperature	• Signs of trauma, bleeding, needle marks (injection), increased or decreased temperature • Chest wall deformity, kyphoscoliosis, thin or atrophied extremities, contractures (neuromuscular diseases)
Secondary assessment	• Hypoxemia in severe obstruction (croup) • Radiograph may show steeple sign (croup) or "thumb sign" (epiglottitis)	• Hypoxemia • Chest radiograph may show hyperinflation or air trapping (both sides in asthma/bronchiolitis; one side with foreign body aspiration) • Chest radiograph may show object in foreign body aspiration • Rapid RSV testing positive (bronchiolitis) • Rapid flu testing, respiratory viral studies positive	• Hypoxemia • Chest radiography: airspace opacity, lobar consolidation or interstitial opacities	• Acute or chronic metabolic alkalosis or acidosis

PEDIATRIC GENERAL SHOCK

PALS - 2020 VERSION

Support Airway, Breathing and Circulation
- Ensure adequate airway, oxygenation and ventilation; monitor pulse oximetry and end-tidal CO_2 (if applicable)
- Establish cardiac monitoring and IV/IO access, if not already done*
- Assess pulses and perfusion; monitor blood pressure (noninvasive or invasive)
- If sepsis is suspected, follow **Pediatric Septic Shock** code card

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Initiate Intravascular Volume Restoration
- **For hypovolemia:** Begin with **crystalloid fluid** (0.9% NS or LR) **bolus** at 20 mL/kg IV/IO rapidly†; repeat as needed to restore normovolemia‡
- **For hypovolemic shock due to hemorrhage:** Control hemorrhage; administer 20 mL/kg **crystalloid fluid bolus** IV/IO rapidly†; administer **PRBCs** or **whole blood** as indicated; consider **TXA;** repeat **crystalloid fluid bolus** if clinically indicated and if blood products are not immediately available‡

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Consider Medication Therapy
- Consider **vasopressor**, **inotrope** or **inodilator therapy** for fluid-refractory (or fluid-intolerant) shock. Choice of vasoactive therapy will depend on the desired physiologic effect(s) and etiology of shock. Place a central venous catheter for administration of vasoactive drugs, if trained; do not delay therapy for CVC placement
- Begin **prostaglandin E1** infusion in any infant with a known or suspected ductal-dependent cardiac lesion (pending confirmation or exclusion)

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Consider Additional Measures
- Minimize oxygen demand: Consider mechanical ventilation; treat fever, pain or seizures, when present; consider sedation and neuromuscular blockade, as clinically indicated
- Obtain laboratory samples (e.g., CBC, CMP, lactate, ABG)
- Identify and manage metabolic abnormalities; treat hypoglycemia; manage acidosis
- If steroid suppressed, consider stress dose hydrocortisone
- Obtain critical care consultation

Goals of Care
- Maintain or restore circulation, defined as normal perfusion for age, normal blood pressure for age, normal HR for age, capillary refill ≤ 2 sec and normal mental status. Additional parameters can include: normal urine output for age, normal lactate levels and normal invasive pressures

IDENTIFY AND TREAT SPECIFIC TYPES OF SHOCK

Hypovolemic Shock

Nonhemorrhagic
- Administer 20-mL/kg **crystalloid fluid bolus** rapidly†; repeat as needed to restore normovolemia‡

Hemorrhagic
- Control hemorrhage
- Administer 20-mL/kg **crystalloid fluid bolus** rapidly†; repeat as indicated (if blood products are not immediately available)‡
- Administer **PRBCs/ whole blood** as indicated
- Administer **TXA** as indicated

Distributive Shock

Septic
- Follow **Pediatric Septic Shock** code card

Anaphylactic
- Administer **epinephrine** (IM, SQ, auto-injector, infusion)
- Administer 20-mL/kg **crystalloid fluid bolus**†; repeat as needed‡
- Administer **albuterol** as indicated
- Administer **corticosteroids**, **antihistamines** as indicated

Neurogenic
- Administer 20-mL/kg **crystalloid fluid bolus**†; repeat as needed‡
- Administer **vasopressors** as indicated
- Treat bradycardia as indicated

Cardiogenic Shock
- Manage arrhythmias (refer to appropriate code cards)
- Administer 5- to 10-mL/kg **crystalloid fluid bolus** over 10 to 20 min if clinically indicated; repeat as needed‡
- Consider administering **milrinone** as clinically indicated; consider administering **epinephrine**, **dopamine**, or **dobutamine** additively or independently, as clinically indicated.
- Correct metabolic derangements
- Consider **ventilatory support** to reduce cardiac work
- Seek expert consultation

Obstructive Shock

Cardiac Tamponade
- Perform, or arrange for, urgent **pericardiocentesis**
- Administer 20-mL/kg **crystalloid fluid bolus** rapidly†; repeat as needed to support perfusion‡

Tension Pneumothorax
- Perform emergent **needle decompression**; perform, or arrange for, insertion of **thoracostomy tube**

Pulmonary Embolism
- Administer 20-mL/kg **crystalloid fluid bolus**† as needed to support perfusion; repeat as needed‡
- Consider medical therapy with **fractionated** or **unfractionated heparin**
- Consider **thrombolytic therapy** (IV or endovascular localized)
- Consider **thrombectomy**

Obstructive Cardiac or Aortic Lesion
- Initiate **prostaglandin E1**
- Support ventricular function with **inodilators, inotropes** and/or **vasocative substances** as indicated
- Consider **ventilatory support** to reduce cardiac workload
- Manage acidosis
- Consult pediatric cardiologist for definitive diagnosis and management; note that immediate surgical or catheter based intervention may be warranted

*If unable to obtain intravenous access and if clinically warranted, establish intraosseous access. If possible, two large-bore IV (or IO) access points are best for hypovolemic shock.
†Administer smaller (10-mL/kg) fluid bolus volumes in neonates. Also consider smaller (5- to 10-mL/kg) fluid bolus volumes in children with poor cardiac function/heart failure. (Fluid therapy may be contraindicated in children with hypervolemic conditions.)
‡Reassess after each bolus. Monitor for signs of hypervolemia, including worsening heart failure and worsening perfusion.

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PEDIATRIC SEPTIC SHOCK

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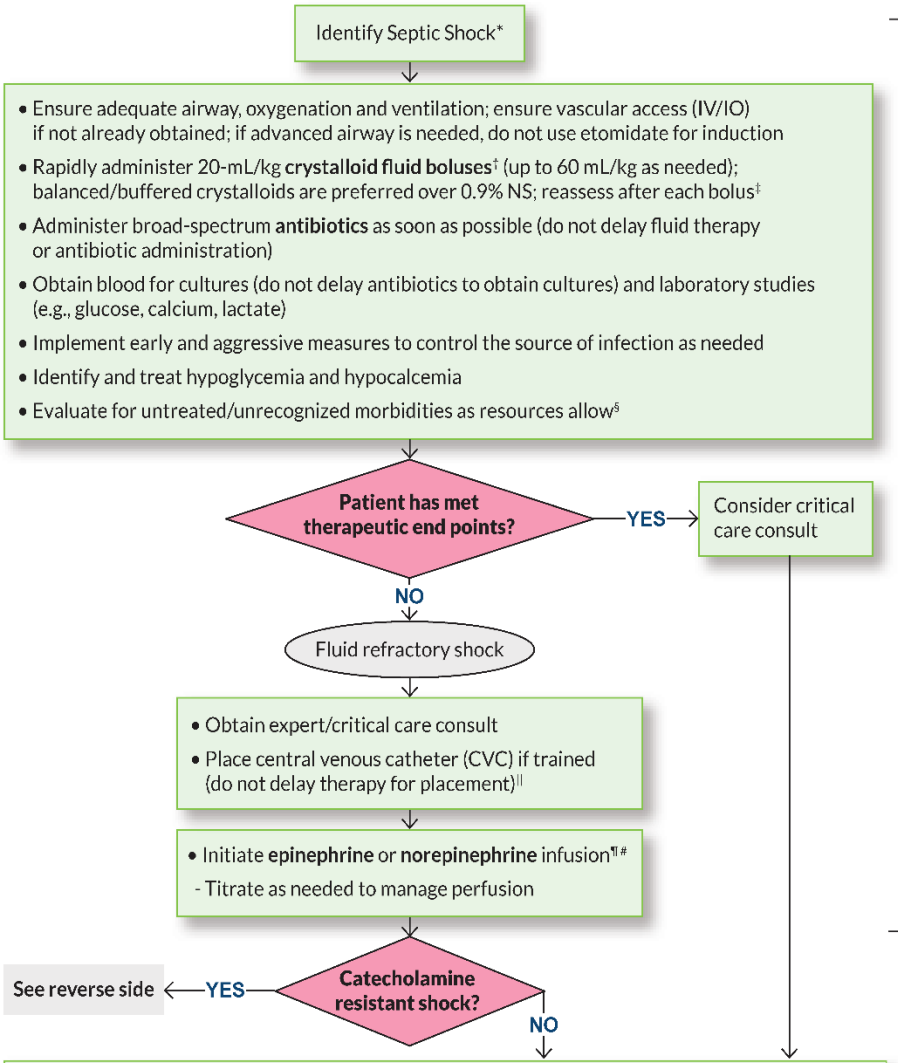

Within First Hour

- IV/IO within 5 min
- Appropriate fluid resuscitation within 15 to 30 min
- Antibiotics within 60 min; vasopressors within 60 min if needed

Goals of First Hour

- Maintain or restore airway, oxygenation and ventilation
- Maintain or restore circulation, defined as normal perfusion for age, normal blood pressure for age, normal HR for age, capillary refill ≤ 2 sec and normal mental status. Additional parameters can include normal urine output for age, normal lactate levels and normal invasive pressures

Medications	Dosage
Epinephrine	0.1 to 1 mcg/kg/min IV/IO infusion, titrated to desired clinical effect
Norepinephrine	0.05 to 2 mcg/kg/min IV/IO infusion, titrated to desired clinical effect

*Per facility protocols and facility trigger tool (signs and symptoms may include altered mental status, altered HR [usually tachycardia], altered temperature [fever or hypothermia], altered perfusion, hypotension [late finding; may not be present], elevated lactic acid, metabolic acidosis).
†Do not use colloids in the initial resuscitation of children and infants with septic shock or another sepsis-associated organ dysfunction.
‡Reassess after each bolus for signs of hypervolemia and/or congestive heart failure (crackles, hepatomegaly). For neonates administer boluses of 10 mL/kg. Also consider smaller (5- to 10-mL/kg) fluid bolus volumes in children with cardiac dysfunction/heart failure. In the absence of intensive care availability, consider a decreased fluid bolus of up to 40 mL/kg (in 10 to 20 mL/kg aliquots) over the first hour. In the absence of both hypotension and intensive care availability, administer maintenance fluids instead of bolus fluids.
§See Untreated/Unrecognized Morbidities box.
||Consider ketamine for sedation when placing CVC.
¶Despite the lack of evidence, SAC experts have a preference for epinephrine with low cardiac output and/or myocardial dysfunction and norepinephrine in the setting of low systemic vascular resistance. May alternatively initiate dopamine infusion as initial catecholamine if epinephrine/norepinephrine are not available.
#Preferable to administer through CVC, but do not delay initiation for CVC placement.
**Children with purpura fulminans, recent or chronic steroid use, or pituitary or adrenal abnormalities are at risk for absolute adrenal insufficiency.
††Consider a trial of noninvasive mechanical ventilation (over invasive mechanical ventilation) in children and infants with sepsis induced pediatric acute respiratory distress syndrome (PARDS) without a clear indication for intubation and who are responding to initial resuscitation; consider a trial of prone positioning in children with sepsis and severe PARDS.

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PEDIATRIC SEPTIC SHOCK

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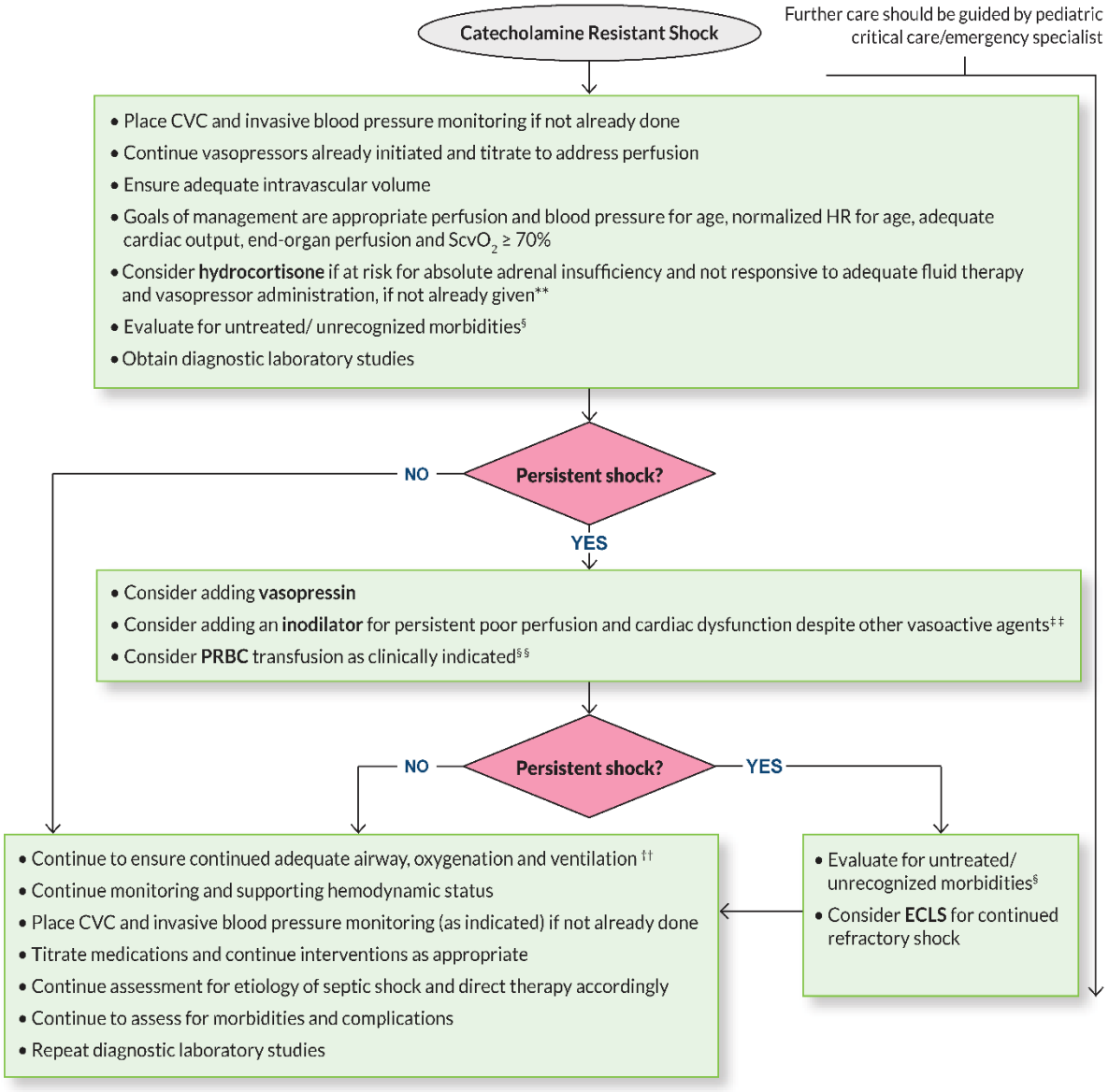

Therapeutic End Points in Shock
• Normal peripheral pulses and capillary refill (≤ 2 sec) • Normal HR for age • Normal blood pressure for age • Normal urine output - Infants and young children: 1.5 to 2 mL/kg/hr - Adolescents: 1 mL/kg/hr • Normal mental status • Correction of acidosis • Normal lactate levels • Normal perfusion pressure (MAP – CVP) for age, $ScvO_2$ ≥ 70% (except congenital heart patients with mixing lesions), and cardiac index > 3.5 < 5.5 L/min/m^2 in PICU

Medications	Dosage
Epinephrine	0.1 to 1 mcg/kg/min IV/IO infusion, titrated to desired clinical effect
Dopamine	2 to 20 mcg/kg/min IV/IO infusion, titrated to desired clinical effect
Hydrocortisone	2 mg/kg IV/IO, max, 100 mg
Milrinone	• Loading dose: 50 mcg/kg IV/IO over 10 to 60 min (may choose not to administer bolus in setting of hypotension) • Infusion: 0.25 to 0.75 mcg/kg/min
Norepinephrine	0.05 to 2 mcg/kg/min IV/IO infusion, titrated to desired clinical effect
Vasopressin	0.0002 to 0.002 units/kg/min (0.2 to 2 milliunits/kg/min) IV/IO infusion, titrated to desired clinical effect

Untreated/Unrecognized Morbidities
• Unrecognized/uncontrolled source infection • Pericardial effusion • Pneumothorax • Adrenal insufficiency • Hypothyroid • Hemorrhage or ongoing blood loss • Increased intra-abdominal pressure • Excessive immunosuppression and/ or immunocompromise

§See Untreated/Unrecognized Morbidities box.
**Children with purpura fulminans, recent or chronic steroid use, or pituitary or adrenal abnormalities are at risk for absolute adrenal insufficiency.
‡‡For neonates, modification of this approach may be indicated.
§§Do not transfuse if HGB ≥ 7 if hemodynamically stabilized and follow institutional protocols/guidelines.
††Consider a trial of noninvasive mechanical ventilation (over invasive mechanical ventilation) in children and infants with sepsis induced pediatric acute respiratory distress syndrome (PARDS) without a clear indication for intubation and who are responding to initial resuscitation; consider a trial of prone positioning in children with sepsis and severe PARDS.

American Red Cross
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CHILDBIRTH

Signs and Symptoms

- Gravidity / Parity
- Any pregnancy complications
- Vaginal fluid / bleeding?
- Painful uterine contractions / back pain / stomach pain
- Duration of contractions and time between
- Crowning / urge to push
- Any complications expected with the newborn

Possible Complications

- Preterm labor
- Placenta previa
- Prolapsed cord
- Abnormal presentations (i.e., breech)
- Spontaneous vaginal delivery (i.e. natural outcome)

Treatment

- O2 if hypoxemic, IV / IO, cardiac monitor, and blood glucose check
- Place in left lateral decubitus or pad under right hip
- Hyper / hypotensive? Any abnormal bleeding? Refer to **OBSTETRIC EMERGENCY PROTOCOL**
- Visually inspect to see if patient is crowning. If crowning is present, assist with the birth of the child. If no, continue to monitor, reassess, and transport patient to nearest MTF
- Prep for birth: Position mother in supine supported position, prepare 2 sets of hemostats and scissors / scalpel, umbilical cord clamp if available, bulb suction
- If delivery is inevitable:
  - Deliver fetal head supporting the perineum with a gloved hand or towel
  - Use slight downward pressure on the fetal head to deliver anterior shoulder, then slight upward pressure to deliver posterior shoulder
  - Place infant on warm, dry towel / blanket or directly on the maternal abdomen for skin to skin
  - Suction the mouth then nose with bulb suction if obvious obstruction from secretions
  - Clamp cord after 1-3 min with 2 hemostats and cut between clamps. Wrap infant with dry towel / blanket to prevent hypothermia or cover infant while maintaining skin to skin
  - Deliver placenta within 30 min, DO NOT PULL. Keep placenta for evaluation by MTF
  - Externally massage uterine fundus to encourage contraction / limit bleeding
  - Continue to monitor and re-assess mother and neonate enroute to nearest MTF and refer to **NEWBORN PROTOCOL**

Notes, Cautions, Warnings

- If umbilical cord (i.e. nuchal cord) around neck, you deliver by keeping the fetal head near the mons or attempt to reduce manually prior to delivery of shoulders (should feel rope-like structure around neck). As last resort, and if unable to keep pressure off the cord, clamp and cut cord before delivery of the shoulders
- If umbilical cord is seen (i.e. prolapsed cord), elevate presenting part with vaginal hand* and maintain elevation until delivery via C-section. **Do not place pressure on the cord or monitor pulse via the cord**
- If neonate appears to be stuck in the birth canal (i.e., turtling of the head) without delivery of the anterior shoulder, remove hand from head, flex the mother's hips (both knees to chest), and attempt with gentle downward pressure

*Vaginal hand is the hand in the vagina that is being used to elevate the presenting part. Other hand remains free to perform any concurrent actions.

NEWBORN CARE AND DISTRESS

Signs and Symptoms

- Full term delivery?
- Meconium staining of amniotic fluid?
- Any signs of dehydration? (sunken fontanelles, tearless, decreased UOP, and dry mouth, skin and tongue)
- Fluid Overload? (SOB, ankle / sacral edema, increased JVP, and crackles in lungs)
- History of delivery method? (SVD, C/S, forceps, vacuum, breech)
- Cord management? (cleaned and secured)

- Determine APGAR after first 60 seconds of care and repeat q 5 min
- Score of 6 or less = IMMEDIATE RESUSCITATION
  - Severely depressed: 0-3
  - Moderately depressed: 4-6
  - Excellent condition: 7-10

APGAR SCORING	0 POINTS	1 POINT	2 POINTS
ACTIVITY (MUSCLE TONE)	Absent	Arms and legs flex	Active movement
PULSE	Absent	Below 100 bpm	Over 100 bpm
GRIMACE (REFLEX IRRITABILITY)	Flaccid	Some extremity flexion	Active motion (pull away, cough)
APPEARANCE (SKIN COLOR)	Blue, pale	Body pink, extremities blue	Completely pink
RESPIRATIONS	Absent	Slow, irregular	Vigorous cry

Treatment

- Does the patient have good tone? Is the airway open? (breathing / crying)
  - Use bulb syringe to clear mouth / nose, dry and stimulate (foot tap / back rub), keep warm, find APGAR score, and monitor SpO2 and treat hypoglycemia (glucose < 40 mg/dL)
- Does the patient have a HR < 100, apnea or gasping, labored breathing or persistent cyanosis?
  - Attempt to clear airway if needed, provide PPV via BVM: 30-60 breaths/min for a SpO2 of 94-99%
  - Intubate if NO chest rise
- Does the patient have a HR < 60?
  - Provide chest compressions and PPV (120 event/min: 90 compressions interspersed with 30 ventilations)
  - Consider intubation
  - Epinephrine (0.1 mg/mL) 0.01-0.03 mg/kg IV / IO q 3-5 min (0.1-0.3 mL of 0.1 mg/mL 10cc Cardiac Epi vial)
  - Consider hypoglycemia (D12.5 1 mL/kg IV; dilute D50 to ¼ strength or 1 mL D50 in 3 mL NS)
  - Consider Shock (IVF or Blood 10 mL/kg IO)
  - Consider pneumothorax (Intubation)

Notes, Cautions, Warnings

- Routine oral, nasal, or any other suctioning is not recommended regardless of whether fluid is meconium or clear

Reference: 2025 American Academy of Pediatrics Neonatal Resuscitation Guidelines

OBSTETRIC EMERGENCIES

Signs and Symptoms

- Gravidity / Parity
- Any pregnancy complications? (i.e. preeclampsia, gestational diabetes, etc.)
- Any abnormal bleeding?
- Painful uterine contractions / back pain / stomach pain?
- Blurry vision / dizziness?
- Changes in fetal movement?

Differential Diagnosis

- Pre-eclampsia / eclampsia
- Placenta previa
- Abruptio placentae
- Spontaneous abortion
- Uterine rupture
- Ectopic pregnancy

Treatment

- O2 if hypoxemic, IV / IO, cardiac monitor, blood glucose check and place in left lateral decubitus or pad under right hip
- Is the patient seizing?
  - Magnesium Sulfate 4-6 g IV over 15-30 min or 5 mg IM each buttock
  - If blood glucose is within normal limits and patient is in Status Epilepticus move to **SEIZURE PROTOCOL**
    - Midazolam 5 mg IV / IO or 10 mg IM
      OR
      Lorazepam 2-4 mg IV / IM
    - Wait 5 min and if not resolved, give an additional dose
  - If blood glucose is < 70 or > 250 move to **HYPER / HYPOGLYCEMIA PROTOCOL**
- Do they have severe hypertension? (> / = 160/110): serial vitals q 5 min for 15 min
  - Hypertensive emergency? (Persistent BP >/= 160/110 for 15+ min)
    - Labetalol 20 mg IV
      OR
      Nifedipine 10 mg PO / IR
    - Magnesium Sulfate 4-6 g IV over 15-30 min
- Is the patient experiencing abdominal pain alone refer to **ABDOMINAL INJURY PROTOCOL**
- Is there vaginal bleeding present? If tachycardic / orthostatic administer blood if available, 1 g TXA IV / IO over 10-20 min. If bleeding continues > 30 min, may repeat TXA dose
  - If vitals within normal limits, is there S / S of labor? Refer to **CHILDBIRTH PROTOCOL**
- Continue to monitor, re-assess and address for changes in BP, seizures, glucose, vision changes and headaches

Notes, Cautions, Warnings

- Use caution when using Magnesium – it can lead to cardiorespiratory collapse with hypotension and decreased respiratory drive
- Treat all hypertensive patients as if they are pre-eclamptic despite any prior history of hypertension
- The leading cause of postpartum hemorrhage is uterine atony (lack of contracting), which can be treated with uterine massage
- Seizure: can give Midazolam 0.1 mg/kg IV every 15-30 min or 1 mg IV every 2-3 min up to 5 mg while waiting for magnesium to take effect
- Seizure activity in an OB patient signifies eclampsia
- The best life support for the fetus is to resuscitate the mother

SEXUAL ASSAULT

CLINICAL INDICATIONS:

- Reported and/or suspected assault on any person regardless of age or sex.
- Trauma and/or bleeding to the vagina, rectum or buttocks that cannot be identified as being the result of any other cause.

REMARKS:

- Focus shall be placed on the victim and on doing what is necessary and appropriate to support victim recovery and also, if a Service Member, to support that Service Member to be fully mission capable and engaged.
- Medical personnel should be sex-responsive, culturally competent, and recovery- oriented.
  - Medical providers giving care to sexual assault victims shall recognize the high prevalence of pre-existing trauma (prior to present sexual assault incident) and the concept of trauma-informed care.
  - If the attending flight medic is not appropriately trained to utilize a Sexual Assault Forensic Evidence (SAFE) Kit, information will be forwarded to the Medical Treatment Facility in order to make the necessary arrangements to complete the SAFE Kit administration as soon as possible.
- Flight Paramedics shall abide by the Sexual Assault Prevention and Response (SAPR) Program and coordinate with the Sexual Assault Response Coordinator (SARC) and Sexual Assault Prevention and Response Victim Advocate (SAPR VA). The SARCs shall serve as the single point of contact for coordinating care to ensure that sexual assault victims receive appropriate and responsive care.
- Sexual assault victims shall be given priority and treated as emergency cases. Emergency care shall consist of emergency medical care and the offer of a SAFE.

PATIENT MANAGEMENT PROCEDURE:

1. In the management of sexual assault patients, the DoD's first priority for victims is to protect, treat with dignity and respect, and to provide the medical treatment, care, and counseling that patients deserve. Under the DoD Confidentiality Policy, sexual assault victims have two reporting options: Restricted and Unrestricted. It is mandatory that all DoD health care providers (including 68Ws) adhere to the parameters of confidentiality and notification pursuant to each form of reporting.
   a. **Restricted Reporting**: Reporting option that allows assault victims to confidentially disclose the assault to specified individuals (e.g., SARC, SAPR VA, healthcare personnel) and receives medical treatment (including emergency care), counseling, and assignment of a SARC and SAPR VA; without triggering an investigation. The victim's report provided to healthcare personnel (including the information acquired from a SAFE Kit), SARCs, or SAPR VAs will NOT be reported to law enforcement or to the command to initiate the official investigative process unless the victim consents or an established EXCEPTION applies. Restricted reporting applies to Service Members and their military dependents 18 years of age and older. Additional persons who may be entitled to Restricted Reporting are NG and Reserve Component members who must be on Title 10 orders to be eligible for SAFE/Restricted reporting. Only a SARC, SAPR VA, or healthcare personnel may receive a Restricted Report.

SEXUAL ASSAULT (cont.)

   b. **Unrestricted Reporting:** A process that an individual covered by this policy uses to disclose, without requesting confidentiality or Restricted Reporting, that he or she is the victim of a sexual assault. Under these circumstances, the victim's report provided to healthcare personnel, the SARC, a SAPR VA, command authorities, or other persons is reported to law enforcement and may be used to initiate the official investigative process.

2. Priority treatment as emergency cases include activities relating to access to healthcare, coding, and medical transfer of evacuation and complete physical assessment, examination, and treatment of injuries including immediate emergency interventions.
3. ****DO NOT**** attempt to examine the patient without informed consent except to treat immediate life, limb, or eyesight threats. SARC notification must not delay emergency medical care treatment of a victim.
   a. Limit cleaning of wounds to only determine severity.
   b. Check for associated or additional injury and/or other illnesses. Refer to appropriate medical treatment guidelines as appropriate.
4. In situations where installations do not have SAFE kit capability, the installation commander will require that the eligible victim, who wishes to have a SAFE, be transported to a MTF or local off-base, non-military facility that has a SAFE capability. A local sexual assault nurse examiner or other healthcare providers who are trained and credentialed to perform a SAFE may also be contacted to report to the MTF to conduct the examination.
5. Preserve all evidence:
   a. Bag all personal items (e.g., blood stained items, clothes). Paper bags are recommended if available, in order to prevent excess moisture accumulation and subsequent evidence degradation.
   b. Ensure all items are signed for before handing off.
   c. Ensure all interactions, statements made by the patient, and all treatment given is medically documented in patient care record while maintaining patient confidentiality.

Reference: AR 600-52 Sexual Harassment / Assault Response and Prevention Program

TREATMENT OF MINORS

CLINICAL INDICATIONS:

- For the purpose of this protocol, all patients under age 18 years are considered minors
- Treatment of a minor patient with / without a parent or legal guardian present

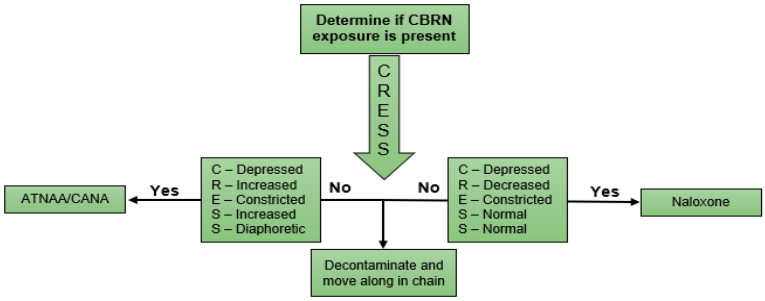
REMARKS:

- Medical aircrew and medical directors should consult medical rules of eligibility and applicable laws accordingly.

PATIENT MANAGEMENT PROCEDURE:

1. Treatment and transport of any minor requiring immediate care to save a life or prevent severe injury will be performed following the principle of implied consent for emergency care. (Assume any minor who needs treatment to save life, limb, eyesight, or to prevent severe injury has provided consent to treatment.)
2. **ALWAYS** act in the patient's best interest. **ALWAYS** maintain complete and careful documentation.
3. If the parent or guardian is present:
   a. Allow one (1) parent / guardian to accompany the child during transport after approval of the pilot in command (PC) **and** if it does not interfere with patient care or flight safety.
   b. In event of major trauma and/or cardiac arrest, judgment should be exercised in allowing parent / guardian to accompany the child. Recent evidence supports this practice in emergency departments and some EMS settings. Care should be exercised to maintain crew safety and mission accomplishment.
   c. Allow the parent / guardian to hold or touch the child, if possible, while ensuring optimal transport restraints of patient and parent / guardian.
   d. Remember to be open and honest to parent / guardian and child about the child's condition and any treatment given. **DO NOT** diagnose, **DO NOT** deceive, and **DO** try to comfort the child and parent / guardian.
4. In many jurisdictions, parent or legal guardians **CANNOT** refuse consent for treatment / transport of a minor with a life-threatening condition. Contact your medical director in the event of the parent / guardian refusing treatment / transport of a minor with a life-threatening condition.

(MARCHE)^2



C	Consciousness (unconscious, seizures, depressed consciousness, agitation)
R	Respirations (present or absent, labored, increased or decreased)
E	Eyes (constricted, dilated, normal)
S	Secretions (dry, normal, increased)
S	Skin (diaphoretic, dry, hot, cyanosis)

Point of Injury (Hot Zone) Response - (MAR)^2	
TCCC	**CBRN**
Massive Hemorrhage	**Mask**
Stop life-threatening external hemorrhage if tactically feasible: • Direct casualty to control hemorrhage by self-aid • Apply the limb tourniquet over the uniform proximal to bleeding site(s). When in doubt, place a Hasty Tourniquet	• Don mask • Help casualty don mask or ensure proper seal if mask already in place. • Ensure Powered Air Purifying Respirator (PAPR) or Self Contained Breathing Apparatus (SCBA) is functional.
Airway	**Antidotes**
• Assess (excessive secretions may indicate nerve agent exposure) • Airway management is generally best deferred	• Antidotes are given in the Hot Zone if the casualty has symptoms of poisoning. • These agents are rapid killers: Nerve agent (give ATNAA, CANA) Cyanide (give hydroxocobalamin) Pharmaceutical based sedating agent (give naloxone)
Respiration	**Rapid Spot Decon**
• Assess: normal, shallow, labored, absent? (increased respirations may indicate nerve agent exposure) • Complete the CRESS assessment and determine if caused by the agent or trauma • Respiratory intervention is generally best deferred	• At the point of injury, physical removal of the agent/rapid spot decontamination is indicated if agent can be seen on the skin, if there is suspicion of wound contamination by agent, or if there is a breach in the suit. • Apply RSDL, M100, M295, Sorbent, tech wipe, etc.
Extraction	
• Egress away from the threat	
Assessment at the Dirty CCP (Warm Zone) - (MARCHE)^2 Treat life threats ONLY	
Decontamination and treatment can be a synchronous process. Reassess CRESS.	
TCCC	**CBRN**
M.A.R. Reassessment (Massive hemorrhage, Airway, Respirations)	**M.A.R. Reassessment (Mask, Antidote, Rapid Decon)**
• Stop all external hemorrhage • Advanced airway prn • Treat tension pneumothorax • Ventilator support (PEEP support, pressure monitoring, etc)	• Check mask seal • Assess response to antidote and reassess CRESS • Reassess need for rapid spot decon
Circulation	**Countermeasures**
• Pulse Check • Skin Check • Assess for Shock • IV/IO access if needed immediately • Fluid resuscitation per TCCC guidelines only if absent radial pulse	• Nebulized or inhaler-administered medications such as albuterol or corticosteroid • IV/IO Drips (hydroxocobalamin, atropine, naloxone, etc.) • Suction the airway • Treat life-threats ONLY • Specific countermeasures may be found in CBRN CPG Part II
Hypothermia	
• Package the casualty • Protect from lethal triad: Hypothermia, acidosis, and coagulopathy	
Head Wounds	
• Determine whether casualty's altered mental status is due to chemical agent or trauma	
Evacuation	
• Determine Evacuation Priority • Fill out CBRNE Casualty Card or TCCC Casualty Card • Move patient for further decontamination or to evacuation platform.	
Re-evaluation - (Cold Zone) TACEVAC or Prolonged Field Care (MARCHE)^2	
Re-triage patient: has patient's condition changed due to decontamination process?	
Reassess: Are immediate life threats addressed? CRESS and (MARCHE)^2 PRN	
Conduct secondary assessment/survey	
Ensure documentation is filled out and transported with patient	
Communicate with receiving medical personnel of decon status and treatment	

CBRN CASUALTY MANAGEMENT

BASIC PRINCIPLES:

Initial care of the CBRN casualty should be approached in the same manner as other casualties. Life threats require prompt recognition and intervention, and non-life-threatening sequelae can be addressed when clinically appropriate. Early recognition and categorization of CBRN-exposed patients is the foundation for further management and is key not only for initiating patient treatment but also for preventing contamination of medical personnel, equipment, and facilities. Thorough and appropriate decontamination is a core skill that requires planning and practice. Attention to details such as preventing hypothermia in patients undergoing decontamination and clinical reassessment at each stage of the process will reduce unnecessary morbidity. Basic life saving measures such as airway management and resuscitation are fundamental concepts that must be mastered at the appropriate level for each practitioner in the CBRN care chain.

CBRN CRITICAL TASK LIST:

1. Recognize CBRN exposure that requires action to protect self and others.
2. Don personal protective equipment (PPE) to prevent exposure in self and assist others with PPE.
3. Egress from the threat:

a. Move upwind, uphill, upstream from threat.
b. Utilize time/distance/shielding for protection.

4. Recognize signs/symptoms of CBRN exposure that prompt immediate self- treatment or treatment of others utilizing CRESS assessment. (RAPID IDENTIFICATION OF CHEMICAL WARFARE AGENTS).
5. Apply TCCC integrated with CBRN response
   TCCC + CBRN = $(MARCHE)^2$].
6. Apply airway management skills in a CBRN setting (positioning, suction, ventilation to include manual and mechanical, placement of definitive airway)
7. Perform Rapid Spot Decontamination.
8. Identify and establish Hot/Warm/Cold Zones.
9. Establish a dirty casualty collection point (CCP).
10. Understand decontamination principles and casualty procedures for partial or complete removal of PPE, clothing, and equipment (casualty cut out).
11. Understand cross contamination and take appropriate measures to prevent it.
12. Understand available technology that can aid in agent identification.

CBRN MEDICAL REGULATING CONSIDERATIONS:

1. Military Treatment Facility (MTF).
    1. DECON/Treatment Coordination. Ensure MTF is prepared to receive dirty casualties and determine the most appropriate location for DECON.
    2. Treatment Capabilities (Toxicology, Critical Care, Trauma Surgery). Determine whether the MTF has the services necessary to care for and sustain the CBRN casualty on site and/or establish telemedicine support.
    3. Capacity. The CBRN casualty is far more resource intensive than a typical trauma or critically ill casualty. Assess the MTF's capacity and capability to treat CBRN casualties and identify potential alternate locations.
2. Integrate the medical regulating system into CBRN casualty evacuation.

EVACUATION PLATFORM CONSIDERATIONS:

1. Evacuation of patients must continue even in a contaminated environment.

CBRNE CASUALTY MANAGEMENT (cont.)

2. Clean and Dirty. It is necessary to plan for both clean and dirty platforms for evacuation.
   a. Optimize the use of resources, medical or nonmedical, which are already contaminated before employing uncontaminated resources.
   b. Once a vehicle or aircraft has entered a contaminated area, it is highly unlikely that it will be able to be spared long enough to undergo a complete decontamination. Factors include - contaminant, the tempo of the battle, and the resources available.
   c. Contaminated vehicles (air and ground) will have restricted use and are confined to a contaminated environment until decontamination can occur.
3. Refuel.
   a. Consider the time it takes for refueling in a MASCAL situation, as well as the distance from the objective to the DECON site and MTF.
   b. Factor in any platform decontamination that may be necessary prior to arrival at the refueling site.
   c. WARM ZONE Forward Arming and Refuel Points may be necessary.
4. Preparation time (hasty vs. deliberate). Factor the time it takes to prepare the platform for a hasty or deliberate CBRN mission.
5. Radiological Exposure Limitations:
   a. Operational exposure guidance: MEDEVAC operations will establish operational exposure guidelines by the appropriate Surgeon and Command limiting radiation exposure to crews by absorbed dosage.
   b. Radiation exposure records are maintained by the unit CBRN noncommissioned officer and are made available to the commander, staff, and surgeon.
6. Flying Hour Limitations:
   a. Environmental Relative Factors (ERF) under Mission Oriented Protective Posture (MOPP) 3 and 4 limits flying hours to 3 hours day, night or combined modes of flight.
   b. ERF extensions are limited to a case by case basis.

CBRN LANDING ZONES / AMBULANCE (CASUALTY) EXHCHANGE POINTS:

1. Route coordination. Consider alternate routes, primary routes may be jammed or unavailable.
2. Consider appropriate distance to accommodate for aircraft rotor wash and direction of landing for Dirty LZs and Clean LZs at the DECON/CCP locations.
3. Environmental Considerations:
   a. Wind
   b. Terrain / Slope
   c. Drainage (for DECON Sites)
   d. Water Sources

MILITARY WORKING DOG: DECONTAMINATION PROCEDURES

While not generally a MEDEVAC mission, ensuring proper MWD Decon prior to transport is vital to ensuring the platform and crew are not contaminated by the agent involved.

- Rinse the MWD thoroughly with plain water beginning at the head along the back and to the tail; then rinse down the MWD's sides, chest, stomach, legs, and paws.
- Work the soap into the hair starting the head, along the back and to the tip of the tail, then work down the MWD's sides, chest, and abdomen, legs, and paws. Ensure the soap reaches the MWD's skin. If the MWD has erect ears, flush the ears with otic solution or water.

Note. Special attention should be paid to the MWD's stomach, face, ears, eyes, under tail, paws and in between legs to ensure all contamination is removed.

CBRNE CASUALTY MANAGEMENT (cont.)

- Flushed the eyes with copious amounts of water, ophthalmic solution, or saline. Rinse with plain water using the same pattern as the initial rinse (head to back to tail, then down sides, chest, stomach, legs, and paws).
- Allow the MWD to shake off excess water. A tarp or other impervious materiel may be placed around the MWD while it shakes off excess water to prevent contaminating of other people, MWDs, or equipment.

MILITARY WORKING DOG: TREATMENT OF NERVE AGENTS

- For mildly exposed MWDs, administer a total of two ATNAA injections (atropine and 2-PAM Cl in a single autoinjector) (carried by the MWD handler) into the back of the thigh of the dog. The initial dosage of atropine is 4 mg and the dosage for 2-PAM Cl is 1200 mg
- For severely exposed MWDs, administer three ATNAA and one CANA. This is similar to the buddy aid a Service member provides another Service member suffering from severe nerve agent exposure. In general, MWDs should not need additional 2-PAM Cl injections.
- Single atropine injections may be given every 10 to 20 minutes until the nerve agent effects have subsided or signs of atropinization appear. The MWD must be monitored for heat stress. Atropine dries the mucous membranes thus preventing the MWD from expelling body heat.
- The initial dosage of 2-PAM Cl in the dog is 20 mg/kilogram. Three ATNAA injectors should provide sufficient amount of 2-PAM Cl. If a MWD is still showing signs of seizure after initial treatment, the handler may give up to 3 additional CANA autoinjections at 5 to 10 minute intervals until the seizures are gone.
- Maintain a clear airway by removing respiratory secretions and saliva obstructing the airway. Loosen or remove the muzzle. In severe nerve agent exposure, the animal's respiration is markedly depressed and extreme muscular weakness or paralysis is present. In such cases, assisted ventilation is required to effectively resuscitate the animal.
- Adequate atropine and 2-PAM Cl should bring about an improvement or restoration of spontaneous respiration and also improve blood circulation. However, the effectiveness of 2-PAM Cl is lost after a short period of time. The 2-PAM Cl varies in its effectiveness against nerve agents. It is least effective against GD nerve agent. In some cases, severe nerve agent symptoms may persist or recur and require veterinary personnel to administer additional 2-PAM Cl autoinjectors every 8 to 12 hours for up to 3 days.

MWD AIRWAY MANAGEMENT

Clinical Signs

- Dyspnea
- Labored inspiration
- Stridor / snoring
- Trauma to the airway
- Disruption of mouth, pharynx, larynx, or trachea

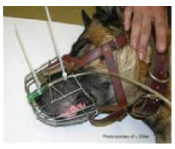
Differential Diagnosis

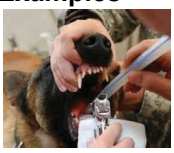
- Upper airway obstruction
- Laryngeal paralysis
- Pneumo / hemo / pyothorax
- Diaphragmatic hernia
- Pleural effusion
- Pulmonary contusions
- Pulmonary edema
- Pneumonia

Treatment

- Inspect, wipe and / or suction mouth and pharynx
- Ventilate with 100% oxygen
  - If unable, move to next step
- Endotracheal Intubation (Size 9 – 11 mm ET tube)
  - If unable, move to next step
- Suction Airway
  - If airway still not clear, move to next step
- Perform Tracheostomy
  - If lung sounds do not sound clear and bilateral, reposition and suction ET tube
- Evaluate for pleural space and parenchymal problems
  - Open PTX requires any occlusive seal over the wound with a chest bandage to secure the material.
  - Decreased lung sounds, signs of respiratory distress, or rapid deterioration = thoracentesis (6th – 8th intercostal space; insert the needle at the cranial aspect of the rib)
    - Repeated thoracenteses may be required
- Ventilatory support: Manual IPPV (MIPPV) or Mechanical Ventilation (MV)
  - May be required for MWDs that fail to respond to correction or stabilization of the primary respiratory problem and supplemental oxygen support
  - Ventilatory support requires heavily sedated or anesthetized patient, even if a tracheostomy tube is in place
  - MIPPV is feasible if personnel can be spared for this, and is ideal for short-term (< 6 hours) of ventilator support
  - MV may be necessary if MIPPV fails or duration of ventilator support is expected to be > 6 hours
  - Induce general anesthesia and use Controlled Ventilation or Assist-Control ventilator mode

100% Oxygen Supplementation Examples





Conscious or fractious muzzled dogs (10 – 15 L/min)
Orotracheal intubation or tracheostomy (2 L/min)

MECHANICAL VENTILATOR SETTINGS AND KEY PARAMETERS

PARAMETER	NORMAL LUNGS	ABNORMAL LUNGS
FiO2	100%, then reduce to < 60%	100%, then reduce to < 60%
Tidal Volume (VT)	5 – 15 mL/kg	5 – 15 mL/kg
Breathing Rate (f)	8 – 20 bpm	8 – 20 bpm
Minute Ventilation (VE)	150 – 250 mL/kg/min	150 – 250 mL/kg/min
Peak Inspiratory Pressure (PIP)	10 – 20 cmH2O	15 – 25 cmH2O
Positive End Expiratory Pressure (PEEP)	0 – 2 cmH2O	2 – 8 cmH2O
Trigger Sensitivity	-2 cmH2O or 2 L/min	-2 cmH2O or 2 L/min
Inspiratory: Expiratory Ratio (I:E)	1:2	1:2
Inspiratory Time	~ 1 sec	~ 1 sec

Notes, Cautions, Warnings

- Unconscious MWDs: use tracheal insufflation, orotracheal intubation, or tracheostomy
- If obstruction cannot be removed in a few seconds, consider tracheal insufflation with oxygen and perform tracheostomy
- Intubation of the MWD is most easily performed with the dog in sternal position, head and neck extended, and tongue pulled forward. Verify placement by palpating neck for 1 tube. If 2 tubes are felt, the tube is in the esophagus.
- Capnometer reading > 10 mmHg also ensures correct placement.
- The mediastinum in dogs is thin and typically ruptures; therefore, always tap both sides of the chest, even if a positive tap is achieved on one side of the chest, as air will form pockets and will migrate

Reference: K9 CPGs

MWD ANALGESIA AND SEDATION

Indications

- Trauma or pain
- Need for chemical restraint
- Continued sedation
- Anxiety
- Irritable / Quarrelsome / Unruly

Indications

- The goal of analgesia is to reduce pain to a tolerable level while still protecting K9 airway and mentation
- The goal of sedation / chemical restraint is to stop awareness of painful procedures and prevent injury to medical personnel

Treatment

- Mild Pain:
  - Opioid alone (if K9 is not unruly, an opioid may be all that is needed)
    - Morphine 0.25-0.5 mg/kg IM (equivalent to one 10 mg morphine autoinjector) or
    - Hydromorphone 0.1 mg/kg IV / IO / IM or
    - Fentanyl (injectable) q 20-30 minutes at 2-5 mcg/kg IV / IO or 10 mcg/kg IM
  - Ketamine (50 mg) IV / IM / IO + Midazolam (10 mg) IV / IO / IM
- Moderate to Severe Pain
  - Ketamine (50 mg) IV / IM / IO + Opioid
  - Ketamine (50 mg) IV / IM / IO + Midazolam (10 mg) IV / IO / IM + Opioid
- Chemical Restraint / Sedation
  - Ketamine (100 mg) IV / IM / IO + Midazolam (10 mg) IV / IO / IM or
  - Ketamine (100 mg) IV / IM / IO + Opioid
- Naloxone should be available when using opioid analgesics
  - Recommended doses are: 2 mg IV / IO or 4 mg IM / IN PRN
- Constant Rate Infusion (CRI)
  - Induction – Propofol 10 mg
    - Induce with bolus of Propofol 6-8 mg/kg
    - Unconsciousness maintained by CRI of 100-300 mcg/kg/min (0.1-0.3 mg/kg/min) Titrated to effect based on indicators of plane of anesthesia
    - Patient too deep: the CRI is reduced by 50 mcg/kg/min, depth reassessed in 5-10 min
    - Patient too light: bolus 500-1000 mcg/kg and the CRI is increased by 50 mcg/kg/min
  - Analgesia – Opioids
    - Morphine (15 mg) 0.1-0.25 mg/kg/hr
    - Hydromorphone (2 mg) 0.02-0.05 mg/kg/hr
    - Fentanyl (50 mcg) 0.1-1.0 mcg/kg/min

Notes, Cautions, Warnings

- **CAUTION:** Do NOT use Acetaminophen or Ibuprofen in MWDs, as these drugs can cause liver toxicity. AVOID use of NSAIDs such as Naproxen and Aspirin in emergently ill or injured MWDs
- DO NOT administer Oral Transmucosal Fentanyl Citrate (OFTC) to a K9 orally or per rectum
- Opioid doses for K9s are significantly higher than humans and often cause vomiting so handlers and medics should be prepared to remove the muzzle after administration of an opioid
- Hydromorphone causes excessive panting; use caution with head injuries and respiratory disease
- Head injury and / or non-penetrating eye injury does not preclude the use of Ketamine in K9s at the K9TCCC recommended doses. Use caution with IV / IO Ketamine or Midazolam in a head injury as this makes it difficult to perform a neurological exam or determine if the casualty is decompensating
- The sole use of routine benzodiazepines such as Midazolam is NOT recommended for analgesia
- If a K9 appears to be partially dissociated, it is more efficacious to administer more Ketamine than to administer more benzodiazepine
- Polypharmacy is recommended in K9s; benzodiazepines can be used in conjunction with Ketamine and/or opioid analgesia

Reference: K9 CPGs

MWD CPR

Causes

- Traumatic: blast / blunt force / penetrating
- Non-traumatic: anesthesia / near-drowning / electrocution

Indications to Initiate CPR

- Pulselessness
- Apneic

Treatment

- 2-person, closed-chest CPR should be initiated as soon as Cardiopulmonary Arrest (CPA) is declared
- Chest compressions (100 per min) in lateral recumbency (either side) over widest part of the chest
  - Sustain compressions for 2-3 minutes per cycle
  - Compress 1/3 to 1/2 chest width
- Clear airway and intubate ASAP
  - Perform tracheostomy if airway is obstructed
- Manually ventilate (8-10 breaths per min) 100% O2
  - Intubate if possible; if intubation is not possible, perform emergent tracheostomy
- Attain ECG
- Attain IV / IO access
  - Follow all drugs with 10 mL saline push
  - Do NOT give large volumes of fluids during CPR, unless MWD is hypovolemic
- Asystole / PEA / Sinus bradycardia
  - Vasopressin 0.8 U/kg IV / IO once and Low-dose Epinephrine 0.01 mg/kg IV / IO every other BLS cycle
  - Consider Atropine 0.04 mg/kg IV / IO every other BLS cycle if bradycardia preceded arrest
  - With prolonged CPA > 10 minutes, consider
    - Epinephrine HIGH dose (0.1 mg/kg IV / IO)
    - Bicarbonate therapy (1 – 2 mEq/kg IV, repeated every 10 minutes)
- VF / Pulseless VT
  - Continue BLS, charge defibrillator, apply paddles to either side of the chest
  - Clear and give 1 shock; Defibrillate 2 – 5 J/kg biphasic (4 – 6 J/kg monophasic)
    - Immediately start compressions for 1 cycle after every defib attempt
    - Defibrillate twice more if needed at same energy level, but resume chest compressions for 1 cycle after each defib
  - With prolonged VF / VT, consider
    - Epinephrine 0.01 mg/kg IV / IO
    - Vasopressin 0.8 U/kg IV / IO once + Lidocaine 2 mg/kg IV / IO
    - Amiodarone 5-10 mg/kg IV / IO
    - Defibrillate at 50% increased energy if refractory
    - Give Magnesium sulfate 30 mg/kg IV once if patient has refractory VT

Post Resuscitation Management

- Maintain normotension – Target MAP of > 65 mmHg or SBP > 90 mmHG
- Maintain ventilation – Target RR of 8-10 bpm – Target EtCO2 of 25-60 mmHg; consider IPPV / MV
- Maintain oxygenation – Target SpO2 > 95% with supplemental oxygen
- Control seizures – Midazolam or Diazepam 0.3 mg/kg IV / IO / IN
- Manage cerebral edema – Mannitol 1-2 g/kg IV over 30 min and Dexamethasone 0.5 mg/kg IV once or Methylprednisolone 30 mg/kg IV once
- Control pathologic ventricular arrhythmias with Lidocaine CRI 50-75 mcg/kg/min
- Control hypoglycemia – supplement IV fluids with 5% dextrose, monitor blood glucose q 4-6 min

Notes, Cautions, Warnings

- 70% of MWDs that arrest will have PEA, asystole, or sinus bradycardia as the initial arrest rhythm. Epinephrine, Vasopressin, and Atropine are best for empiric use if ECG capability is not available
- The key to successful resuscitation is to sustain chest compressions aggressively for 2-3 minutes before stopping to check status. Most people apply too little force when performing chest compressions. Do not be concerned with breaking ribs or injuring the heart or chest with BLS. In contrast to CPR in people, the thorax of MWDs is more compliant and fractures are rare
- Many MWDs will arrest again, and most do so in the first 4 hours of resuscitation. Successful return of spontaneous circulation and resuscitation are unlikely if an MWD arrests again

Reference: K9 CPGs

MWD GASTRIC DILATION-VOLVULUS

History

- Abdominal distention / tympany
- Non-productive retching
- Attempted vomiting without result
- Pain when palpating stomach / abdomen
- Inability / reluctance to lay comfortably
- Pacing, anxious stares
- Signs of compensatory shock (tachycardia, tachypnea)

Definition

- GDV (bloat) is a rapidly life-threatening condition common in MWDs. In GDV, the stomach rapidly dilates (gastric dilation) with fluid, food, and air, and then rotates along the long axis (volvulus) and causes shock by interfering with venous return from the abdomen and pelvic limbs
- GDV is an Urgent Surgical emergency

Treatment

- Initiate Monitoring: ECG, NIBP, SPO2, ETCO2; evaluate for arrhythmias, hypotension, hypoxemia, hypo / hypercapnia
- Give supplemental oxygen and continue through post-op period
- Attain (2) IV / IO sites – Forelimbs
  - Remember: Venous return is impeded from pressure in the abdomen hindlimb IVs will NOT be effective
- Initiate IV / IO crystalloid therapy first, repeat bolus every 10-20 minutes up to 4 times over the course of an hour
  - Quick bolus calculation: Add a zero to the dog's body weight in pounds to approximate a safe but effective bolus volume (ex: An MWD weighting 75 lbs would need about 750 mL of fluid bolus)
  - If refractory to crystalloids: Give Hydroxyethyl starch (HES, "Hetastarch", "VetStarch") bolus IV / IO (20 mL/kg) to maintain normotension; repeat as needed
  - If refractory to HES: Give hypertonic saline (HTS 7-7.5%) IV bolus of 4 mL/kg over 5 min
    - For MWDs that fail to respond to two or three quarter-shock boluses of crystalloids and / or one or two boluses of HES
- Decompress the stomach by percutaneous trocarisation of the stomach
  - Position yourself on the left side of the MWD, or lay the MWD left side down (left lateral recumbency)
  - Palpate last rib, move hand two inches caudal to the last rib, midway between the spine and the ventral border of the abdomen on the right side
  - Forcefully insert a 10-14 gauge trocar or 14-18 gauge IV over-the-needle catheter through the skin, abdominal wall, and stomach wall
  - Note gas or air escaping through the needle from the stomach to signify a successful attempt. If no gas or air, attempt once more (if still unsuccessful do not attempt a third time)
  - Gently apply external pressure to the abdominal wall to assist in decompressing air from the stomach
  - Once the majority of the air is evacuated, remove the trocar / needle, because leaving it inserted may cause trauma to internal organs
- Provide analgesia

Notes, Cautions, Warnings

- GDV TX GOALS:
  - Treat shock
  - Decompress the stomach
  - Stabilize for surgery
  - Evacuate if possible; goal is to initiated surgery within 2-4 hours
- Monitor for ventricular arrhythmias, persistent shock and recurrent dilation
- Surgery is required for definitive treatment

Reference: K9 CPGs

MWD HEAT INJURY

MILD Heat Injury	MODERATE Heat Injury	SEVERE Heat Injury
Heat Stress – excessive thirst, discomfort associated with physical activity, mild dehydration, ***but with controlled panting*** (i.e., the patient can control or reduce panting when exposed to a noxious inhalant such as alcohol	Heat Exhaustion - heat stress present, as well as weakness, anxiety, and ***uncontrolled panting*** (i.e., the patient cannot reduce panting when exposed to a noxious inhalant), but central nervous system (CNS) abnormalities are not present.	Heat Stroke – heat exhaustion present, coupled with varying degrees of CNS abnormalities (changes in mentation and level of consciousness, seizures, abnormal pupil size, blindness, head tremors, and ataxia)

Mild Heat Injury Treatment

- Cease work and remove MWD's gear or vests
- Remove from source of heat; move to shade or air-conditioned area; use fans if available
- Offer cool water in small increments frequently
- Monitor temperature every 15-30 minutes to ensure mild injury doesn't progress; perform serial physical exams

Treatment

- **Moderate / Severe Heat Injury**
  - Perform primary survey and assess airway, breathing and circulatory system
  - Immediately initiate active cooling measures; soak the dog's hair and skin with tepid water; remove gear or vests; use fans if available
  - Continue active cooling measures until body temperature is reduced to 103-103.5F
  - Obtain vascular access and begin IV fluid therapy with an initial crystalloid bolus of 10-20 mL/kg
  - Assess for shock; if present, follow the shock resuscitation protocol
  - Give IV crystalloid fluids 3-5 mL/kg/hr if not in shock
  - Be prepared to support / correct rebound hypothermia (dog may be hypothermic on arrival or develop hypothermia during treatment)
  - Monitor for any development of additional complications that may require treatment such as CNS abnormalities, cardiac arrhythmias, bleeding disorders, or electrolyte abnormalities

CEASE cooling efforts once the body temperature is 103 – 103.5 F to prevent rebound hypothermia. Actively warm the dog if the temperature is < 100 F

- Provide Intensive Monitoring and Management
  - Maintain normotension – target MAP of > 65 mmHg or systolic BP > 90 mmHg
  - Maintain ventilation – target RR of 8-10 bpm and ETCO2 of 35-45 mmHg
  - Maintain oxygenation – target SPO2 > 95% with supplemental oxygen
- Control Seizures: Midazolam or Diazepam 0.3 mg/kg IV / IO / IN PRN; Midazolam can be administered IM; Diazepam can be administered per rectum
- Manage Cerebral Edema: Mannitol 0.5 – 1 g/kg IV over 20 minutes
  OR
  Hypertonic Saline 4 mL/kg IV bolus over 15 minutes
- Control Pathologic Ventricular Arrhythmias: Lidocaine 2 mg/kg IV bolus then 50 – 75 mcg/kg/min CRI
- Control Hypoglycemia: Supplement IV fluids to 2.5 – 5% final dextrose concentration; monitor blood glucose every 4 – 6 hours

Notes, Cautions, Warnings

- Panting is the only significant cooling mechanism for dogs
- No specific body temperature defines heat stroke in MWDs. Most commonly, heat stroke is seen in MWDs with rectal temperatures greater than 107°F
- MWDs are commonly have prolonged clotting times, and platelet abnormalities following heatstroke. Monitor for bleeding and disseminated intravascular coagulation. Given lack of canine blood products, any MWD with evidence of bleeding should be evacuated URGENTLY to a veterinary facility

Reference: K9 CPG's

MWD NORMAL PARAMETERS

NORMAL VITALS AT REST	
Temperature (rectal)	101°-103° F
Heart rate	60-80 bpm
Respiratory rate	16-30 bpm • Controlled panting is common in MWDs
Blood pressure	Systolic: 90-140 mmHg Diastolic: 50-80 mmHg Mean: 60-100 mmHg

- Average MWD weight is 50-80 lbs (23-36 kg) (German Shepherds, Belgian Malinois and Labrador Retrievers)
- All fluid and drug dosages should be calculated based on measured or estimated body weight

IO Catheter Sizes

- Dog < 40 lbs = 15 mm x 15 gauge
- Dog > 40 lbs = 25 mm x 15 gauge

- IV catheterization access points
  - Cephalic vein on the cranial aspect of the forearm
  - Lateral saphenous vein on the lateral aspect of the hind limb at the distal tibial area
- IO catheterization access points
  - Proximolateral humerus
  - Proximomedial tibia
- Arterial pulse is palpated at the femoral artery on the medial aspect of the proximal thigh in the inguinal area
  - It may also be palpated at the dorsal metatarsal artery on the dorso-medial aspect of the proximal hind paw, distal to the hock (ankle)
- NIBP monitoring
  - Width of the cuff should be 30-40% of the limb circumference at the site of the cuff placement
  - Human pediatric cuffs (size 6-8) fit most MWDs
  - Common locations for cuff placement for oscillometric measurements are over the dorsal metatarsal artery, lower forearm and tail base
- Heart sounds are best auscultated over the lower left lateral thoracic wall between the 4th-5th intercostal space
- 3-lead ECG electrodes are sufficient for MWDs. Adhesive electrodes should be taped to the pads of the paws of the left forelimb (black lead), right forelimb (white lead), and left hind limb (red lead) [“White on the Right and Smoke over Fire”]
- Pulse oximetry probes can be utilized on conscious dogs using the ear pinna, lip fold, or flank skin; while not optimal for oximetry, these alternative sites are generally acceptable. For optimal reliability place probe on tongue (only in unconscious dogs)
  - Normal pulse oximetry for an MWD is > 95%

Reference: K9 CPG 02 (Normal Clinical Parameters for MWDs)

MWD NORMAL PARAMETERS (cont.)

Figure 1. Cephalic vein location

Figure 2. Occlusion of cephalic vein

Figure 3. Cephalic IV catheter placement

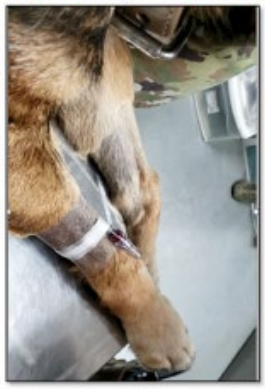
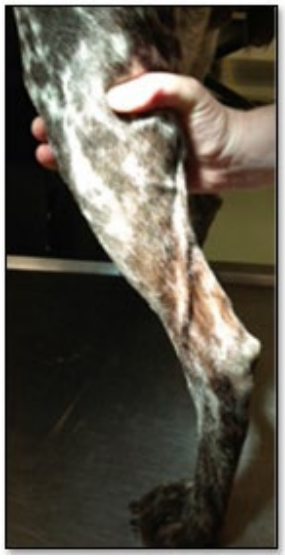


Figure 4. Lateral saphenous vein location



IVC NOTE:

- Use the cephalic or lateral saphenous vein for routine blood sampling, drug administration, and IV fluid therapy
- Use the external jugular vein for long-term IV fluid therapy, large volume fluid delivery, and repeated blood sampling
- To access the external jugular vein, standard human central venous catheter kits can be used; the Seldinger technique is most reliable

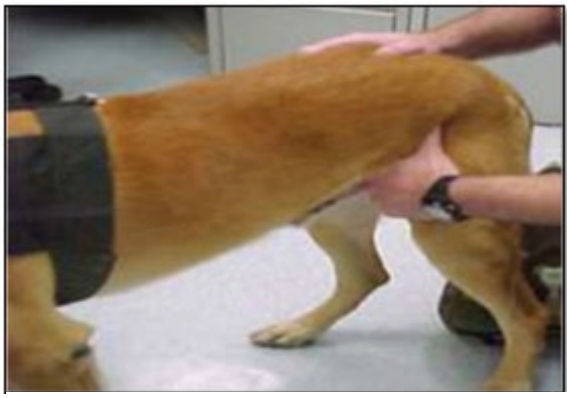


Figure 6. Location for palpation of the femoral arterial pulse while dog is standing

Figure 5. Landmark for IO catheterization on the upper medial aspect of the hind leg

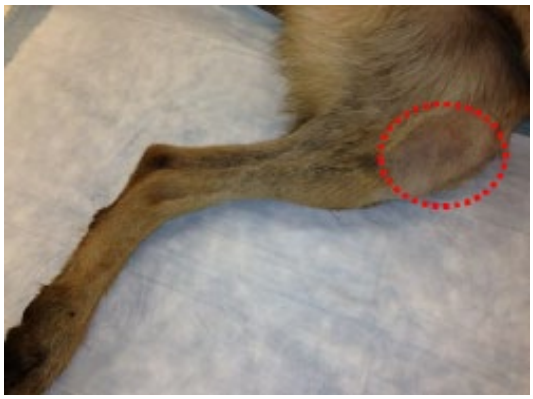


Figure 8. Placement of human pulse oximeter finger probe on tongue

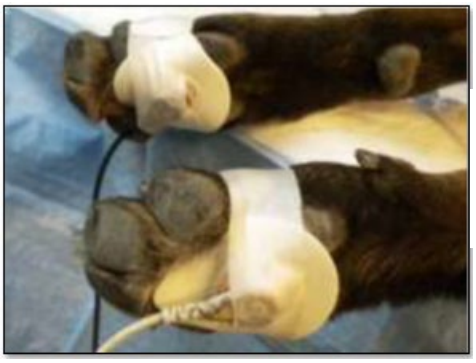


Figure 7. Placement of ECG electrode pads

ECG NOTE:

- Canine ECG complexes resemble human complexes with minor variations in key ECG intervals and possible inverted T-waves
- Electrode or ultrasound gel may be required between the electrode and footpads to improve contact

PULSE OXIMETRY NOTE:

- Human pulse oximetry probes (typically finger probes) are best placed on the tongue for optimal reliability in unconscious, sedated or anesthetized MWDs but can also be placed on the prepuce or vulva
- In conscious dogs, use the ear pinna, lip fold, or flank skin fold. Although these are not optimal for pulse oximetry, these alternate sites generally yield reliable results

MWD SHOCK FLUID THERAPY

Indications

- Hypotension
  - Systolic < 90 mmHg
  - MAP < 65 mmHg
- Hypovolemia
  - Massive hemorrhage (external, cavitary)
  - Severe dehydration (heat injury, GI loss)
  - Cavitary pressure impeding arterial perfusion or venous return

Clinical Signs

- Early, compensatory shock:
  - Tachycardia
  - Tachypnea
  - Alert mentation
  - Rapid pulse
  - Normal to increased pulse pressure
  - Normal Capillary Refill Time (CRT) (< 2 sec)
  - Normal to bright red Mucus Membranes (MM)
- Late, decompensatory shock:
  - Bradycardia
  - Prolonged or poor CRT (> 2 sec)
  - Pulses poor or absent
  - Hypothermia
  - Stupor

Treatment

- Place multiple large-bore IV or IO catheters
  - If one percutaneous attempt is not successful in a shock patient, immediately choose an alternate percutaneous site or perform IO catheterization
  - Cephalic veins ideal for peripheral catheterization
  - IO catheter placement
    - Proximal cranial medial tibia or proximal lateral humerus
    - Most MWDs weigh > 40 lbs so use adult size IOC 25 mm x 15 gauge
    - Use pediatric size IOC 15 mm x 15 gauge in MWDs weighing < 40 lbs
- Give crystalloid fluids as first line treatment
  - Normosol-R or Plasmalyte-A optimal for dogs; saline or LRS acceptable in emergent cases
  - Administer up to 90 mL/kg of crystalloids in the first hour (1 blood volume for the dog)
  - Quick calculation for a bolus shock dose: Add a zero to the dog's body weight (in pounds) to approximate a safe but effective bolus volume. For example, a 45 lbs dog would need about a 450 mL bolus, and a 75 lbs dog would need about 750 mL as a bolus
- Use synthetic colloids or hypertonic saline (HTS) in dogs with refractory shock
  - Give a Hydroxyethyl starch (HES) IV / IO bolus 10-20 mL/kg over 5- 0 minutes if clinical signs of shock do not abate after the first 30 minutes (first 2 quarter-shock IV challenges) of crystalloid fluids, or response to crystalloid challenges is not sustained
    - Repeat this bolus if no response to therapy
    - Give a Hypertonic saline (HTS) IV / IO bolus 4 mL/kg over 5 minutes (if 7-7.5% HTS is available) for MWDs that fail to respond to two or three quarter-shock boluses of crystalloids and / or one to two boluses of HES
- Consider TXA 10 mg/kg in 100 mL NS or LR, IV over 15 min but not later than 3 hours post injury
- Targeted shock resuscitation end points
  - MAP > 65 mmHg or a Sys > 90 mmHg
  - Normal level of consciousness (LOC) and an alert mentation
  - Light pink-to-salmon pink MM and CRT < 2 sec
  - BP that is 60-90 bpm at rest with strong, synchronous pulse quality
  - RR at rest 12-40 bpm with normal effort
  - Once shock has been resolved, continue IV crystalloid fluids at 3-5 mL/kg/hr for 12-24 hrs to maintain adequate intravascular volume
- Provide supplemental oxygen therapy
- Identify and treat the cause of shock. The cause of shock must be corrected, if possible

Notes, Cautions, Warnings

- WARNING: human blood products and albumin, or other animal blood products, must never be given to dogs, given the high risk of anaphylactic reactions
- Blood product transfusions for MWDs are only available from Veterinary Service Support units and their administration is only authorized under the direct supervision of a veterinarian
- Clinical target for resuscitation end point is a mean arterial pressure (MAP) of > 65 mmHg or a systolic of > 90 mmHg. Neonatal or pediatric blood pressure cuffs must be used

Reference: K9 CPGs

ACETAMINOPHEN

(Trade Name: Tylenol)

Class / Mechanism of Action

- **Analgesic**
  Although not fully clear, the analgesic effects are believed to be due to activation of descending serotonergic inhibitory pathways in the CNS. Interactions with other nociceptive systems may be involved as well. Antipyresis is produced from inhibition of the hypothalamic heat-regulating center.
  - Onset of action – Oral: < 1 hr, IV: 5-10 min; Duration: 4-6 hrs

Indications

- **Labeled Indications**
  - Treatment of mild to moderate pain and fever
  - Treatment of moderate to severe pain when provided via IV with opioid analgesia

Contraindications

- Hypersensitivity to acetaminophen or any component of the formulation
- Hepatic impairment or liver disease

Adverse Reactions / Precautions

- Use IV formulation cautiously in volume depleted patients
- Avoid use in patients suffering alcohol toxicity, known alcohol abuse, or renal impairment
- IV formulation can cause nausea, vomiting (especially in adults), and headaches
- Limit acetaminophen dose from all sources and all routes of administration to < 4 g/day (adults) and < 3.75 g/day (infants and children < 50 kg)
- **Pregnancy:** Category C **Lactation:** Use caution

Dose / Administration

ADULT

Pain or Fever (Limit total daily dose to < 4 g/day)

- PO
  - **1 g** q 6 hrs
- IV
  - < 50 kg: **12.5 mg/kg** q 4 hrs
    OR
    15 mg/kg q 6 hrs
  - ≥ 50 kg: **650 mg** q 4 hrs
    OR
    1 g q 6 hrs

PEDIATRIC

(Always reference BROSELOW Tape)

Pain or Fever

- PO
  - Infants and Children < 12 years: **10-15 mg/kg/dose** q 4-6 hrs PRN; do not exceed 5 doses (4 g/day) in 24 hrs
- IV
  - Infants and Children < 2 years: **15 mg/kg** q 6 hrs (max DAILY dose: 60 mg/kg/day)
  - Children 2-12 years: **15 mg/kg** q 6 hrs
    - Max SINGLE dose: 15 mg/kg/dose (≤ 750 mg/dose)
    - Max DAILY dose: 75 mg/kg/day (≤ 3.75 g daily)

Note: Children ≥ 12 years & Adolescents: Refer to adult dosing

ACETAZOLAMIDE

(Trade Name: Diamox)

Class / Mechanism of Action

- **Diuretic, Carbonic Anhydrase Inhibitor; Anticonvulsant**
  Inhibits carbonic anhydrase causing a decrease in hydrogen ion renal secretion with increased renal secretion of sodium, potassium, bicarbonate, and water.
  - Onset of action – PO: 2 hrs, IV: 2-10 min

Indications

- **Labeled Indications**
  - Prevention or treatment of symptoms of acute mountain sickness
  - Edema due to congestive heart failure

Contraindications

- Hypersensitivity to acetazolamide, sulfonamides, or any component of the formulation
- Confirmed low sodium / potassium levels otherwise none in emergency setting

Adverse Reactions / Precautions

- May worsen respiratory acidosis
- Drowsiness, deceased alertness, impairment of coordination, nausea, headache
- Flushing of skin, allergic skin reaction, skin photosensitivity
- **Pregnancy:** Category C **Lactation:** Use caution

Dose / Administration

ADULT

Altitude Illness (Acute Mountain Sickness)

Note: For high altitude cerebral edema (HACE), dexamethasone is the primary treatment; however, acetazolamide can be used (together with dexamethasone) at the AMS dose

- IV / IO
  - Prevention: **125 mg** q 12 hrs
  - Treatment: **250 mg** q 12 hrs

Edema (Only with referring doctor or medical director instruction)

- PO / IV
  - **250-500 mg** once daily or every other day

PEDIATRIC

(Always reference BROSELOW Tape)

Altitude Illness (Acute Mountain Sickness)

Note: For high altitude cerebral edema (HACE), dexamethasone is the primary treatment; however, acetazolamide can be used (together with dexamethasone) at the AMS dose

- PO (IM not recommended due to alkaline pH)
  - Prevention: **1.25 mg/kg/dose** q 12 hrs
  - Treatment: **2.5 mg/kg/dose** q 12 hrs
    - Maximum dose: 250 mg/dose

ACETYLSALICYLIC ACID

(Trade Name: Aspirin)

Class / Mechanism of Action

- **Nonsteroidal Anti-inflammatory Drug (NSAID)**
  Blocks cyclooxygenase (COX 1 and 2) enzymes, resulting in reduced formation of prostaglandin precursors. Blocks formation of prostaglandin derivative, thromboxane A2, resulting in inhibited platelet aggregation. Has antipyretic, analgesic, and anti-inflammatory properties.

Indications

- **Labeled Indications**
  - Treatment of acute coronary syndromes (ST-Elevation MI, Non-ST-Elevation MI, unstable angina), acute ischemic stroke, and transient ischemic episodes

Contraindications

- Hypersensitivity to salicylates, other NSAIDs, or any component of the formulation
- Asthma, rhinitis
- Inherited or acquired bleeding disorders (including factor VII and factor IX deficiency)
- Do not use in children less than 16 years old (Reye's syndrome)

Adverse Reactions / Precautions

- Not for use on trauma patients in the combat environment
- Risk of bleeding. Avoid use in patients with known or suspected: Bleeding disorders, GI bleed, GI ulcers, patients taking Coumadin, or within 24 hrs of taking Alteplase (tPA) for suspected stroke
- **Pregnancy:** Category C **Lactation:** Yes, short term or low dose OK

Dose / Administration

ADULT	**PEDIATRIC**
Acute Coronary Syndrome (ST-segment Elevation Myocardial Infarction [STEMI], Unstable Angina (UA) / Non-ST-Segment Elevation Myocardial Infarction [NSTEMI]) (Not for use in trauma patients) • PO ○ **162-325 mg** (chew nonenteric-coated aspirin as a single 325 mg tablet or four 81 mg chewable tablets	(Always reference BROSELOW Tape) **N/A** • **Contraindicated in children under 16 years (Reye's Syndrome)**

ACTIVATED CHARCOAL

(Trade Name: Actidose)

Class / Mechanism of Action

- **Antidote**
  Non-absorbable agent that absorbs toxins within the GI tract inhibiting GI absorption.

Indications

- **Labeled Indications**
  - Management of suspected or known poisonings when gastrointestinal decontamination is an option
  - Decontamination within 1 hr of ingestion of toxic substance

Contraindications

- Presence of intestinal obstruction or GI tract not anatomically intact
- Patients at risk of GI hemorrhage or perforation
- Patients with an unprotected airway (e.g., CNS depression without intubation) or if use would increase the risk and severity of aspiration

Adverse Reactions / Precautions

- Aspiration and respiratory failure may occur. If patient is unconscious, must establish airway control and utilize NG / OG tube
- Be prepared for possible emesis. Consider the use of antiemetic. Other GI side effects include abdominal distention, constipation, intestinal obstruction and mouth / teeth discoloration
- **Pregnancy:** Safe **Lactation:** Safe

Dose / Administration

ADULT

Acute Poisoning

- PO / NG / OG
  - Single dose: **25-100 g**

Note: Activated Charcoal has limited efficacy if not utilized within 1 hr of toxin ingestion

Note: Some products may contain sorbitol. Coadministration of a cathartic, including sorbitol, is no longer recommended

Note: Multidose charcoal is indicated if patient ingested a life-threatening amount of drug (carbamazepine, dapsone, phenobarbital, guanine, or theophylline)

PEDIATRIC

(Always reference BROSELOW Tape)

Acute Poisoning

- PO / NG / OG
  - Infants < 1 y/o: **10-25 g**
  - Children 1-12 y/o: **25-50 g**
  - Adolescents: **25-100 g**

Note: Activated Charcoal has limited efficacy if not utilized within 1 hr of toxin ingestion

Note: Some products may contain sorbitol. Coadministration of a cathartic, including sorbitol, is no longer recommended

ADENOSINE

(Trade Name: Adenocard)

Class / Mechanism of Action

- **Antiarrhythmic Agent**
  Slows conduction time through the AV node, inhibits re-entry pathways through the AV node, restoring normal sinus rhythm. The half-life of under 10 sec allows for rapid repeat dosing.

Indications

- **Labeled Indications**
  - Paroxysmal supraventricular tachycardia (PSVT) when clinically advisable, vagal maneuvers should be attempted first. Not effective for conversion of atrial fibrillation, atrial flutter, or ventricular tachycardia
- **Off-labeled Indications**
  - ALS / PALS Guidelines (2020): Stable, narrow-complex regular tachycardias; unstable narrow complex regular tachycardias while preparations are made for synchronized direct-current cardioversion; stable regular monomorphic, wide-complex tachycardia as a therapeutic (if SVT) and diagnostic maneuver

Contraindications

- Hypersensitivity to adenosine or any component of the formulation
- Second- or third-degree AV block, sick sinus syndrome, or symptomatic bradycardia (except in patients with a functioning artificial pacemaker)
- Use in patients with atrial fibrillation / flutter with underlying Wolff-Parkinson-White (WPW) syndrome
- Known or suspected bronchoconstrictive (asthma) or bronchospastic lung disease

Adverse Reactions / Precautions

- May cause transient asystole and new arrhythmia after cardioversion (PACs, AF, PVCs) chest discomfort
- Headache, dizziness, flushing, GI upset
- Dyspnea, bronchospasm in asthmatics
- **Pregnancy:** Category C **Lactation:** Use caution

Dose / Administration

ADULT

Paroxysmal Supraventricular Tachycardia (PSVT)

- IV / IO
  - Rapid push over 1-2 secs, via proximal peripheral line (forearm or above, large bore), followed immediately by a normal saline flush
    - Initial: **6 mg**; if not effective within 1-2 min, administer **12 mg** (max SINGLE dose: 12 mg). Immediately follow each dose with **10-20 mL** normal saline flush

Note: Initial dose of adenosine should be reduced to 3 mg if patient is currently receiving carbamazepine or dipyridamole, has a transplanted heart, or if adenosine is administered via central line

Note: Adenosine effects are antagonized by caffeine and theophylline, and patients may require higher doses

PEDIATRIC

(Always reference BROSELOW Tape)

Paroxysmal Supraventricular Tachycardia (PSVT)

- IV / IO
  - As close to the core as possible, rapid push over 1-2 secs, followed immediately by a normal saline flush
    - Initial: **0.1 mg/kg** (max INITIAL dose: 6 mg); if not effective within 1-2 min, administer **0.2 mg/kg** (max SINGLE dose: 12 mg). Immediately follow each dose with **5-10 mL** normal saline flush

ALBUTEROL

(Trade Name: Proventil / Ventolin)

Class / Mechanism of Action

- **Beta$_2$ Agonist (Bronchodilator)**
  Synthetic sympathomimetic that relaxes bronchial smooth muscle, causing bronchodilation, with little cardiac impact.
  - Onset of action: 2-15 min

Indications

- **Labeled Indications**
  - Treatment or prevention of bronchospasm in patients with reversible obstructive airway disease; prevention of exercise-induced bronchospasm
  - Asthma
  - Reactive airway / bronchospasm
  - COPD
- **Off-label Indications**
  - May also be used in crush syndrome (hyperkalemia)

Contraindications

- Hypersensitivity to albuterol or any component of the formulation
- Hypersensitivity to milk protein (dry powder inhalers)

Adverse Reactions / Precautions

- May cause CNS effects such as headache, dizziness, flushing, diaphoresis, tremors, weakness
- May cause mild tachycardia, chest pain, cardiac arrhythmias, QTc interval changes, and more severe cases of cardiac ischemia, heart failure, and cardiomyopathy
- Dyspnea, paradoxical bronchospasm due to airway hyperresponsiveness
- **Pregnancy:** Category C **Lactation:** Yes

Dose / Administration

ADULT

Bronchospasm; Anaphylaxis (adjunct to epinephrine)

- Metered-dose inhaler (90 mcg/actuation)
  - **2-3 inhalations** PRN
- Nebulization solution
  - **2.5-5 mg**; repeat PRN

Severe Exacerbation of Asthma

- Metered-dose inhaler
  - **2-4 inhalations** q 20 min PRN for 3 doses, then taper as tolerated
- Nebulization solution
  - **2.5-5 mg** q 20 min for 3 doses, then taper as tolerated

Hyperkalemia

- Nebulization solution
  - **10 mg over 10 min**

PEDIATRIC

(Always reference BROSELOW Tape)

By Metered Dose Inhaler (MDI; 90 mcg/actuation)

- **4-8 inhalations** q 20 min PRN for 3 doses, then q 1-4 hrs or as clinically indicated

By Nebulizer (Intermittent)

- Children < 20 kg
  - **2.5 mg** q 20 min PRN
- Children > 20 kg
  - **5 mg** q 20 min PRN

By Nebulizer (Continuous)

- **0.5 mg/kg/hr** and titrate PRN, max 20 mg/hr

AMIODARONE

(Trade Name: Nexterone / Pacerone)

Class / Mechanism of Action

- **Antiarrhythmic Agent, Class III**
  Inhibits adrenergic stimulation (alpha and beta blocking), prolongs action potential and refractory period (prolongs PR and QT intervals); decreases AV conduction and sinus node function (decreases sinus rate).

Indications

- **Labeled Indications**
  - Management of life-threatening recurrent ventricular fibrillation (VF) or recurrent hemodynamically unstable ventricular tachycardia (VT) refractory to other antiarrhythmic agents
- **Off-label Indications**
  - Recurrent, hemodynamically unstable VT after other drugs have failed
  - Ventricular tachyarrhythmias (ALS / PALS): VF / VT Cardiac arrest unresponsive to CPR, shock, and vasopressor

Contraindications

- Hypersensitivity to amiodarone, iodine, or any component of the formulation
- Severe sinus-node dysfunction
- 2nd and 3rd degree atrioventricular block (except in patients with a functioning artificial pacemaker)
- Bradycardia causing syncope (except in patients with a functioning artificial pacemaker)
- Cardiogenic shock
- Pre-excited atrial fibrillation / flutter

Adverse Reactions / Precautions

- **Complex drug with multiple complex drug reactions! Do not use with other drugs that prolong QT interval (do not administer with procainamide)**
- Hypotension
- Dizziness, fatigue, headache, poor coordination, neuropathy
- Nausea, vomiting
- Dysrhythmias, asystole, AF, bradycardia, AV block, conduction abnormalities, SA node dysfunction
- Pulmonary toxicity may occur. Acute events include pneumonitis, pulmonary alveolar hemorrhage, and acute respiratory distress syndrome (ARDS)
- May be a vesicant; ensure proper needle or catheter placement prior to infusion
- **Pregnancy:** Category D **Lactation:** Not Recommended

Dose / Administration

ADULT

Pulseless VT / VF

- IV / IO
  - Initial: **300 mg** bolus
  - Second dose: If arrest rhythm persists, administer **150 mg** bolus 3-5 min later

Tachyarrhythmia with a Pulse

- IV / IO
  - Initial Dose: **150 mg** over 10 min; may repeat as needed if arrhythmia recurs
  - Maintenance Infusion: **1 mg/min** over 6 hrs

PEDIATRIC

(Always reference BROSELOW Tape)

Shock-Refractory Pulseless VT / VF

- IV / IO
  - **5 mg/kg;** May repeat twice for refractory VF / pVT (3 total doses, max DAILY dose: 15 mg/kg)
    - Max SINGLE dose: 300 mg
    - Adolescent maximum dose: 2.2 g

Tachyarrhythmia with a Pulse and Poor Perfusion, or Symptomatic with Adequate Perfusion

- IV / IO
  - **5 mg/kg** over 20-60 min; may repeat to daily max of 15 mg/kg
    - Max SINGLE dose: 300 mg
    - Adolescent maximum dose: 2.2 g

AMIODARONE					
Initial Dose: 150 mg over 10 minutes					
MIX 150 mg / 100 mL CONCENTRATION 1.5 mg/mL					
Dose	Rate	Micro 60 gtt/mL	Macro		
			20 gtt/mL	15 gtt/mL	10 gtt/mL
mg/min	mL/min	gtt/min	gtt/min	gtt/min	gtt/min
15	10	600	200	150	100
Macro-Drip (10 gtt/mL) is set of choice for this infusion					
Set rate provides complete initial infusion of 150 mg over 10 minutes. May repeat q 10 minutes PRN if VT recurs					

AMIODARONE					
Maintenance Dose: 1 mg/min over 6 hours (360 mg over 360 minutes)					
MIX 360 mg / 500 mL CONCENTRATION 0.72 mg/mL					
Dose	Rate	Micro 60 gtt/mL	Macro		
			20 gtt/mL	15 gtt/mL	10 gtt/mL
mg/min	mL/min	gtt/min	gtt/min	gtt/min	gtt/min
1	1.4	84	28	21	14
Macro-Drip (20 gtt/mL) is set of choice for this infusion					
Set rate provides maintenance infusion of 360 mg over 6 hours					

ANTIBIOTIC THERAPY CHART

Post-injury antimicrobial agents are recommended to prevent early post-traumatic infectious complications, including sepsis, secondary to common bacterial flora. Selection is based on narrowest spectrum and duration required to prevent early infections prior to adequate surgical wound management. This narrow spectrum is selected to avoid selection of resistant bacteria. The antimicrobials listed are not intended for use in established infections, where multidrug-resistant (MDR) or other nosocomial pathogens may be causing infection.

INJURY	PREFERRED AGENT	FREQUENCY	DURATION
EXTREMITY WONDS			
Skin, soft tissue, **without** open fractures	Cefazolin 2 g	q 6 – 8 hrs	24 hrs
Skin, soft tissue, **with** open fractures, exposed bone, or open joints	Cefazolin 2 g	q 6 – 8 hrs	24 hrs, then with each subsequent I&D until soft tissue coverage
THORACIC WOUNDS			
Penetrating chest injury	Cefazolin 2 g	q 6 – 8 hrs	24 hrs
ABDOMINAL WOUNDS			
Penetrating abdominal injury **with suspected / known** hollow viscus injury and soilage; may apply to rectal / perineal injuries as well	Cefazolin 2 g *PLUS* Metronidazole 500 mg IV	q 6 – 8 hrs q 8 – 12 hrs	Stop 24 hrs after control of contamination
MAXILLOFACIAL AND NECK WOUNDS			
Open maxillofacial fractures, maxillofacial fractures **with** foreign body or fixation device	Cefazolin 2 g	q 6 – 8 hrs	24 hrs
CENTRAL NERVOUS SYSTEM WOUNDS			
Penetrating brain injury	Cefazolin 2 g IV *PLUS* (consider) Metronidazole 500 mg	q 6 – 8 hrs q 8 – 12 hrs	5 days or until CSF leak is closed, whichever is longer
Penetrating spinal cord injury	Cefazolin 2 g IV *PLUS* (consider) Metronidazole 500 mg	q 6 – 8 hrs q 8 – 12 hrs	
EYE WOUNDS			
Eye injury, burn, or abrasion	Erythromycin ophthalmic ointment *OR* Bacitracin ophthalmic ointment	q 6 hrs PRN for symptomatic relief	Until epithelium healed. No systemic treatment required
Eye injury, penetrating	Levofloxacin 750 mg IV / PO *PLUS* Vancomycin 15 – 20 mg/kg IV	q 24 hrs q 8 – 12 hrs	7 days or until evaluated by an ophthalmologist. No topical agents
BURNS			
Not indicated in the pre-hospital setting			
DELAYED EVACUATION TO SURGICAL CARE			
PO tolerable	Moxifloxacin 400 mg PO	1 x dose	Single dose therapy
Not PO tolerable	Ertapenem 1 g IV / IM	1 x dose	

ATROPINE SULFATE

(Trade Name: AtroPen)

Class / Mechanism of Action

- **Anticholinergic, Antidysrhythmic, Antidote for Carbamate Anticholinesterase Poisoning**
  Blocks acetylcholine at parasympathetic sites in smooth muscle, secretory glands, and the CNS; increases cardiac output and dries secretions. Atropine reverses the muscarinic effects of cholinergic poisoning. Reverses bronchorrhea and bronchoconstriction but do not affect the nicotinic receptors responsible for muscle weakness, fasciculations, and paralysis.

Indications

- **Labeled Indications**
  - Treatment of symptomatic sinus bradycardia, AV block (nodal level)
  - Antidote for anticholinesterase poisoning (carbamate insecticides, nerve agents, organophosphate insecticides)

Contraindications

- Hypersensitivity to atropine or any component of the formulation
- Narrow-angle glaucoma; adhesions between the iris and lens (ophthalmic product)
- Pyloric stenosis
- Prostatic hypertrophy
- **NOTE:** NO contraindication should prevent the use of atropine in setting of life-threatening organophosphate, carbamate, or nerve agent poisoning

Adverse Reactions / Precautions

- Tachycardia and arrhythmia (VTach, Vfib), hypotension, palpitations
- Dilated pupils
- Headache, dry mouth, constipation, urinary retention, flushing
- Higher doses may be required for organophosphate poisoning
- **Paradoxical bradycardia noted with doses less than 0.1 mg**
- **Pregnancy:** Use with caution; do not withhold antidotes or cardiac medications due to pregnancy **Lactation:** Use with caution; present in breast milk

Dose / Administration

ADULT

Symptomatic Bradycardia

- IV / IO
  - **1 mg** q 3-5 min, not to exceed a total of **3 mg** or **0.04 mg/kg**

Nerve Agent Poisoning / Organophosphate / Carbamate Insecticide

- IV / IO (Nerve Agent)
  - Atropine **20 mg in 250 mL**, titrate to dry respiratory secretions
- IM (ATNAA)
  - **2 mg Atropine / 600 mg 2-Pam**
    - Severe symptoms: 3 doses (6 mg total)
- IM (AtroPen)
  - **2 mg** once an exposure is known or strongly suspected

PEDIATRIC

(Always reference BROSELOW Tape)

Symptomatic Bradycardia

- IV / IO
  - **0.02 mg/kg.** May repeat once in 3-5 min
    - Minimum SINGLE dose: 0.1 mg
    - Max SINGLE dose: 0.5 mg
    - Max TOTAL dose: 1 mg in children; 3 mg in adolescents

Organophosphate / Carbamate Insecticide

- IV / IO
  - Children < 12 years: Initial dose: **0.05 mg/kg**; repeat q 5 min PR, doubling the previous dose, until symptoms resolve
  - Children ≥ 12 years: Initial dose: **1 mg/kg**; repeat q 5 mins PRN, doubling the previous dose, until symptoms resolve

CALCIUM CHLORIDE (CaCl) 10%

Class / Mechanism of Action

- **Calcium Salt, Electrolyte Supplement**
  Moderates nerve and muscle contractility via action potential excitation threshold regulation.

Indications

- **Labeled Indications**
  - Treatment of hypocalcemia and conditions secondary to hypocalcemia (e.g., tetany, seizures, arrhythmias); treatment of hypermagnesemia; massive transfusion prophylaxis
- **Off-labeled Indications**
  - Calcium channel blocker toxicity; beta-blocker toxicity (refractory to glucagon and high dose vasopressors); severe hyperkalemia (K+ >6.5 mEq/L with toxic ECG changes); malignant arrhythmia (including cardiac arrest) associated with hypermagnesemia

Contraindications

- Known or suspected digoxin toxicity
- Not recommended as routine treatment in cardiac arrest (includes asystole, ventricular fibrillation, pulseless ventricular tachycardia, or pulseless electrical activity)
- Hypercalcemia

Adverse Reactions / Precautions

- Hypokalemia: Use with caution in patients with severe hypokalemia. Acute rises in calcium can cause life-threatening arrhythmias
- Rapid push can cause arrhythmia, bradycardia, cardiac arrest, hypotension, syncope, vasodilation
- **Use small IV / large vein, flush prior and after. AVOID Extravasation** (will cause tissue necrosis)
  - In general, IV Calcium Gluconate is preferred over IV Calcium Chloride in nonemergency settings due to the potential for extravasation with Calcium Chloride
- **Do not infuse Calcium Chloride in the same IV line as phosphate-containing solutions**
- Precipitates with $NaHCO_3$ in IV Bag/Tubing
- **Pregnancy:** Safe **Lactation:** Safe

Dose / Administration

ADULT

Cardiac Arrest or Cardiotoxicity in the Presence of Hyperkalemia, Hypocalcemia, or Hypermagnesemia

- IV / IO (SLOW)
  - **500-1000 mg** over 2-5 mins

Beta-Blocker Overdose, Refractory to Glucagon and High-Dose Vasopressors (Off-labeled use)

- IV / IO
  - **20-40 mg/kg** over 5-10 mins followed by an infusion of **20-40 mg/kg/hr** titrated to adequate hemodynamic response

Calcium Channel Blocker Toxicity (Off-labeled use) (CaCl preferred over Calcium Gluconate)

- IV / IO
  - Initial: **1-2 g** or **20-40 mg/kg/hr**

Damage Control Resuscitation

- IV / IO (SLOW)
  - **1000 mg** after 1st blood unit and after q 4th unit. May be given before TXA

PEDIATRIC

(Always reference BROSELOW Tape)

Cardiac Arrest or Cardiotoxicity in the Presence of Hyperkalemia, Hypocalcemia, Hypermagnesemia, Calcium Channel Blocker Toxicity

- IV / IO (SLOW)
  - **20 mg/kg** (0.2 mL/kg of the 10% solution) PRN to achieve desired clinical effect

Note: Calcium Chloride is x3 more potent than Calcium Gluconate and therefore lower doses of Calcium Chloride must be used to reach similar therapeutic doses

CALCIUM GLUCONATE (CaGlu)

Class / Mechanism of Action

- **Calcium Salt, Electrolyte Supplement**
  Moderates nerve and muscle contractility via regulation of action potential excitation threshold.

Indications

- **Labeled Indications**
  - Treatment of hypocalcemia and conditions secondary to hypocalcemia (e.g., tetany, seizures, arrhythmias); cardiac disturbances secondary to hyperkalemia; treatment of magnesium sulfate toxicity (hypermagnesemia); massive transfusion prophylaxis
- **Off-labeled Indications**
  - Calcium channel blocker toxicity; treatment of hydrofluoric acid exposure

Contraindications

- Ventricular fibrillation
- Hypercalcemia
- In neonates receiving ceftriaxone; may cause intravascular ceftriaxone-calcium precipitates with resulting end-organ damage. If using in children > 28 days on concomitant ceftriaxone, do not administer simultaneously through same IV line or connector; may administer sequentially through the same line with thorough flushing

Adverse Reactions / Precautions

- Hypokalemia: Use with caution in patients with severe hypokalemia. Acute rises in calcium can cause life-threatening arrhythmias
- Rapid push can cause arrhythmia, bradycardia, cardiac arrest, hypotension, syncope, vasodilation
  - Do not exceed 200 mg/min except in emergency situations
- Caution in patients receiving digoxin therapy; may cause arrhythmias
- **Use small IV / large vein, flush prior and after. AVOID extravasation** (will cause tissue necrosis)
  - In general, IV Calcium Gluconate is preferred over IV Calcium Chloride in nonemergency settings due to the potential for extravasation with Calcium Chloride
- Do not infuse Calcium Gluconate in the same IV line as phosphate-containing solutions
- Precipitates with Sodium Bicarbonate in IV bag / tubing
- Avoid in patients receiving cardiac glycosides; may cause cardiac arrhythmias
- **Pregnancy:** Safe **Lactation:** Present in breast milk

Dose / Administration

ADULT

Cardiac Arrest or Cardiotoxicity in the Presence of Hyperkalemia, Hypocalcemia, or Hypermagnesemia

- IV / IO (SLOW)
  - **1.5-3 g** over 2-5 mins

Calcium Channel Blocker Toxicity (Off-labeled use)**: Hypotension/Conduction Disturbances**

- IV / IO
  - **3-6 g** over 5-10 mins; may repeat q 10-20 mins with 3-4 additional doses

Hypocalcemia Prophylaxis from Massive Transfusion

- IV / IO
  - **30 mL of 10% solution** over 5 mins

Hydrofluoric Acid Exposure (Off-labeled use: Burn Protocol)

- Topical Therapy
  - After **thorough irrigation**, a CaGlu gel (3:1 concentration of KY Jelly to 10% CaGlu) can be made and applied to the affected area, left on for 30 minutes, cleaned off, and repeated q 4 hrs. Assess for pain relief and monitor EKG. (NO Calcium Chloride!)

PEDIATRIC

(Always reference BROSELOW Tape)

Cardiac Arrest or Cardiotoxicity in the Presence of Hyperkalemia, Hypocalcemia, Hypermagnesemia, or Calcium Channle Blocker Toxicity

- IV / IO (SLOW)
  - **60 mg/kg** (0.6 mL/kg of 10% solution); repeat PRN to achieve desired clinical effect

Note: Calcium Chloride is 3x more potent than Calcium Gluconate and therefore higher doses of Calcium Gluconate must be used to reach similar therapeutic doses

CEFAZOLIN

(Trade Name: Ancef)

Class / Mechanism of Action

- **Antibiotic (Cephalosporin 1st Gen)**
  Bactericidal - Inhibits bacterial cell wall synthesis by binding to one or more penicillin-binding proteins which inhibits cell wall biosynthesis, causing bacteria to eventually lyse.

Indications

- **Labeled Indications**
  - Used for infection control prophylaxis for traumatic open injuries and surgical prophylaxis

Contraindications

- Hypersensitivity to cefazolin, other cephalosporin antibiotics, other beta-lactams, or any component of the formulation
- Some cross reactions occur in those with penicillin allergies. Use with caution

Adverse Reactions / Precautions

- Superinfection: prolonged use may result in fungal or bacterial superinfection (including C.Difficile)
- Increased INR (bleeding risk), especially in nutritionally deficient, hepatic/renal disease, prolonged treatment
- **Pregnancy:** Safe **Lactation:** Considered safe; trace amounts found in breast milk

Dose / Administration

ADULT

Infection Control

- IV
  - **2 g in 250 mL NS** over 5 min q 8 hrs for 24 hrs. This is adequate for most dirty wounds of the head and neck, torso, and extremities

Note: See antibiotic chart for dosing in accordance with injury

PEDIATRIC

(Always reference BROSELOW Tape)

Infection Control

- IV
  - **20-30 mg/kg** q 6-8 hrs (max DAILY dose: 100 mg/kg/day)

CEFTRIAXONE

(Trade Name: Rocephin)

Class / Mechanism of Action

- **Antibiotic, Cephalosporin**
  Inhibits bacterial cell wall synthesis by binding to one or more of the penicillin-binding proteins (PBPs) which in turn inhibits the final transpeptidation step of peptidoglycan synthesis in bacterial cell walls, thus inhibiting cell wall biosynthesis.

Indications

- **Labeled Indications**
  - Infections
  - Meningitis
- **Off-Label Indications**
  - Animal or human bite wound treatment

Contraindications

- Hypersensitivity to Ceftriaxone or any component of the formula and/or other cephalosporins

Adverse Reactions / Precautions

- Skin tightness
- Diarrhea
- Do NOT use in hyperbilirubinemic neonates

Dose / Administration

ADULT

Sepsis

- IV / IO
  - **2 g** over 10 min q 24 hrs

PEDIATRIC

(Always reference BROSELOW Tape)

Sepsis

- IV / IM
  - Infants, children, and adolescents: **50-75 mg/kg/dose** q 24 hrs
    OR
    25-37.5 mg/kg/dose q 12 hrs
    - Max daily dose: 2 g/day

Note: Higher doses are recommended in certain infections (e.g., endocarditis, meningitis). Refer to doctor's orders for specified treatment plan.

DEXAMETHASONE

(Trade Name: Decadron)

Class / Mechanism of Action

- **Synthetic glucocorticoid steroid**
  Anti-inflammatory, immunosuppressant.
  - Onset of action – IV: Rapid; Duration – IV: 72 hrs

Indications

- **Labeled Indications**
  - Anti-inflammatory or immunosuppressant in treatment of a variety of diseases: allergic, dermatologic, endocrine, hematologic, inflammatory, neoplastic, renal, respiratory, rheumatic, and autoimmune
  - Management of cerebral edema
- **Off-label Indications**
  - Treatment of acute mountain sickness (AMS) and high-altitude cerebral edema

Contraindications

- Hypersensitivity to dexamethasone or any component of the formulation
- Systemic fungal infection

Adverse Reactions / Precautions

- Not for use in treatment of head injury. Increased mortality has occurred in head injury patients treated with a high dose IV methylprednisolone. Corticosteroids should not be used in head injuries
- May cause hyperglycemia / reduced glucose tolerance, especially in patients predisposed to diabetes mellitus
- **Pregnancy:** Avoid chronic high dose use **Lactation:** Single dose compatible

Dose / Administration

ADULT

Acute Mountain Sickness (AMS) (Off-labeled use)

- PO / IM / IV
  - **4 mg** q 6 hrs. Continue until 24 hrs after symptoms resolve or descent completed (not longer than 7 days total)

High Altitude Cerebral Edema (HACE) (Off-labeled use)

- PO / IM / IV
  - **8 mg** as a single dose; followed by **4 mg** q 6 hrs until descent is complete and symptoms resolve

PEDIATRIC

(Always reference BROSELOW Tape)

Upper Airway Edema in Croup / Acute Asthma Exacerbation

- PO / IV/ IM
  - **0.6 mg/kg** as one dose for croup and q 24 hrs for asthma exacerbation (max dose: 16 mg)

Acute Mountain Sickness (AMS), High Altitude Cerebral Edema (HACE) (Off-labeled use)

- PO / IM / IV
  - **0.15 mg/kg/dose** q 6 hrs (max: 4 mg/dose)

Note: Consider use in possible High Altitude Pulmonary Edema because of associated cerebral edema with pulmonary edema

DEXTROSE 50%

(Trade Name: Glutose I B-D Glucose)

Class / Mechanism of Action

- **Antidote, Hypoglycemia**
  Basic source of calories (fuel) for the body and brain, regulated by insulin. Rapidly increases blood glucose, decreases protein and nitrogen loss, prevents ketosis, and promotes glycogen deposition in liver. When used in the treatment of hyperkalemia (combined with insulin), stimulates the transient uptake of potassium by cells, lowering serum potassium.
  - Onset of action – Treatment of hypoglycemia Oral dose: 10 mins; Treatment of Hyperkalemia IV: 30 mins

Indications

- **Labeled Indications**
  - Treatment of hypoglycemia. Doses may be repeated in severe cases
- **Off-Label Indications**
  - Treatment of hyperkalemia. Must be used in combination with Insulin
  - Calcium channel blocker or beta-blocker overdose/toxicity (adjunctive agent)
  - Hypernatremia

Contraindications

- Known hyperglycemia, otherwise none in the pre-hospital setting

Adverse Reactions / Precautions

- Most adverse effects associated with excessive dose or infusion rate
- If evidence of malnutrition or alcohol abuse, thiamine should be given first
- **Tissue necrosis if extravasation occurs**; immediately D/C and change IV site
- Hyperglycemia
- Hypokalemia
- Hyponatremia
- **Pregnancy:** Adverse outcomes not expected **Lactation:** Use with caution, consider benefit to mother versus exposure to infant

Dose / Administration

ADULT

Hypoglycemia

- PO
  - **15-20 g** as a single dose; may repeat in 15 mins PRN
- IV
  - **10-25 g** (40-100 mL of 25% solution or 20-50 mL of 50% solution)
  - For patients with traumatic brain injury: give **25 g** (50 mL) if blood glucose < 100 mg/dL

Hyperkalemia, Severe/Emergent

- IV
  - **25-50 g** over 5 mins, administered with separate administration of IV insulin

Note: The Society of Critical Care Medicine recommends: Treat blood glucose < 70 mg/dL (< 100 mg/dL in patients with neurologic injury) immediately by stopping insulin therapy (if receiving) and administering 10-20 g (20-40 mL of 50% solution) IV; repeat blood glucose measurement in 15 mins with repeat dextrose PRN; avoid overcorrection

PEDIATRIC

(Always reference BROSELOW Tape)

Hypoglycemia

- IV
  - Newborns: **5-10 mL/kg D10** (max dose: 25 g/dose)
  - Infants and Children: **2-4 mL/kg D25** (max dose: 25 g/dose)
  - Adolescents: Refer to adult dosing

Note:
D25 = 25 mL NS + 25 mL D50 (12.5 g in 50 mL solution)
D10 = 100 mL NS + 25 mL D50 (12.5 g in 125 mL solution) or 40 mL NS + 10 mL D50 (5 g in 50 mL solution)
PO: Smaller doses (5-10 g) could be considered for patients on automated insulin delivery to help avoid rebound hyperglycemia

DIAZEPAM

(Trade Name: Valium)

Class / Mechanism of Action

- **Benzodiazepine**
  Acts as an Anxiolytic/Hypnotic, anticonvulsant, and sedative.
  - Long Half Life: 25-100 hrs; Onset of action – IV: Almost Immediate; Duration – IV: 20-30 mins

Indications

- **Labeled Indications**
  - Anxiety disorders
  - Convulsive disorders and Alcohol Withdrawal Symptoms
  - Skeletal muscle relaxant
  - Induce sedation and amnesia (Midazolam is primary medication)

Contraindications

- Hypersensitivity to Diazepam or any component of the formulation or other benzodiazepines
- Acute narrow – angle glaucoma
- Untreated open – angle glaucoma

Adverse Reactions / Precautions

- **No Analgesic properties** (Narcotic pain control is needed for RSI / Intubated trauma patients)
- May Cause Respiratory depression: Do not give without stable IV line and BVM (airway control) ready
- Hypotension, vasodilation
- Amnesia, confusion, drowsiness, slurred speech (Paradoxical reactions possible: aggressiveness, agitation, anxiety, inappropriate behavior)
- **Pregnancy:** Category D **Lactation:** Not Recommended

Dose / Administration

ADULT

Anxiety

- Oral / IV / IM (oral and IV doses more reliable)
  - **2-10 mg** q 3-6 hrs PRN (max DAILY dose: 40 mg/day)

Status Epilepticus / Seizures

- IV (SLOW)
  - **5-10 mg** over 2 mins; repeat q 3-5 mins PRN (max TOTAL dose: 30 mg for acute seizures)

Sedation in ICU Patient

- IV
  - Loading dose: **5-10 mg**
  - Maintenance dose: **0.03-0.1 mg/kg** q 30 mins to 6 hrs

Muscle Spasm Associated with Tetanus

- IV
  - Initial: **10-30 mg** q 1-4 hrs PRN

Nerve Agent Exposure (CBRNE)

- IV
  - **10-20 mg** for seizures associated with Nerve Agent exposure (up to 40 mg may be needed)
- IM
  - Administer 3 ATNAA (atropine / 2-Pam autoinjector) and 1 CANA (10 mg Diazepam autoinjector)

PEDIATRIC

(Always reference BROSELOW Tape)

Sedation / Muscle Relaxation / Anxiety

- IV / IM (IV doses more reliable)
  - Infants & Children: **0.05-0.1 mg/kg over** 3-5 mins, titrate slowly to effect (max TOTAL dose: 0.25 mg/kg)
  - Adolescents: **5 mg IV**; may repeat with 2.5 mg if needed

Status Epilepticus

- IV
  - **0.15-0.20 mg/kg/dose** to a max of 10 mg/dose; may repeat dose once in 5 mins

Muscle Spasm Associated with Tetanus

- IV / IM
  - Infants > 30 days and Children < 5 years: **1-2 mg** q 3-4 hrs PRN
  - Children ≥ 5 years**:** **5-10 mg** q 3-4 hrs PRN

DILTIAZEM

(Trade Name: Cardizem)

Class / Mechanism of Action

- **Calcium Channel Blocker; Antiarrhythmic Agent, Class IV**
  Inhibits calcium ion from entering the "slow channels" or select voltage-sensitive areas of vascular smooth muscle and myocardium during depolarization; produces relaxation of coronary vascular smooth muscle and coronary vasodilation; increases myocardial oxygen delivery in patients with vasospastic angina.
  - Onset of action – IV: 3 mins; Duration – IV: 1-3 hrs

Indications

- **Labeled Indications**
  - Atrial fibrillation or atrial flutter for acute ventricular rate control, conversion of supraventricular tachycardia, hypertension, chronic stable angina, vasospastic angina
- **Off-label Indications**
  - Atrial fibrillation or atrial flutter, chronic ventricular rate control, hypertrophic cardiomyopathy; idiopathic ventricular tachycardia; non-sustained ventricular tachycardia or ventricular premature beats, symptomatic; Pulmonary arterial hypertension (group 1)

Contraindications

- Sick sinus syndrome (except in patients with a functioning artificial pacemaker); Second- or third-degree AV block
- Atrial fibrillation or flutter associated with accessory bypass tract (WPW, short PR syndrome)
- Severe hypotension; Cardiogenic shock; Hypersensitivity to diltiazem or any formulation component
- Ventricular tachycardia (with wide-complex tachycardia [QRS ≥ 0.12 seconds], must determine whether origin is supraventricular or ventricular)

Adverse Reactions / Precautions

- Cardiovascular: Edema, atrioventricular block, bradycardia, hypotension, dyspnea
- Central nervous system: Headache, dizziness, pain, nervousness, vomiting, weakness, myalgia
- **Pregnancy:** Use with caution **Lactation:** Use with caution

Dose / Administration

ADULT

Atrial Fibrillation or Atrial Flutter, Rate Control

Note: For rate control in hemodynamically stable patients. Do not use in patients with preexcitation associated with an accessory pathway, as this can lead to ventricular arrhythmias

- IV
  - Bolus dose: **0.25 mg/kg** over 2 mins (average dose: 20 mg). If rate control is insufficient after 15 mins, a repeat bolus dose of **0.35 mg/kg** over 2 mins may be given (average dose: 25 mg). Patients who respond after 1 or 2 bolus doses can be started on a continuous infusion
  - Continuous infusion following bolus(es): Initial: **5-10 mg/hr**. Infusion rate may be increased in **5 mg/hr** increments according to ventricular response, up to a max of 15 mg/hr

Supraventricular Tachycardia (Alternative Agent)

Note: For hemodynamically stable patients if vagal maneuvers and/or adenosine are unsuccessful

- IV
  - Bolus dose: **0.25 mg/kg** (actual body weight) over 2 mins (average dose: 20 mg). If rate control is insufficient after 15 mins, a repeat bolus dose of **0.35 mg/kg** over 2 mins may be given (average dose: 25 mg). If bolus(es) do not terminate the arrhythmia, consider alternative therapy

PEDIATRIC

(Always reference BROSELOW Tape)

Atrial Tachyarrhythmias, Rate Control

Note: Very limited data available for infants, children, and adolescents

- IV
  - Initial bolus: **0.25 mg/kg** over 5 mins (max: 20 mg/dose [average adult dose]) followed by a continuous IV infusion. Dose should be individualized based on patient response
  - Continuous infusion (titrated to effect): **0.05-0.15 mg/kg/hr**

DIPHENHYDRAMINE

(Trade Name: Benadryl)

Class / Mechanism of Action

- **Histamine H_1 Antagonist**
  First generation (sedating) antihistamine. Competes with histamine for H_1-receptor sites within the gastrointestinal tract, blood vessels, and respiratory tract; Also produces anticholinergic and sedative effects.

Indications

- **Labeled Indications**
  - Allergic reaction, anaphylaxis and anaphylactic shock
  - Motion Sickness
  - Antitussive

Contraindications

- Hypersensitivity to diphenhydramine or any component of the formulation
- Use on Neonates, premature infants, and nursing mothers
- Caution: Acute Asthma, CNS depression

Adverse Reactions / Precautions

- Normally causes sedation but may cause paradoxical excitation in children
- Rapid IV infusion may precipitate seizures in pediatrics
- May cause sedation and respiratory depression especially when used with other sedatives or alcohol
- May cause hypotension (use with caution in patient with cardiovascular disease)
- Anti-cholinergic effects
- **Pregnancy:** Category B **Lactation:** Unsafe

Dose / Administration

ADULT

Allergic Reactions and Motion Sickness

- PO
  - **25 mg** q 4-6 hrs or **50 mg** q 6-8 hrs
- IM / IV Push
  - **10-50 mg** once q 6 hrs PRN

Anaphylaxis

Note: Diphenhydramine is not the first line medication for anaphylaxis

- IV
  - **25-50 mg** q 4-6 hrs PRN; administered after epinephrine

Acute Hemolytic Reaction (Rapid onset of itching, chills, flushing, nausea/vomiting, coughing, wheezing, laryngeal edema, dyspnea, hypotension hemoglobinuria, rise in venous pressure, distended neck veins, crackles in lung bases)

- IV / IM
  - **25 mg** once

PEDIATRIC

(Always reference BROSELOW Tape)

Anaphylaxis / Anaphylactic Shock

- IV / IM / PO
  - **1-2 mg/kg** (max dose: 50 mg)

Allergic Reaction (by age)

- Ages 2 to < 6 years:
  - PO: **6.25 mg** q 4-8 hrs
- Ages ≥ 6 to < 12 years:
  - PO: **12.5-25 mg** q 4-8 hrs
- Ages > 12 years (adolescents):
  - IV / IM / PO: **25-50 mg/dose**

Motion Sickness

- PO
  - **0.5-1 mg/kg** q 6 hrs
- IV / IM
  - **1.25 mg/kg** q 6 hrs

DOBUTAMINE

(Trade Name: Dobutrex)

Class / Mechanism of Action

- **Adrenergic Agonist**
  Positive Inotropic agent. Stimulates beta1 adrenergic receptors: Increases HR and contraction force while sparing beta2 and alpha receptors.
  - Onset – IV: 1-2 minutes

Indications

- **Labeled Indications**
  - Short term management of cardiac decompensation

Contraindications

- Hypersensitivity to dobutamine or sulfites (some contain sodium metabisulfite), or any component of the formulation
- Hypertrophic cardiomyopathy with outflow tract obstruction

Adverse Reactions / Precautions

- **Always attempt to correct Hypovolemia 1st when using vasopressors and / or inotropes**
  - **May be combined with Dopamine or Norepinephrine for hypotension not responding to fluid administration**
  - **No applicable use in hemorrhagic shock until fluid replacement therapy maximized**
- Increase in BP is common but does have a rare incidence of causing hypotension
- Increases HR
- Hypotension and ventricular ectopy
- **Pregnancy:** Category B **Lactation:** Use caution

Dose / Administration

ADULT

Cardiac Decompensation

- IV
  - **2-5 mcg/kg/min.** Start low and titrate to targeted MAP > 60 mmHg
    - Usual dosage: 2-10 mcg/kg/min
    - Maximum dose: 20 mcg/kg/min
  - Preparation: Mix **250 mg** Dobutamine in **250 mL** D5W or NS for a concentration of 1000 mcg/mL

Infusion Rates for Dobutamine at 1000 mcg/mL

Desired Delivery Rate (mcg/kg/min)	Infusion Rate (mL/kg/hr)
2.5	0.15
5	0.3
7.5	0.45
10	0.6
12.5	0.75
15	0.9
20	1.2

PEDIATRIC

(Always reference BROSELOW Tape)

Cardiac Decompensation

- Continuous IV / IO
  - **2-20 mcg/kg/min,** titrate to effect

DOPAMINE

(Trade Name: Intropin)

Class / Mechanism of Action

- **Adrenergic Agonist; Inotrope; Vasopressor**
  Stimulates adrenergic and dopaminergic receptors. Low doses are mainly dopaminergic stimulating and produce renal and mesenteric vasodilation. High doses stimulate both dopaminergic and beta1 adrenergic receptors, producing cardiac stimulation and renal vasodilation. Large doses stimulate alpha adrenergic receptors.
  - Onset of action – Adults: within 5 mins; Duration – Adults: < 10 mins

Indications

- **Labeled Indications**
  - Treatment of non-hemorrhagic shock (e.g., neurogenic, renal failure, cardiac decompensation) persisting after adequate fluid volume replacement (fluid-refractory shock)
- **Off-Labeled Indications**
  - Symptomatic bradycardia or heart block unresponsive to atropine

Contraindications

- Hypersensitivity to sulfites
- Ventricular Fibrillation
- Pheochromocytoma
- Uncorrected tachyarrhythmias

Adverse Reactions / Precautions

- **No applicable use in hemorrhagic shock unless fluid replacement therapy maximized! Maximize use of Blood products / Crystalloids before considering use in hemorrhagic shock**
- Doses > 20 mcg/kg/min likely do not have a beneficial effect on blood pressure and may increase risk of tachyarrhythmias. Consider other agents when doses above this range are required
- Vesicant (causes blisters): Avoid extravasation, will cause tissue damage/necrosis
- Assure adequate circulatory volume to minimize the need for vasoconstrictors. Monitor BP closely, avoid hypertension and adjust infusion rate as needed
- Not recommended for use in Septic Shock patients
- **Pregnancy:** Do not withhold in Cardiac patients **Lactation:** Unknown

Dose / Administration

ADULT

Hemodynamic Support

- IV
  - **0.5-20 mcg/kg/min;** lower doses are preferred, titrate to desired response

Bradycardia / ROSC

- IV / IO
  - **5-20 mcg/kg/min;** titrate to desired response

Note: Add an additional vasopressor if Dopamine doses of 20 mcg/kg/min are inadequate (***phenylephrine****, **norepinephrine**, **epinephrine***)

Note: Dopamine MOA/efficacy is dependent on the administered dose. For:

- Renal profusion: **1-5 mcg/kg/min**
- Cardiac: **5-10 mcg/kg/min**
- Vasoconstriction: > **10 mcg/kg/min**

PEDIATRIC

(Always reference BROSELOW Tape)

Hemodynamic Support

- IV
  - **2-20 mcg/kg/min**; titrate to desired response

TABLE OF CONTENTS

DOPAMINE						
Dosing Range: 5-20 mcg/kg/min (300-1200 mcg/kg/hr)						
MIX 800 mg / 500 mL CONCENTRATION 1600 mcg/mL						
Patient Weight	Dose	Rate	Micro 60 gtt/mL	Macro		
				20 gtt/mL	15 gtt/mL	10 gtt/mL
kg	mcg/kg/min	mL/hr	gtt/min	gtt/min	gtt/min	gtt/min
50	5	9	9	3	2	2
	10	19	19	6	5	3
	15	28	28	9	7	5
	20	38	38	13	10	6
55	5	10	10	3	3	2
	10	21	21	7	5	4
	15	31	31	10	8	5
	20	41	41	14	10	7
60	5	11	11	4	3	2
	10	23	23	8	6	4
	15	34	34	11	9	6
	20	45	45	15	11	8
65	5	12	12	4	3	2
	10	24	24	8	6	4
	15	37	37	12	9	6
	20	49	49	16	12	8
70	5	13	13	4	3	2
	10	26	26	9	7	4
	15	39	39	13	10	7
	20	53	53	18	13	9
75	5	14	14	5	4	2
	10	28	28	9	7	5
	15	42	42	14	11	7
	20	56	56	19	14	9
80	5	15	15	5	4	3
	10	30	30	10	8	5
	15	45	45	15	11	8
	20	60	60	20	15	10
85	5	16	16	5	4	3
	10	32	32	11	8	5
	15	48	48	16	12	8
	20	64	64	21	16	11
90	5	17	17	6	4	3
	10	34	34	11	8	6
	15	51	51	17	13	9
	20	68	68	23	17	11
95	5	18	18	6	5	3
	10	36	36	12	9	6
	15	53	53	18	13	9
	20	71	71	24	18	12
100	5	19	19	6	5	3
	10	38	38	13	9	6
	15	56	56	19	14	9
	20	75	75	25	19	13
105	5	20	20	7	5	3
	10	39	39	13	10	7
	15	59	59	20	15	10
	20	79	79	26	20	13
Micro-Drip is set of choice for this infusion						
Titrate to minimum effective dose. Allow 3-5 minutes between dosing changes to assess hemodynamic effects						

EPINEPHRINE 1 mg/mL

(Trade Name: EpiPen / EpiPen Jr)

Class / Mechanism of Action

- **Alpha & Beta Agonist**
  Sympathomimetic, stimulates both alpha- and beta-adrenergic receptors, causing relaxation of the bronchial tree, induces systemic vasoconstriction and increases heart rate and contractility

Indications

- **Labeled Indications**
  - Allergic Reactions, anaphylaxis
  - Asthma (Bronchoconstriction)

Contraindications

- There are no absolute contraindications to the use of intranasal or injectable epinephrine in a life-threatening situation
- Hypersensitivity to sympathomimetic amines, glaucoma and non-anaphylactic shock
- Not for IV use; must first dilute into 10 mL NS syringe for Cardiac / IV use

Adverse Reactions / Precautions

- **No applicable use in hemorrhagic shock unless fluid replacement therapy maximized! Maximize use of blood products / crystalloids before considering use in hemorrhagic shock**
- Chest pain, tachycardia, arrhythmias, palpitations, sudden death
- Anxiety, cerebral hemorrhage, headache
- Vesicant: Avoid extravasation; will cause tissue damage / necrosis
- Use with caution in patients taking tricyclic antidepressants; effects of epinephrine may be increased
- **Pregnancy:** Category C **Lactation:** Use caution

Dose / Administration

ADULT

Bronchodilator

- SubQ / IM
  - **0.3-0.5 mg** q 5-10 mins
- Nebulization
  - Add **0.5 mL** to nebulizer and dilute with 3 mL of NS; administer over 15 min

Anaphylaxis / Hypersensitivity Reaction

- IM
  - **0.3-0.5 mg** in mid-outer thigh q 5-10 mins until clinical improvement
- IV
  - Initiate with an infusion at **5-15 mcg/min** (with crystalloid) (See infusion chart next page)

Acute Hemolytic Reaction

- IM
  - **0.5 mg** in lateral thigh. Repeat q 5-15 min for moderate bronchospasm or facial / laryngeal edema

PEDIATRIC

(Always reference BROSELOW Tape)

Acute Severe Asthma Exacerbation

- SubQ
  - **0.01 mg/kg** (0.01 mL/kg of 1 mg/mL concentration) q 20 mins for 3 doses PRN
    - Maximum SINGLE dose: 0.5 mg

Croup / Bronchiolitis

- Nebulization
  - **3 mg** (3 mL of the 1 mg/mL concentration) mixed with 3 mL NS

Anaphylaxis / Hypersensitivity Reaction

- IM
  - **0.01 mg/kg** (0.01 mL/kg of 1 mg/mL concentration) q 10-15 mins PRN to control symptoms (max SINGLE dose: 0.3 mg)
- Autoinjector, Children < 15 kg
  - **0.15 mg**. If anaphylactic symptoms persist, dose may be repeated in 5-15 mins using an additional EpiPen Jr
- Autoinjector, Children ≥ 15 kg
  - **0.3 mg**. If anaphylactic symptoms persist, dose may be repeated in 5-15 mins using an additional EpiPen

Epinephrine 1 mg / 1 mL (1:1,000)

Anaphylaxis

Dosing Range: 5-15 mcg/min (300-900 mcg/hr)

MIX 1 mg / 500 mL
CONCENTRATION 2 mcg/mL

Dose	Rate	Micro 60 gtt/mL	Macro		
			20 gtt/mL	15 gtt/mL	10 gtt/mL
mcg/min	mL/hr	gtt/min	gtt/min	gtt/min	gtt/min
5	150	150	50	38	25
6	180	180	60	45	30
7	210	210	70	53	35
8	240	240	80	60	40
9	270	270	90	68	45
10	300	300	100	75	50
11	330	330	110	83	55
12	360	360	120	90	60
13	390	390	130	98	65
14	420	420	140	105	70
15	450	450	150	113	75

Macro-Drip (10 gtt/mL) is set of choice for this infusion

Start at lowest dose and titrate to desired effect

EPINEPHRINE 0.1 mg/mL

(Trade Name: Adrenalin)

Class / Mechanism of Action

- **Alpha & Beta Agonist B**
  Sympathomimetic, stimulates both alpha- and beta-adrenergic receptors, causing relaxation of the bronchial tree, cardiac stimulation, and dilation of skeletal muscle blood vessels.

Indications

- **Labeled Indications**
  - Cardiac Arrest (VF, pulseless VT, asystole, PEA)
  - Drip-Dose: Bradycardia (Symptomatic), Fluid Resistant Shock
  - Push-Dose: Refractory Anaphylaxis

Contraindications

- **There are no absolute contraindications to the use of intranasal or injectable epinephrine in a life-threatening situation**
- Hypersensitivity to sympathomimetic amines, glaucoma and non-anaphylactic shock

Adverse Reactions / Precautions

- **No applicable use in hemorrhagic shock unless fluid replacement therapy maximized! Maximize use of blood products / crystalloids before considering use in hemorrhagic shock**
- Chest Pain, tachycardia, arrhythmias, palpitations, sudden death
- Anxiety, cerebral hemorrhage, headache
- Vesicant: Avoid extravasation, will cause tissue damage / necrosis
- Use with caution in patients taking tricyclic antidepressants; effects of epinephrine may be increased
- **Pregnancy:** Category C **Lactation:** Use caution

Dose / Administration

ADULT

Asystole / Pulseless Arrest, Pulseless VT / VF

- IV: **1 mg / 10 mL (**0.1 mg/mL) pre-filled 10cc Syringe q 3-5 mins to ROSC. Follow each dose with 20 mL flush

Drip-Dose: Bradycardia (Symptomatic), Hypotension-Fluid Resistant Shock

- IV Continuous Infusion
  - *Bradycardia*: **2-10 mcg/min** titrate to desired effect (HR > 60, MAP > 65)
  - *Hypotension/Shock*: **2-10 mcg/min** titrated to clinical end point (BP, end organ perfusion)

Push-Dose: Refractory Anaphylaxis

- IV / IO: Utilize the 0.1 mg/mL solution further diluted in 10 mL of NS
  - **0.05-0.1 mg** administered over 1-10 mins. May repeat once after 3 mins if patient remains unresponsive to initial dose

PEDIATRIC

(Always reference BROSELOW Tape)

Asystole, PEA, Pulseless VT / VF, Unresponsive and Symptomatic Bradycardia

- IV / IO
  - **0.01 mg/kg** (0.1 mL/kg of 0.1 mg/mL) q 3-5 mins (max SINGLE dose: 1 mg)

Severe Hypotension / Shock and Fluid Resistant

- IV / IO Continuous Infusion
  - **0.1-1 mcg/kg/min** titrated to desired effect

Epinephrine 0.1 mg / 1 mL (1:10,000)

Pressor for Hypotension

Dosing Range: 2-20 mcg/min (120-1200 mcg/hr)

MIX 1 mg / 500 mL
CONCENTRATION 2 mcg/mL

Dose	Rate	Micro 60 gtt/mL	Macro		
			20 gtt/mL	15 gtt/mL	10 gtt/mL
mcg/min	mL/hr	gtt/min	gtt/min	gtt/min	gtt/min
2	60	60	20	15	10
3	90	90	30	22.5	15
4	120	120	40	30	20
5	150	150	50	37.5	25
6	180	180	60	45	30
7	210	210	70	52.5	35
8	240	240	80	60	40
9	270	270	90	67.5	45
10	300	300	100	75	50
11	330	330	110	82.5	55
12	360	360	120	90	60
13	390	390	130	97.5	65
14	420	420	140	105	70
15	450	450	150	112.5	75
16	480	480	160	120	80
17	510	510	170	127.5	85
18	540	540	180	135	90
19	570	570	190	142.5	95
20	600	600	200	150	100

Macro-Drip (10 gtt/mL) is set of choice for this infusion

Start at lowest dose and titrate to desired effect

ERTAPENEM

(Trade Name: Invanz)

Class / Mechanism of Action

- **Antibiotic (Carbapenem)**
  Bactericidal – broad spectrum, inhibits bacterial cell wall synthesis by binding to one or more of penicillin binding proteins which inhibit cell wall biosynthesis, causing bacteria to eventually lyse.

Indications

- **Labeled Indications**
  - Used for infection control prophylaxis for traumatic open injuries and surgical prophylaxis

Contraindications

- Hypersensitivity to any component of this product or to other drugs in the same class or in patients who have demonstrated anaphylactic reactions to other beta-lactams (e.g., penicillin and cephalosporins)

Adverse Reactions / Precautions

- Superinfection: prolonged use may result in fungal or bacterial superinfection (including C. Difficile)
- Gastrointestinal: Diarrhea (Adults 9-12%)
- CNS Stimulation/Toxicity: AMS, aggressive behavior, anxiety, tremors, seizures, encephalopathy
- **Pregnancy:** Category C **Lactation:** Yes

Dose / Administration

ADULT

Infection Control

- IV / IO
  - **1 g in 250 mL NS** over 5 mins q 24 hrs (provides 24 hrs of coverage). Repeat for 7-10 days PRN

Infection Prophylaxis

- IV / IO
  - **1 g in 250 mL NS** over 5 mins q 24 hrs (provides 24 hrs of coverage)

PEDIATRIC

(Always reference BROSELOW Tape)

Infection Control

- IV / IM
  - Infants and Children: **15 mg/kg/dose** q 12 hrs
    - Maximum dose: 500 mg
  - Adolescents: **1000mg once daily**

ETOMIDATE

(Trade Name: Amidate)

Class / Mechanism of Action

- **General Anesthetic**
  Ultra short acting non-barbiturate sedative / hypnotic used for induction of anesthesia
  - Onset of action: 30-60 secs; Duration: 5-10 mins

Indications

- **Labeled Indications**
  - Rapid Sequence Induction

Contraindications

- Hypersensitivity to etomidate or any component of the formulation
- Labor / Delivery

Adverse Reactions / Precautions

- **NO Analgesic properties!**
- Apnea / Respiratory Depression
- Hypo / hyperventilation
- Dysrhythmias
- Hypo / hypertension
- Nausea / Vomiting
- Transient involuntary skeletal muscle movement
- Pain at injection site
- Inhibits adrenal steroid production; may increase mortality if repeat dosing is required
- **Pregnancy:** Category C **Lactation:** Use caution

Dose / Administration

ADULT

Rapid Sequence Induction

- IV / IO
  - **0.3 mg/kg** over 30-60 secs for induction of anesthesia

Note: Limit to single dose for anesthesia / induction

PEDIATRIC

(Always reference BROSELOW Tape)

Rapid Sequence Induction

- IV / IO
  - **0.3 mg/kg** over 30-60 secs will produce rapid sedation lasting 10-15 mins (max dose: 20 mg)

Note: Limit to single dose for anesthesia / induction

FENTANYL

(Trade Name: Sublimaze)

Class / Mechanism of Action

- **Analgesic, Opioid (Agonist); General Anesthetic**
  Binds to opioid receptors within the CNS increasing pain threshold and altering pain reception; inhibits ascending pain pathways (blocking painful stimulus); produces CNS depression.
  - Onset of action – IV: almost immediate; Duration – IV: 0.5-1 hr

Indications

- **Labeled Indications**
  - Pain relief
  - Adjunct to general or regional anesthesia

Contraindications

- Hypersensitivity to fentanyl or any component of the formulation
- MAOI taken in the past 14 days
- Hypotension

Adverse Reactions / Precautions

- When using only as pain medication and not adjunct to general anesthesia, ensure Slow IV Push (3-5 min). Rapid infusion may result in chest wall rigidity, impaired ventilation, or respiratory distress/arrest. Always be prepared for use of paralytic and intubation (positive control of airway)
- CNS depression, confusion, paradoxical excitation, serotonin syndrome, delirium, drowsiness, apnea/dyspnea, bradycardia, dysrhythmias (QT-Interval prolongation), hypotension, syncope, nausea/vomiting, abdominal pain, dehydration, fatigue
- **Pregnancy:** Use with caution; use lowest dose needed **Lactation:** Use with caution; use lowest dose needed

Dose / Administration

ADULT

Pain Management

Note: Patients with prior opioid exposure may have increased tolerance and require higher dosing

- IV (SLOW)
  - **0.5-1 mcg/kg** PRN for breakout pain q 30-60 min
- IN / IM
  - **1 mcg/kg**; half dose in each nostril (IN max: 100 mcg/dose, split 50 mcg/nostril)

Sedation During Mechanical Ventilation

- IV / IO
  - Initial Bolus: **1-2 mcg/kg**
  - Continued Sedation (Infusion): **0.5-1 mcg/kg/hr** (see infusion chart next page). Combine with Midazolam for the best effect; consider dosage reduction
  - Continued Sedation (IVP): **0.5-2 mcg/kg** q 30-60 min; **25-50 mcg** incremental boluses and titrate to effect

Pretreatment for RSI

- IV (SLOW)
  - **0.5-1 mcg/kg**

Non-Traumatic Chest Pain (Cardiac)

- IV
  - **25-50 mcg**

PEDIATRIC

(Always reference BROSELOW Tape)

Pain Management

- IV (SLOW)
  - **0.5-1 mcg/kg/dose** q 1-2 hrs PRN (max: 50 mcg/dose)

Pretreatment for RSI

- IV (SLOW)
  - **1 mcg/kg/dose**; may repeat q 3 mins (max: 50 mcg/dose)

FENTANYL (SUBLIMASE)					
Dosing Range: 0.5-1 mcg/kg/hr					
MIX 1 mg / 100 mL CONCENTRATION 10 mcg/mL					
Dose	Rate	Micro (60 gtt/mL)	Macro		
			20 gtt/mL	15 gtt/mL	10 gtt/mL
mcg/hr	mL/hr	gtt/min	gtt/min	gtt/min	gtt/min
25	3	3	1	1	1
30	3	3	1	1	1
35	4	4	1	1	1
40	4	4	1	1	1
45	5	5	2	1	1
50	5	5	2	1	1
55	6	6	2	1	1
60	6	6	2	2	1
65	7	7	2	2	1
70	7	7	2	2	1
75	8	8	3	2	1
80	8	8	3	2	1
85	9	9	3	2	1
90	9	9	3	2	2
95	10	10	3	2	2
100	10	10	3	3	2
105	11	11	4	3	2
110	11	11	4	3	2
115	12	12	4	3	2
120	12	12	4	3	2
125	13	13	4	3	2
130	13	13	4	3	2
135	14	14	5	3	2
140	14	14	5	4	2
145	15	15	5	4	2
150	15	15	5	4	3
155	16	16	5	4	3
160	16	16	5	4	3
165	17	17	6	4	3
170	17	17	6	4	3
175	18	18	6	4	3
180	18	18	6	5	3
185	19	19	6	5	3
190	19	19	6	5	3
195	20	20	7	5	3
200	20	20	7	5	3
Micro-Drip is the set of choice for this infusion					
Sample Patient: 80 kg Patient at 0.5-1 mcg/kg/hr = 40-80 mcg/hr dosing range					

FUROSEMIDE

(Trade Name: Lasix)

Class / Mechanism of Action

- **Antihypertensive; Loop Diuretic**
  Inhibits reabsorption of sodium and chloride in the kidney, causing increased loss of water, sodium, chloride, magnesium, and calcium within urine. When given IV it also causes rapid venous dilation. Symptomatic improvement of acute pulmonary edema approximately 15-20 minutes.

Indications

- **Labeled Indications**
  - Management of edema associated with heart failure, cirrhosis of the liver (i.e. ascites), or kidney disease (including nephrotic syndrome); acute pulmonary edema

Contraindications

- Hypersensitivity to furosemide or any component of the formulation
- Anuria (no pre-hospital utility in hypovolemic shock)

Adverse Reactions / Precautions

- Can cause profound diuresis with resulting shock and electrolyte depletion. Monitor closely!
  - May cause: Hypovolemia, hypotension, hyponatremia, hypokalemia
- May potentiate effect of additional antihypertensives
- May lead to Acute Kidney Injury due to fluid loss
- Ototoxicity: associated with hearing loss and tinnitus; generally reversible
- **Pregnancy:** Category C **Lactation:** Use caution; large doses suppress volume and lactation

Dose / Administration

ADULT

Acute Pulmonary Edema

- IV
  - **40 mg** over 1-2 mins. If response is not adequate within 1 hr, may increase dose to 80 mg

Edema (Heart Failure)

- IV / IM
  - Initial: **20-40 mg** once then titrate PRN to an effective dose. If the initial dose does not result in diuresis, double the individual dose (rather than administer the same dose more frequently) until diuresis occurs
- Continuous IV Infusion
  - Initial: **5 mg/hr**; if diuretic response is not adequate, repeat IV bolus dose and increase continuous infusion to 10 mg/hr; continue to bolus and titrate infusion PRN up to 40 mg/hr

PEDIATRIC

(Always reference BROSELOW Tape)

Edema (Heart Failure)

- IV / IM
  - Initial: **1 mg/kg** as a single dose
  - If necessary, can increase dose by up to **1 mg/kg** and give greater than 2 hours after the previous dose, repeating until desired response is achieved, to a maximum dose of **6 mg/kg**

GLUCAGON

Class / Mechanism of Action

- **Antidote, Hypoglycemia Antidote**
  Hyperglycemic agent, pancreatic hormone, insulin antagonist; raises blood glucose levels by stimulating increased production of cyclic AMP, promoting hepatic glycogenolysis and gluconeogenesis.

Indications

- **Labeled Indications**
  - Management of hypoglycemia (Glucose < 70)
- **Off-label Indications**
  - Beta-blocker or calcium channel blocker induced myocardial depression (with or without hypotension) unresponsive to standard measures
  - Hypoglycemia secondary to insulin or sulfonylurea overdose (as adjunct to dextrose)

Contraindications

- Hypersensitivity to glucagon or any component of the formulation
- Insulinoma / Pheochromocytoma
- Hyperglycemia

Adverse Reactions / Precautions

- Should NOT be used as 1st line medication for hypoglycemia or altered mental status
  - **Hypoglycemia patients should receive dextrose**. If IV access cannot be established or if dextrose is not available, glucagon may be used as alternate until dextrose can be given
- Nausea, vomiting, headache, upper respiratory system symptoms (couch, epistaxis, congestion, etc.), hyperglycemia
- **Pregnancy:** Safe **Lactation:** Safe

Dose / Administration

ADULT

Hypoglycemia

Note: Patients with inadequate glycogen stores (e.g., starvation, adrenal insufficiency, chronic hypoglycemia) may not respond to glucagon and should be treated with glucose

- IV / IM / SubQ
  - **1 mg**; may repeat in 15 mins PRN

Beta-Blocker / Calcium Channel Blocker Overdose (Myocardial Depression) Unresponsive to Standard Measures (Off-labeled use)

- IV
  - **2-10 mg** bolus; if no clinical response, may repeat bolus dose after 10-15 mins. If clinical response with bolus, start continuous infusion at 2-5 mg/hr (range: 1-15 mg/hr); titrate infusion rate to achieve adequate hemodynamic response

PEDIATRIC

(Always reference BROSELOW Tape)

Hypoglycemia

Note: Patients with inadequate glycogen stores (e.g., starvation, adrenal insufficiency, chronic hypoglycemia) may not respond to glucagon and should be treated with glucose

- IV / IM / SubQ
  - Children < 20 kg: **0.5 mg**; if no response in 15 mins, may repeat dose
  - Children ≥ 20 kg: **1 mg**; if no response in 15 mins, may repeat dose

Beta-Blocker / Calcium Channel Blocker Overdose (Myocardial Depression) Unresponsive to Standard Measures (Off-labeled use)

- IV (Infants and Children)
  - Loading dose: **0.05 mg/kg** as a single dose; if no response, may repeat dose
  - Continuous IV infusion: **0.05-0.1 mg/kg/hr**; titrate to effect
- IV (Adolescents)
  - Loading dose: **5-10 mg**
  - Continuous IV infusion: **1-5 mg/hr**; titrate to patient response

HEPARIN

Class / Mechanism of Action

- **Anticoagulant**
  Inactivates thrombin and activated coagulation factors (IX, X, XI, XII, and plasmin) and prevents conversion of fibrinogen to fibrin.

Indications

- **Labeled Indications**
  - Treatment of thromboembolic disorders
- **Off-label Indications**
  - ST elevation MI (STEMI) as an adjunct to thrombolysis; unstable angina / non-STEMI

Contraindications

- Hypersensitivity to heparin or any component of the formulation (unless life-threatening situation necessitates use and alternative anticoagulant is not available)
- Uncontrolled active bleeding (except when caused by disseminated intravascular coagulation)
- Severe thrombocytopenia (low platelet level); history of heparin-induced thrombocytopenia
- Not for use when appropriate blood coagulation tests cannot be obtained at appropriate intervals

Adverse Reactions / Precautions

- Continuously monitor for bleeding; Stop immediately if any bleeding occurs
- Urticarial reactions and anaphylaxis can occur
- Heparin-induced thrombocytopenia (HIT) may occur during heparin therapy. Discontinue therapy as HIT can be fatal without treatment
- **Pregnancy:** Safe **Lactation:** Safe, use preservative-free formulation

Dose / Administration

ADULT

Acute Coronary Syndromes: STEMI / Unstable Angina as an Adjunct to Fibrinolysis (Full Dose Alteplase)

- IV
  - Initial: **60 units/kg** bolus (max: 4000 units)
  - Continuous maintenance infusion: **12 units/kg/hr** (max: 1000 units/hr)

Arterial Occlusion

- IV
  - **60-80 units/kg**; followed by continuous **12-18 units/kg/hr**. Adjust infusion rate to maintain coagulation rate

Treatment of Venous Thromboembolism (Off-label)

- SubQ
  - **5000 units** q 8 hrs
  - Should be considered prior to aeromedical evacuation for **KNOWN** VTE

COVID VTE Prophylaxis

- SubQ
  - **7500 units** q 8 hrs

Note: Heparin is ONLY for use under written direction of referring provider or direct consultation with medical director

PEDIATRIC

(Always reference BROSELOW Tape)

Treatment of Venous Thromboembolism (Off-label)

- IV
  - Infants: Initial loading dose: **75 units/kg** over 10 mins; then initial continuous maintenance infusion at **28 units/kg/hr**
  - Children and Adolescents: Initial loading dose: **75 units/kg** over 10 mins, then initial continuous maintenance infusion at **20 units/kg/hr**

HYDROMORPHONE

(Trade Name: Dilaudid)

Class / Mechanism of Action

- **Opioid Analgesic**
  Binds to opioid receptors within the CNS increasing pain threshold and altering pain reception; inhibits ascending pain pathways (blocking painful stimulus); produces CNS depression.
  - Onset of action: < 5 min; Peak effect: 10-20 min; Duration: 1-4 hrs

Indications

- **Labeled Indications**
  - Moderate to severe pain

Contraindications

- Hypersensitivity to hydromorphone or any component of the formulation
- Severe respiratory depression/acute or severe asthma (in absence of resuscitative equipment or ventilator support)
- GI obstruction, including paralytic ileus

Adverse Reactions / Precautions

- Always be prepared for use of paralytic and intubation (maintain positive control of airway)
- **Head trauma: Use with extreme caution in head injury, or suspected increased ICP; exaggerated increase in ICP may occur**
- May cause hypotension, use with caution in hypovolemic patients
- May cause life-threatening respiratory depression and apnea
- CNS depression: Impairs physical and mental abilities
- Dizziness, headache, syncope
- Use of hydromorphone is not recommended in patients taking MAOI or within 14 days of discounting treatment
- **Pregnancy:** Use with caution; use lowest dose for duration of pain **Lactation:** Use with caution; monitor infant

Dose / Administration

ADULT

Acute Pain (Moderate-to-Severe)

- IV / IO (SLOW)
  - **0.5 mg** (range 0.25-2 mg) q 1-6 hrs PRN (long acting, fewest side effects)
- IM
  - **1-2 mg**

Note: Critically ill patients require lower dose; opioid tolerant patients may require a higher dose

PEDIATRIC

(Always reference BROSELOW Tape)

Acute Pain (Moderate-to-Severe)

- IV / IO (SLOW)
  - Infants > 6 months weighing > 10 kg: **0.01-0.015 mg/kg/dose** q 3-6 hrs PRN
  - Children / Adolescents weighing < 50 kg: **0.015 mg/kg/dose** q 3-6 hrs PRN
  - Children / Adolescents ≥ 50 kg (Opioid-naive): **0.2-0.6 mg** q 2-4 hrs PRN; patients with prior opioid exposure may tolerate higher initial doses

HYDROXOCOBALAMIN

(Trade Name: Cyanokit)

Class / Mechanism of Action

- **Antidote; Vitamin**
  Precursor to Vitamin B_{12} (cyanocobalamin). Binds cyanide ion to form nontoxic cyanocobalamin which is excreted within urine.

Indications

- **Labeled Indications**
  - IM: Treatment of pernicious anemia and B_{12} deficiencies
  - IV: (Cyanokit®) Treatment of known or suspected cyanide poisoning

Contraindications

- No contraindications when treating for suspected or known cyanide poisoning

Adverse Reactions / Precautions

- May cause transient hypertension (> 180 mmHg systolic, > 110 mmHg diastolic)
- Will cause persistent red colored urine and skin, acute renal injury, rendering pulse oximetry values inaccurate
- **Pregnancy:** Use caution **Lactation:** Use caution

Dose / Administration

ADULT

Cyanide Poisonings

Note: If cyanide poisoning is suspected, antidotal therapy must be given immediately

- IV / IO
  - Initial: **5 g** over 15 mins; Repeat a second 5 g dose based on severity and clinical response (max TOTAL dose: 10 g)

Smoke Inhalation / Fire victims (Closed Space Exposure with Evidence of Airway Injury: Soot in Mouth / Nose / Sputum)

- Cyanokit®
  - Preparation: Reconstitute each vial with 200 mL of NS (LR and D5W also OK). Do not shake vial (gently mix). Do not use if solution is not dark red

Note: Patient may present with both cyanide and carbon monoxide poisoning. Hydroxocobalamin is the agent of choice for treating cyanide toxicity in this setting

PEDIATRIC

(Always reference BROSELOW Tape)

Cyanide Poisonings (Off-labeled)

- IV / IO
  - Initial: **70 mg/kg (max dose: 5 g)** as single infusion given over 15 min; Repeat a second dose of 70 mg/kg based on severity and clinical response

Smoke Inhalation / Fire victims (Closed Space Exposure with Evidence of Airway Injury: Soot in Mouth / Nose / Sputum)

- Cyanokit®
  - Preparation: Reconstitute each vial with 200 mL of NS (LR and D5W also OK). Do not shake vial (gently mix). Do not use if solution is not dark red

Note: Patient may present with both cyanide and carbon monoxide poisoning. Hydroxocobalamin is the agent of choice for treating cyanide toxicity in this setting

KETAMINE

(Trade Name: Ketalar)

Class / Mechanism of Action

- **Antidepressant; General Anesthetic**
  Dissociative anesthetic; produces a cataleptic-like state acting directly on the cortex and limbic system.
  - Onset of action - IV: 30-60 secs; Duration: dose dependent averaging 10-20 mins

Indications

- **Labeled Indications**
  - Induction and maintenance of general anesthesia
- **Off-label Indications**
  - Analgesia and sedation
  - Preferred general anesthetic / sedative (pre-hospital) for head injury patients (does not raise ICP)

Contraindications

- Hypersensitivity to ketamine or any component of the formulation
- Conditions that cannot tolerate sustained increases in blood pressure (non-traumatic intracerebral hemorrhage, hypertension associated with acute coronary syndrome; NOT contraindicated in TBI)
- Children < 3 months in age

Adverse Reactions / Precautions

- Rapid IV administration may cause hypotension, apnea, or laryngospasm. Large doses (> 1 mg/kg) may cause hypotension and respiratory depression
- Use with caution in patients with cardiovascular disease. Continuously monitor cardiac function
- Dosing between 0.5-0.9 mg/kg IV (and equivalent IM dose) can give patients the feeling of unreality leading to agitation and should be avoided
- **If patient experiences Ketamine Induced Agitation (Emergence Phenomena), give Midazolam 2-5 mg IV one time for adults and 0.05 mg/kg for children not hypotensive or in danger of being hypotensive**
- **Pregnancy:** Low doses of ketamine may be used, but other agents are preferred **Lactation:** Use caution

Dose / Administration

ADULT

LOW DOSE

Analgesia

- IV / IO Push over 1 min
  - **0.1-0.3 mg/kg**, q 10-30 min PRN
- IM / IN
  - **0.5-1.0 mg/kg**, q 10-30 min PRN

HIGH DOSE

RSI / Induction of Anesthesia; Combative Patients

- IV (SLOW)
  - **1-2 mg/kg**
- IM
  - **4-5 mg/kg**

Maintenance of anesthesia

- IV
  - **0.5-2 mg/kg** q 10-20 min
- IV Continuous Infusion
  - **0.5-2 mg/kg bolus,** then **1-3 mg/kg/hr**. Titrate levels by 0.25 mg/kg/hr as needed to achieve appropriate sedation (See infusion chart next page)

PEDIATRIC

(Always reference BROSELOW Tape)

Analgesia / Sedation

- IV
  - **0.1-0.3 mg/kg**, slow IV push or infusion over 10-15 min
- IN (children >6 years old)
  - **0.5-1 mg/kg**, may repeat **0.25 mg/kg** in 10 min

Induction of anesthesia

- IV
  - **1-2 mg/kg**

Maintenance of anesthesia:

- IV Continuous Infusion (infants ≥5 months, children, and adolescents)
  - **0.5-2 mg/kg IV,** then **5-20 mcg/kg/min IV infusion**, starting at lowest dose and titrating upward PRN

Note: Avoid sub-dissociative doses to prevent emergence phenomenon

Note: If patient experiences Ketamine Induced Agitation (Emergence Phenomena), give Midazolam 2-5 mg IV one time for adults and 0.05 mg/kg for children not hypotensive or in danger of being hypotensive

TABLE OF CONTENTS

KETAMINE (KETALAR)						
Dosing Range: 1-3 mg/kg/hr (17-50 mcg/kg/min)						
MIX 500 mg / 500 mL CONCENTRATION 1 mg/mL						
Patient Weight	Dose	Rate	Micro	Macro		
			60 gtt/mL	20 gtt/mL	15 gtt/mL	10 gtt/mL
kg	mcg/kg/min	mL/hr	gtt/min	gtt/min	gtt/min	gtt/min
50	15	45	45	15	11	8
	20	60	60	20	15	10
	25	75	75	25	19	13
	30	90	90	30	23	15
	35	105	105	35	26	18
	40	12	120	40	30	20
	45	135	135	45	34	23
	50	150	150	50	38	25
	55	165	165	55	41	28
	60	180	180	60	45	30
55	15	50	50	17	13	8
	20	66	66	22	17	11
	25	83	83	28	21	14
	30	99	99	33	25	17
	35	116	116	39	29	19
	40	132	132	44	33	22
	45	149	149	50	37	25
	50	165	165	55	41	28
	55	182	182	61	46	30
	60	198	198	66	50	33
60	15	54	54	18	14	9
	20	72	72	24	18	12
	25	90	90	30	23	15
	30	108	108	36	27	18
	35	126	126	42	32	21
	40	140	140	47	35	23
	45	162	162	54	41	27
	50	180	180	60	45	30
	55	198	198	66	50	33
	60	216	216	72	54	36
65	15	60	60	20	15	10
	20	78	78	26	20	13
	25	98	98	33	25	16
	30	117	117	39	29	20
	35	137	137	46	34	23
	40	156	156	52	39	26
	45	176	176	59	44	29
	50	195	195	65	49	33
	55	215	215	72	54	36
	60	234	234	78	59	39
70	15	63	63	21	16	11
	20	84	84	28	21	14
	25	105	105	35	26	18
	30	126	126	42	32	21
	35	147	147	49	37	25
	40	168	168	56	42	28
	45	189	189	63	47	32
	50	210	210	70	53	35
	55	231	231	77	58	39
	60	252	252	84	63	42
75	15	68	68	23	17	11
	20	90	90	30	23	15
	25	113	113	38	28	19
	30	135	135	45	34	23
	35	158	158	53	40	26
	40	180	180	60	45	30
	45	203	203	68	51	34
	50	225	225	75	56	38
	55	248	248	83	62	41
	60	270	270	90	68	45
Macro-Drip is set of choice for this infusion						
Sample patient: 80 kg Patient at 1-3 mg/kg/hr = 80-240 mg/hr (80-240 mL/hr)						

KETAMINE (KETALAR)						
Dosing Range: 1-3 mg/kg/hr (17-50 mcg/kg/min)						
MIX 500 mg / 500 mL CONCENTRATION 1 mg/mL						
Patient Weight	Dose	Rate	Micro	Macro		
			60 gtt/mL	20 gtt/mL	15 gtt/mL	10 gtt/mL
kg	mcg/kg/min	mL/hr	gtt/min	gtt/min	gtt/min	gtt/min
80	15	72	72	24	18	12
	20	96	96	32	24	16
	25	120	120	40	30	20
	30	144	144	48	36	24
	35	168	168	56	42	28
	40	192	192	64	48	32
	45	216	216	72	54	36
	50	240	240	80	60	40
	55	264	264	88	66	44
	60	288	288	96	72	48
85	15	77	77	26	19	13
	20	102	102	34	26	17
	25	128	128	43	32	21
	30	153	153	51	38	26
	35	179	179	60	45	30
	40	204	204	68	51	34
	45	230	230	77	58	38
	50	255	155	85	64	43
	55	281	281	94	70	47
	60	306	306	102	77	51
90	15	81	81	27	20	14
	20	108	108	36	28	18
	25	135	135	45	34	23
	30	162	162	54	41	27
	35	189	189	63	47	32
	40	216	216	72	54	36
	45	243	243	81	61	41
	50	270	270	90	68	45
	55	297	297	99	74	50
	60	324	324	108	81	54
95	15	90	90	30	23	15
	20	114	114	38	29	19
	25	143	143	48	36	24
	30	171	171	57	43	29
	35	200	200	67	50	33
	40	228	228	76	57	38
	45	257	257	86	64	43
	50	285	285	95	71	48
	55	314	314	105	79	52
	60	342	342	114	86	57
100	15	90	90	30	23	15
	20	120	120	40	30	20
	25	150	150	50	38	25
	30	180	180	60	45	30
	35	210	210	70	53	35
	40	240	240	80	60	40
	45	270	270	90	68	45
	50	300	300	100	75	50
	55	330	330	110	83	55
	60	360	360	120	90	60
105	15	95	95	32	24	16
	20	126	126	42	32	21
	25	158	158	53	40	26
	30	189	189	63	47	32
	35	221	221	74	55	37
	40	252	252	84	63	42
	45	284	284	95	71	47
	50	315	315	105	79	53
	55	347	347	116	87	58
	60	378	378	126	95	63
Macro-Drip is set of choice for this infusion						
Sample patient: 80 kg Patient at 1-3 mg/kg/hr = 80-240 mg/hr (80-240 mL/hr)						

KETOROLAC

(Trade Name: Toradol)

Class / Mechanism of Action

- **Nonsteroidal Anti-Inflammatory Drug (NSAID)**
  Inhibits cyclooxygenase (COX 1 & 2) enzymes, which decreases production of prostaglandin precursors. Provides antipyretic, analgesic, and anti-inflammatory action.

Indications

- **Labeled Indications**
  - Short term management of moderate to severe acute pain as an opioid alternative

Contraindications

- Hypersensitivity to Ketorolac, Aspirin, other NSAIDs, or any component of the formulation
- High risk of bleeding, recent history of GI bleeding or perforation, known history of peptic ulcer disease
- **Not for use as pain management for battlefield trauma patients!**
- Suspected cerebrovascular bleeding
- Renal disease or patients at risk of renal failure secondary to volume depletion
- Concurrent use with other NSAIDs: Significant drug interactions exist. Requires dose / frequency adjustment or avoidance

Adverse Reactions / Precautions

- Inhibits platelet function
- Associated with an increased risk of adverse cardiovascular thrombotic events, including MI and stroke
- May increase risk of GI irritation, inflammation, ulceration, bleeding, and perforation
- Hyperkalemia; increased risk with patients > 65 years of age
- May cause severe bronchospasm in patients with asthma
- May cause new onset hypertension or worsening of existing hypertension
- **Pregnancy:** Use of NSAIDs should be avoided by 20 weeks' gestation **Lactation:** Use caution

Dose / Administration

ADULT

Pain Management (Acute; Moderately Severe)

- IV
  - Adults ≥ 50 kg: **15-30 mg** q 6 hrs (max DAILY dose: 120 mg)
  - Adults ≥ 65 years and/or adults ≤ 50 kg: **15 mg** q 6 hours (max DAILY dose: 60 mg)
- IM
  - Adults ≥ 50 kg: **15-30 mg** q 6 hrs (max DAILY dose: 120 mg)
  - Adults ≥ 65 years and/or adults ≤ 50 kg: **15-30 mg** q 6 hrs (max DAILY dose: 60 mg)

PEDIATRIC

(Always reference BROSELOW Tape)

Pain Management (Acute; Moderately Severe)

- Children < 2
  - IV
    - **0.25 mg/kg** q 6-8 hrs (max dose: 15 mg/dose)
- Children 2-16 years old:
  - IM / IV
    - **0.5 mg/kg** q 6-8 hrs (max dose: 30 mg/dose)
- Adolescents > 17
  - Refer to adult dose

Note: Not recommended as first line choice in pediatric patients

LABETALOL

(Trade Name: Trandate)

Class / Mechanism of Action

- **Beta Blocker with Alpha Blocking Activity**
  Blocks alpha and beta1/beta2 adrenergic receptor sites.
  - Onset - IV: 2-5 min

Indications

- **Labeled Indications**
  - Treatment of severe hypertension and hypertensive emergencies
- **Off-label Indications**
  - Pre-eclampsia and severe hypertension in pregnancy, hypertension during acute ischemic stroke, and pediatric hypertension

Contraindications

- Hypersensitivity to Labetalol or any component of the formulation
- Bradycardia < 60 bpm, Heart block > 1st degree
- Uncompensated heart failure, Cardiogenic shock
- Asthma, COPD
- Administration of non-dihydropyridine calcium channel blockers (verapamil)

Adverse Reactions / Precautions

- Symptomatic hypotension with or without syncope. Monitor EKG closely
- Use with extreme caution in patients with compensated heart failure and bradycardia
- Patients with bronchospastic diseases (reactive airway) should not use beta blockers
- May worsen, prolong, or cause hypoglycemia. Could also mask hypoglycemic symptoms
- **Pregnancy:** Yes, close fetal monitoring recommended **Lactation:** Use caution

Dose / Administration

ADULT

Hypertension Crisis (Hypertensive Emergency / Urgency) (Sys: > 185 / Dia: > 110)

- IV:
  - Intermittent Bolus: **1-20 mg** over 1-2 mins. Followed by **20-80 mg** q 10 min until target BP is reached. Consider continuous infusion if unable to target
  - Continuous Infusion: Initial loading dose: **10-20 mg** over 2 mins, followed by **0.5-2 mg/min** (may require titration up to 10 mg/min)

Note: Goal is to lower MAP by no more than 25%. Reduce MAP gradually by 10-20% over the first hr, then by
5-15% over the next 23 hrs

PEDIATRIC

(Always reference BROSELOW Tape)

Hypertension Emergencies

- IV:
  - Intermittent Bolus: **0.2-1 mg/kg** have been reported (max dose: 40 mg/dose)
  - Continuous Infusion: **0.25-3 mg/kg/hr;** administration requires the use of an infusion pump

Note: Not first line medication for children; use with caution

Ringer's Lactate (Lactated Ringers)

Class: Isotonic crystalloid solution.
Mechanism of Action: Replaces water and electrolytes.
Indications: Hypovolemic shock; keep open IV. Standard burn resuscitation
Contraindications: Should not be used in the same line with blood components. Use with caution for intravascular volume replacement for hemorrhagic shock due to hemodilution and exacerbation of coagulopathy. Use with caution in patients with known congestive heart failure and kidney disease.
Adverse Reactions: Rare
Drug Interactions: Few in the pre-hospital emergency setting.
Dosage and Administration: Hypovolemic shock; titrate according to the patient's physiological response. Burn resuscitation, use Rule of 10's to calculate infusion rate. (See appropriate Guidelines)

Dextrose 5% in Water (D5W)

Class: Hypotonic dextrose-containing solution.
Mechanism of Action: D5W provides nutrients in the form of dextrose as well as free water.
Indications: IV diluent for certain emergency drugs; for dilution of concentrated drugs for intravenous infusion.
Contraindications: Not for use as fluid replacement for hypovolemic states.
Adverse Reactions: Rare
Drug Interactions: None
Dosage and Administration: Dependent on drug being administered.

LEVETIRACETAM

(Trade Name: Keppra)

Class / Mechanism of Action

- **Anticonvulsant**
  - Causes modulation of synaptic neurotransmitter release through binding to the synaptic vesicle protein SV2A in the brain

Indications

- **Labeled Indications**
  - Treatment of focal (partial) onset seizures
- **Labeled Indications**
  - Traumatic brain injury, severe acute (short-term seizure prophylaxis); status epilepticus; craniotomy, seizure prophylaxis; subarachnoid hemorrhage (short-term seizure prophylaxis)

Contraindications

- Hypersensitivity to Levetiracetam or any component of the formulation

Adverse Reactions / Precautions

- May cause CNS depression
- Dermatologic reactions, possibly severe (TEN, SJS, etc.)
- Hypertension has been reported in children < 4 years
- Hematologic effects: decreases in red blood cell counts, hemoglobin, hematocrit, white blood cell counts, and neutrophils and increases in eosinophils have been observed

Dose / Administration

ADULT	**PEDIATRIC**

Traumatic Brain Injury (Severe Acute) / Short Term Seizure Prophylaxis
• IV
  ○ Loading dose: **1500 mg** over 15 min
  ○ Maintenance dose: **1000 mg** over 15 min q 12 hrs
	(Always reference BROSELOW Tape)
	Traumatic Brain Injury / Seizure Prophylaxis
	• IV
	  ○ **20-55 mg/kg/day** in divided doses twice daily

LIDOCAINE

(Trade Name: Xylocaine)

Class / Mechanism of Action

- **Antiarrhythmic**
  Suppresses automaticity of cardiac conduction tissue.

Indications

- **Labeled Indications**
  - Acute treatment of ventricular arrhythmias from myocardial infarction (alternate to amiodarone when amiodarone is not available)
- **Off-label Indications**
  - Hemodynamically stable monomorphic VT and polymorphic VT
  - Pulseless VT / VF (unresponsive to defibrillation, CPR, and vasopressor administration)
  - Monomorphic VT secondary to drug, when amiodarone is not available

Contraindications

- Hypersensitivity to lidocaine or any component of the formulation
- Prophylactic use in AMI
- Bradycardia, severe degrees (2nd or 3rd) of SA, AV, or intraventricular heart block
- Wolff-Parkinson-White syndrome, Adam-Stokes syndrome

Adverse Reactions / Precautions

- Continuous EKG monitoring is necessary
- Increased ventricular rate may be seen when given to a patient in A Fib.
- At high doses, monitor closely for CNS toxicity, seizure, depression, and respiratory depression.
- D/C immediately if toxicity develops
- The elderly may have increased chance of CNS and cardiovascular side effects

Dose / Administration

ADULT

Cardiac Arrest from VF/VT (if Amiodarone is not available)

- IV / IO
  - Initial dose: **1-1.5 mg/kg**
  - For refractory VF may give additional **0.5-0.75 mg/kg** IV push, q 5-10 min
    - Maximum: 3 doses or total of 3 mg/kg
    - Follow with continuous infusion 1-4 mg/min after ROSC

Perfusing Arrhythmia (if Amiodarone is not available): Stable VT, Wide Complex Tachycardia, Significant Ectopy

- IV / IO
  - **1-1.5 mg/kg.** Repeat **0.5-0.75 mg/kg** q 5-10 mins
    - Maximum cumulative dose: 3 mg/kg
    - Follow with continuous infusion 1-4 mg/min (20-50 mcg/kg/min)

Flush after Initiation of IO

- May add 2-3 mL Lidocaine 2% (without epinephrine) to 5 mL NS flush

Local Anesthesia During Tube / Finger Thoracostomy

- Draw 10 mL 2% Lidocaine and locally anesthetize incision area

Decompression Illness / Arterial Gas Embolism

- IV / IO
  - **1.5 mg/kg**

PEDIATRIC

(Always reference BROSELOW Tape)

Shock Refractory VF/pVT

- IV / IO
  - Initial dose**: 1 mg/kg** loading dose
  - Continuous Infusion: **20-50 mcg/kg/min** infusion (repeat bolus dose if infusion initiated > 15 min after initial bolus therapy)

LORAZEPAM

(Trade Name: Ativan)

Class / Mechanism of Action

- **Benzodiazepine**
  Acts as an anxiolytic / hypnotic, anticonvulsant and sedative.
  - Onset of action – IV: Sedation 2-3 min, IM: Hypnotic 15-30 min; Duration – IV: 8-12 hrs

Indications

- **Labeled Indications**
  - Anesthesia premedication
  - Status epilepticus
- **Off-label Indications**
  - Rapid tranquilization of the combative / agitated patient
  - Alcohol withdrawal delirium / syndrome
  - Seizures
  - Induce sedation and amnesia (Midazolam is primary medication)

Contraindications

- Hypersensitivity to Lorazepam or any component of the formulation or other benzodiazepines
- Acute narrow angle glaucoma, Acute Alcohol Intoxication, Sleep apnea
- Respiratory Insufficiency/Depression (except during mechanical ventilation)
  - **Overdose Reversal: FLUMAZENIL can be used; however, it carries an elevated risk. Respiratory support until the medication is metabolized is traditionally the best care in Benzodiazepine overdose**
- Neurologic Depression (Head Trauma) (unless having active seizure)

Adverse Reactions / Precautions

- **No analgesic properties** (narcotic pain control is needed for RSI / intubated trauma patients)
- May cause respiratory depression: do not give without stable IV line and BVM (airway control) ready
- Hypotension, vasodilation
- Amnesia, confusion, drowsiness, slurred speech (paradoxical reactions possible: aggressiveness, agitation, anxiety, inappropriate behavior)

Dose / Administration

ADULT

Acute Seizures

Note: Not recommended IM for seizure due to erratic absorption

- IV
  - **4 mg** q 5 min

Anxiety

- IV
  - **0.5-2 mg** slow IVP

Rapid Tranquilization of Agitated / Combative Patient

- IV / IM
  - **2-4 mg** q 30-60 min**;** may be used alone or administered with an antipsychotic (i.e., haloperidol)

PEDIATRIC

(Always reference BROSELOW Tape)

Acute Seizures / Status Epilepticus

- IV / IO
  - **0.1 mg/kg** slow push. May repeat x1 dose in 5-10 min (max dose: 4 mg/dose)

Agitation

- IV / IM
  - **0.02-0.1 mg/kg** q 4-8 hrs PRN (max dose: 2 mg/dose)

MAGNESIUM SULFATE

Class / Mechanism of Action

- **Anticonvulsant, Electrolyte Supplement**
  IV magnesium decreases acetylcholine in motor nerve terminals and slows rate of SA node impulse formation and prolongs conduction time. Magnesium functions to facilitate the movement of calcium, sodium, and potassium in and out of cells.

Indications

- **Labeled Indications**
  - Prevention and treatment of seizures in pregnancies with severe pre-eclampsia or eclampsia
- **Off-label Indication**
  - Torsades de Pointes: Cardiac arrhythmias (VT / VF) cause by low serum magnesium

Contraindications

- Hypersensitivity any component of the formulation
- Myocardial damage and heart blocks
- IV use for pre-eclampsia / eclampsia during a 2-hour period before delivery

Adverse Reactions / Precautions

- Possible cardiovascular arrest, respiratory depression, and hypotension in large doses
- Hypomagnesaemia is often joined by hypokalemia and requires correction to normalize potassium
- **Magnesium Sulfate should be diluted into 50-100 mL NS or D5W for all adult and pediatric infusions**
- **Pediatrics:** Rapid infusion may cause hypotension or bradycardia. Have calcium chloride available to reverse magnesium toxicity if it occurs
- **Pregnancy:** Category D **Lactation:** Use caution

Dose / Administration

ADULT

Torsades de Pointes or VF / Pulseless VT Associated with Torsades de Pointes (Off-labeled use)

- IV / IO
  - **1-2 g** over 15 min. If no response or Torsades de Pointes recurs, may repeat dose to a total of 4 g in 1 hr

Wheezing in Respiratory Distress (3rd line drug)

- IV
  - **2 g** single dose over 20 min

Eclampsia/Pre-Eclampsia, Severe (Off-labeled use)

- IV
  - **4-6 g** over 15-30 mins followed by **1-2 g/hr** continuous infusion for 24 hrs

PEDIATRIC

(Always reference BROSELOW Tape)

Pulseless Torsades de Pointes

- IV / IO
  - **25-50 mg/kg** bolus (max dose: 2 g)

Status Asthmaticus

- IV / IO
  - **25-50 mg/kg** over 15 to 30 min (max dose: 2 g)

Hypomagnesemia:

- IV / IO
  - **25-50 mg/kg** over 10 to 20 min (max dose: 2 g

MANNITOL (20%)

Class / Mechanism of Action

- **Osmotic Diuretic**
  Increases osmotic pressure of glomerular filtrate. This reduces kidney reabsorption of water and electrolytes and increases urinary output. Decreases cerebral blood volume and intracranial pressure (ICP) while increasing cerebral blood flow and O2 transport.
  - Onset of action – Reduction of ICP: 15-30 min, Diuresis: 1-3 hrs

Indications

Labeled Indications:

- Reduction of increased ICP secondary to cerebral edema
- Reduction of elevated intraocular pressure
- Urinary excretion of toxic substances

Contraindications

- Hypersensitivity to mannitol or any component of the formulation
- Active intracranial bleeding
- Pulmonary congestion and edema
- Severe renal disease, or renal dysfunction after mannitol use
- SBP < 110
- Any active bleeding

Adverse Reactions / Precautions

- Chest pain, CHF, tachycardia, circulatory overload (with rapid administration), peripheral edema
- Headache, seizure
- Fluid and electrolyte imbalance, dehydration and hypovolemia
- Keep in a temperature-controlled climate. Will crystalize at low temperatures
- Repeated use may worsen ICP

Dose / Administration

ADULT	PEDIATRIC

Moderate to Severe Head Injury / Patient Continuing to Deteriorate or Showing Signs of Herniation Despite Adjustment to Ventilation and Starting Hypertonic Saline
• IV / IO
  ○ **1 g/kg** IV bolus over 20 min
  ○ Follow with **0.5 g/kg** q 3 hrs
 	
Note: If available, have urinary catheter in place and monitor output
 	
Note: 3% Hypertonic Saline is preferred over Mannitol
	(Always reference BROSELOW Tape)
	Increased Intracranial Pressure (Off-labeled use)
	• IV / IO
	  ○ **0.25-1 g/kg** over 20-30 min
	  ▪ Repeat PRN to maintain serum osmolality <320 mOsm/kg

METHYLPREDINISOLONE

(Trade Name: SoluMedrol)

Class / Mechanism of Action

- **Systemic Corticosteroid**
  Anti-inflammatory, immunosuppressant, shock.

Indications

- **Labeled Indications**
  - Treatment of a variety of diseases: allergic, inflammatory, hematologic, neoplastic, and autoimmune
- **Off-labeled Indications**
  - None identified unless added by medical direction

Contraindications

- Hypersensitivity to methylprednisolone or any component of the formulation
- No other in emergency setting

Adverse Reactions / Precautions

- Not for use in treatment of head injury; increased mortality has occurred in head injury patients treated with high dose IV methylprednisolone
- No immediate effect will be observed while treating in the pre-hospital environment. Onset of action may take several hours

Dose / Administration

ADULT	PEDIATRIC (Always reference BROSELOW Tape)

Asthma Exacerbations (Including Status Asthmaticus) / Allergic Reaction
• IV
  ○ **125 mg** x 1 dose
 	
Note: Only methylprednisolone sodium succinate can be used for IV doses
	Anaphylaxis / Asthma Exacerbations (Including Status Asthmaticus) / Allergic Reaction
	• IV
	  ○ Children & Adolescents: **2 mg/kg** initial dose**;** followed by 1 to 2 mg/kg/day divided over q 6 or 12 hours (Max daily dose, 120mg)
	
	Note: Only methylprednisolone sodium succinate can be used for IV doses

METOCLOPRAMIDE

(Trade Name: Reglan)

Class / Mechanism of Action

- **Prokinetic Agent: Antiemetic, Upper GI Stimulant**
  Potent dopamine-receptor antagonist. At higher doses blocks serotonin receptor in chemoreceptor trigger zones of CNS. Increases GI tract motility and gastric emptying.
  - Onset of action – IV: 1-3 mins; Duration – IV: 1-2 hrs

Indications

- **Labeled Indications**
  - Prevention of postoperative nausea and vomiting; acid Reflux / heartburn / GERD; migraine headache

Contraindications

- Hypersensitivity to glucagon or any component of the formulation
- Insulinoma / Pheochromocytoma
- History of tardive dyskinesia

Adverse Reactions / Precautions

- Tardive dyskinesia
- Dystonic reaction to Metoclopramide in the past
- GI Obstruction or Hemorrhage
- Seizure disorder (epilepsy)

Dose / Administration

ADULT	PEDIATRIC
Nausea / Vomiting • IV / IO ○ **5-10 mg** over 3 min q 6-8 hrs PRN (max TOTAL dose: 30 mg) **Note:** Rapid IV push may cause intense feelings of anxiety and restlessness **Note: I**deal administration to prevent agitation / adverse effects: Dilute in a 50 or 100 mL NS bag and infuse over 10-15 min	(Always reference BROSELOW Tape) **Not recommended or approved for routine pediatric use**

METOPROLOL

Trade Name: Lopressor

Class / Mechanism of Action

- **Beta-1 Selective Beta-Blocker; Antihypertensive; Antianginal Agent**
  Selective inhibitor of beta1-adrenergic receptors; competitively blocks beta1-receptors, with little or no effect on beta2-receptors at oral doses <100 mg (in adults); does not exhibit any membrane stabilizing or intrinsic sympathomimetic activity.
  - Onset of action – IV: 5 mins; Duration – IV: 3-5 hours

Indications

- **Labeled Indications**
  - Angina, hypertension, myocardial infarction
- **Off-labeled Indications**
  - Atrial fibrillation/flutter; hypertrophic cardiomyopathy; Marfan syndrome with aortic aneurysm; migraine prophylaxis; supraventricular tachycardia (AVNRT, AVRT, focal atrial tachycardia); thyrotoxicosis; ventricular arrhythmias

Contraindications

- Hypersensitivity to metoprolol, any component of the formulation, or other beta-blockers; second- or third-degree heart block
- Severe sinus bradycardia (heart rate < 45 beats/minute); significant first-degree heart block (P-R interval ≥ 0.24 seconds); systolic blood pressure < 100 mmHg; moderate to severe cardiac failure

Adverse Reactions / Precautions

- Cardiovascular: Hypotension, bradycardia, first degree atrioventricular block, arterial insufficiency, cardiac failure, CVA, cold extremities, palpitations, peripheral edema, claudication
- Central nervous system: Dizziness, fatigue, depression, vertigo, confusion, disturbed sleep, hallucination, headache, insomnia, nightmares, temporary amnesia, tinnitus

Dose / Administration

ADULT

Atrial Fibrillation / Atrial Flutter

- IV
  - **2.5-5 mg** over 2-5 min; repeat q 5 min PRN (max TOTAL dose: 15 mg)

Supraventricular Tachycardia / Ventricular Arrhythmia

Note: For hemodynamically stable patients if vagal maneuvers and/or adenosine are unsuccessful

- IV
  - **2.5-5 mg** over 2-5 min; repeat q 5 min PRN to achieve a ventricular rate of 90-100 (max TOTAL dose: 15 mg)

Note: For sustained ventricular tachycardia, Betablockers are generally administered in addition to an antiarrhythmic drug (e.g., Amiodarone) for these indications. A beta-blocker is also used to reduce shocks in patients who receive an implantable cardioverter defibrillator for these indications; propranolol may be the preferred beta-blocker in these situations

PEDIATRIC

(Always reference BROSELOW Tape)

Note: Guidelines do not recommend betablockers as initial therapy in pediatric patients; beta-blockers should be reserved for use in patients who have contraindications to preferred agents or patients with hypertension and chronic kidney disease, proteinuria, or diabetes mellitus

MIDAZOLAM

(Trade Name: Versed)

Class / Mechanism of Action

- **Benzodiazepine**
  Short-acting benzodiazepine. Acts as an Anxiolytic/Hypnotic, anticonvulsant and sedative.
  - Onset of action (sedation) – IV: 1-5 mins, IM: 15 mins, IN: < 10 mins; Duration: 15 minutes to 6 hours (HIGH variability)

Indications

- **Labeled Indications**
- Preoperative sedation, induction and maintenance of general anesthesia
- **Off-labeled Indications**
- Anxiety / agitation, status epilepticus, conscious sedation (intranasal)

Contraindications

- Hypersensitivity to midazolam or any component of the formulation or other benzodiazepines
- Acute narrow angle glaucoma, Acute Alcohol Intoxication
- Respiratory Insufficiency / Depression (except during mechanical ventilation)
- Should not be used in shock, coma, or acute alcohol intoxication with depression of vital signs
- Neurologic Depression (Head Trauma) unless having active seizure

Adverse Reactions / Precautions

- **No Analgesic properties** (Narcotic pain control is needed for intubated patients)
- May cause respiratory depression: do not give without stable IV line and BVM (airway control) ready
- Hypotension may occur more frequently in patients who have received opioid analgesics
- Amnesia, confusion, drowsiness, slurred speech (paradoxical reactions possible: aggressiveness, agitation, anxiety, inappropriate behavior)
- **Benzodiazepine overdose can be treated with supportive measures alone**

Dose / Administration

ADULT

Sedation

Note: Best used in combination with Fentanyl

- IV / IO (Push Dose)
  - **0.01-0.05 mg/kg** over 2 min q 10-15 min until desired sedation achieved
- IV / IO (Continuous)
  - **0.01-0.1 mg/kg/hr**

Transcutaneous Pacing / Cardioversion / Agitation / Anxiety

- IV
  - **0.5-2 mg** q 5 min until goal achieved or RR < 10
  - If intubated: **1-4 mg** q 5 min until goal achieved

Seizure

- IM
  - **10 mg** as a single dose
- IV / IO
  - **5 mg** q 5 min until seizure stops

PEDIATRIC

(Always reference BROSELOW Tape)

Procedural Sedation / Transcutaneous Pacing / Cardioversion

- IM
  - **0.1-0.15 mg/kg** (max dose: 10 mg)
- IN
  - **0.2 mg/kg** may repeat in 15 min (max dose: 10 mg)

Seizure / Status Epilepticus (Prehospital Treatment)

- IM / IN
  - **0.2 mg/kg once** (max dose: 10 mg)

Note: Do not administer Midazolam IV to pediatric patients that are NOT intubated

MORPHINE

Class / Mechanism of Action

- **Opioid Analgesic**
  Binds to opioid receptors within the CNS, causing inhibition of ascending pain pathways (blocking painful stimulus), altering the perception of and response to pain; produces generalized CNS depression.
  - Onset on action – IV: 5-10 mins

Indications

- **Labeled Indications**
  - Moderate to severe acute and chronic pain; pain of myocardial infarction; preanesthetic medication
- **Off-label Indications**
  - Critically ill patients in the ICU (analgesia and sedation)

Contraindications

- Hypersensitivity to morphine sulphate or any component of the formulation
- Severe respiratory depression
- Acute or severe asthma (in an unmonitored setting or without resuscitative equipment)
- GI obstruction to include known or suspected paralytic ileus

Adverse Reactions / Precautions

- Always be prepared for use of paralytic and intubation (maintain positive control of airway)
- **Head trauma: Use with extreme caution in head injury or suspected increased ICP; exaggerated increase in ICP may occur. Some formulations are specifically contraindicated**
- May cause Hypotension. Use with caution in hypovolemic patients
- May worsen Bradycardia
- May cause life-threatening hypoventilation and respiratory depression
- CNS depression: Impairs physical and mental abilities
- IM, SubQ: The use of IM / SubQ injections is no longer recommended especially for repeated administration due to painful administration, variable absorption, and lag time to peak effect
- **Pregnancy**: Use with caution **Lactation:** Nonopioid analgesia recommended for lactating patients peripartum

Dose / Administration

ADULT

Chest Pain / AMI

- IV / IO
  - **1-5 mg** only if discomfort is not relieved by nitroglycerin

Acute Pain (Moderate-to-Severe)

- IV / IO (SLOW)
  - **2.5-10 mg** q 1-4 hrs PRN

PEDIATRIC

(Always reference BROSELOW Tape)

Acute Pain (Moderate-to-Severe)

- IV (SLOW)
  - Infants ≤ 6 mo: **0.025-0.05 mg/kg/dose** q 2-4 hrs
  - Infants > 6 mo / < 50 kg: **0.05-0.1 mg/kg/dose** q 2-4 hrs; titrate based on patient response
  - > 50 kg: **2-5 mg** q 2-4 hrs PRN. Use lower end of the dosing range in opioid naive patients
- Continuous infusion:
  - Infants > 6 mo / < 50 kg: **10-40 mcg/kg/hr**; titrate PRN for pain
  - > 50 kg: **1.5 mg/hr**; titrate carefully to effect; usual maintenance dose: 0.8-3 mg/hr

MOXIFLOXACIN

(Trade Name: Avelox)

Class / Mechanism of Action

- **Antibiotic (Fluoroquinolone)**
  Bactericidal - DNA gyrase inhibitor and topoisomerase IV inhibitor – which is an essential enzyme that maintains the superhelical structure, replication, transcription, and repair of bacterial DNA.

Indications

- **Labeled Indications**
  - Used for infection control prophylaxis for traumatic open injuries and surgical prophylaxis

Contraindications

- Hypersensitivity to moxifloxacin, other quinolone antibiotics, or any component of the formulation

Adverse Reactions / Precautions

- Superinfection – prolonged use may result in fungal or bacterial superinfection (including C.Difficile)
- May cause QT prolongation
- Avoid use in known aortic aneurysm or dissection
- **Pregnancy:** Safe for use, dosage may need to be increased in late-stage pregnancy
  Lactation: Unknown

Dose / Administration

ADULT

Infection Control

- PO
  - **400 mg** once daily (max DAILY dose: 400 mg/day)

PEDIATRIC

(Always reference BROSELOW Tape)

Infection Control

- PO
  - Maximum dose: 200 mg/dose
  - > 3 mo – 2 y/o: **6 mg/kg** q 12 hrs
  - 2 – < 6 y/o: **5 mg/kg** q 12 hrs
  - 6 – < 12 y/o: **4 mg/kg** q 12 hrs
  - > 12 y/o (< 45 kg): **4 mg/kg** q 12 hrs
  - > 12 y/o (> 45 kg): Refer to adult dosing

NALOXONE

(Trade Name: Narcan)

Class / Mechanism of Action

- **Antidote, Opioid Antagonist**
  Competes and displaces opioids at opioid receptor sites, reversing narcotic effects.

Indications

- **Labeled Indications**
  - Reversal of opioid drug effects, including respiratory depression

Contraindications

- Hypersensitivity to naloxone or any component of the formulation

Adverse Reactions / Precautions

- When correcting respiratory depression in a postoperative (intubated patient), carefully titrate the dose to reverse hypoventilation; do not fully awaken patient or reverse analgesic effect
- Recurrence of respiratory and / or CNS depression is possible; continue to watch for respiratory or CNS depression
- May precipitate acute narcotic withdrawal in opioid-dependent patients, including pain, tachycardia, hypertension, abdominal cramps, diarrhea, nausea, vomiting, agitation, and irritability
- In neonates, opioid withdrawal may be life-threatening; symptoms may include excessive crying, failure to feel, seizures, and hyperactive reflexes
- **Pregnancy:** Category C **Lactation:** Yes, use caution

Dose / Administration

ADULT

Opioid Overdose

- IV (Push over 30 sec) / IM / IN / SubQ
  - **0.4-2 mg** q 2-3 min PRN
    - If there is no response after 10 mg total, look for other causes of respiratory depression
    - Following reversal, may need to readminister after 20-60 minutes

Reversal of Respiratory Depression with Therapeutic Opioid Doses

- IV (Push over 30 sec) / IM / IN / SubQ
  - **0.05-0.2 mg** q 2-3 min PRN; repeat doses may be needed within 1-2 hr intervals

PEDIATRIC

(Always reference BROSELOW Tape)

Opioid Overdose

- IV / IM / IN / SubQ
  - < 5 years or ≤ 20 kg (Off-labeled use): **0.1 mg/kg** q 2-3 min PRN (max dose: 2 mg)
  - ≥ 5 years or > 20 kg: Adult dosing

Reversal of Respiratory Depression with Therapeutic Opioid Doses

- IV / IM / IN / SubQ
  - **1-15 mcg/kg** q 20-60 min

NIFEDIPINE

(Trade Name: Procardia)

Class / Mechanism of Action

- **Antianginal Agent, Calcium Channel Blocker**
  Inhibits movement of calcium ion across cell membranes of smooth muscle and myocardium resulting in
  relaxation of coronary vascular smooth muscle and vasodilation as well as reduced peripheral vascular
  resistance (reducing blood pressure).

Indications

- **Labeled Indications**
  - Chronic stable or vasospastic angina
- **Off-label Indications**
  - Prevention and treatment of high-altitude pulmonary edema

Contraindications

- Hypersensitivity to nifedipine or any component of the formulation
- Cardiogenic Shock
- ST-elevation myocardial infarction
- **Do not use for acute anginal episodes; may precipitate myocardial infarction**

Adverse Reactions / Precautions

- Symptomatic hypotension and reflex tachycardia may occur resulting in angina and / or MI in patients with coronary heart disease
- Peripheral edema
- unstable angina / non-ST-elevation myocardial infarction: not recommended in the absence of a beta-blocker
- **Pregnancy:** Category C **Lactation:** Yes, not recommended

Dose / Administration

ADULT

High Altitude Pulmonary Edema (Off-labeled use)

- PO
  - **30 mg** (Extended Release) q 12 hrs
    OR
    20 mg (Immediate Release) q 8 hrs

Pulmonary Hypertension (Off-labeled use)

- PO
  - **30 mg** (Extended Release) once daily; may increase cautiously to 120-240 mg/day

Note: Do not use for acute anginal episodes; may precipitate myocardial infarction

PEDIATRIC

(Always reference BROSELOW Tape)

High Altitude Pulmonary Edema (Off-labeled use)

- PO
  - **1.5 mg/kg/day** (Extended Release; preferred dosing; max SINGLE dose: 30 mg)
  - **0.5 mg/kg** q 8 hrs (Immediate Release; max SINGLE dose: 20 mg/dose)

Note: Treatment is only necessary if response to oxygen and / or descent is poor

NITROGLYCERIN

(Trade Name: NitroMist / Nitrostat)

Class / Mechanism of Action

- **Antianginal Agent, Vasodilator**
  Induces smooth muscle relaxation and vasodilation of peripheral veins and arteries and coronary arteries thus improving collateral blood flow to ischemic regions of the myocardium. Reduces cardiac oxygen demand by decreasing preload.
  - Onset of action - Sublingual tablet and spray: 1-3 min; Duration: 25 min

Indications

- **Labeled Indications**
  - Treatment or prevention of angina pectoris

Contraindications

- Hypersensitivity to nitrates or any component of the formulation
- Use of phosphodiesterase-5 inhibitors (Sildenafil, Levitra, Cialis) in the previous 48 hrs
- Increased intracranial pressure
- Hypotension (SBP < 90 mmHg or > 30 mmHg below baseline), Bradycardia < 50 bpm, tachycardia without heart failure (> 100 bpm), and right ventricular infarction

Adverse Reactions / Precautions

- **IV / IO access should be placed and SBP should be > 110. Use cautiously in cases of chest pain unless inferior wall / right-ventricular MI can be ruled-out by ECG prior to administration**
- Can cause severe hypotension with associated paradoxical bradycardia and increased angina
- Use with caution in volume depleted patients
- Do not use for inferior wall MI and suspected right ventricular involvement
- **Pregnancy:** Category C **Lactation:** Yes, use caution

Dose / Administration

ADULT

Angina / Coronary Artery Disease

- PO
  - Sublingual: **0.4 mg** q 5 min (max dose: 3 doses in 15 min)
  - Translingual: **1 spray (0.4 mg/spray)** onto or under tongue q 3-5 min (max dose: 3 doses in 15 min)

CHF Related Respiratory Distress

- PO
  - Sublingual: **0.4 mg** q 5 min (max dose: 3 doses in 15 min as long as SBP > 90)

PEDIATRIC

(Always reference BROSELOW Tape)

Not indicated in most children, even with heart failure, as their heart failure is not usually due to coronary artery disease. Could cause significant problems in those with depressed myocardial function. Consult Medical Direction (if able) before use in Pediatrics

CHF or Cardiogenic Shock / Hypertensive Crisis / Myocardial Ischemia

- IV Drip
  - Infants/Children: **0.25-0.5 mcg/kg/min**; titrate by 1 mcg/kg/min q 15-20 minutes as tolerated, to desired effect
  - Adolescents: **5-10 mcg/min** (not per kg)
    - Maximum dose: increase to 200 mcg/min, as tolerated, to desired effect

NOREPINEPHRINE

(Trade Name: Levophed)

Class / Mechanism of Action

- **Alpha and Beta Agonist**
  Stimulates beta1 and alpha-adrenergic receptors increases contractility, heart rate, and vasoconstriction. Increases systemic blood pressure and coronary blood flow. Effects on vasoconstriction (alpha receptors) are greater than inotropic (beta receptors).
  - Onset of action – IV: Very rapid, Duration: 1-2 min

Indications

- **Labeled Indications**
  - Treatment of shock persisting after adequate fluid volume replacement; severe hypotension
  - ALS 2020: Severe cardiogenic shock and hemodynamically significant hypotension (SBP < 70mmHg) with low total peripheral resistance. Agent of last resort for management of ischemic heart disease and shock

Contraindications

- Hypersensitivity to norepinephrine, bisulfites or any component of the formulation
- Hypotension from hypovolemia except as an emergency measure to maintain coronary and cerebral perfusion until volume can be replaced

Adverse Reactions / Precautions

- **No applicable use in hemorrhagic shock unless fluid replacement therapy maximized! Maximize use of blood products / crystalloids before considering use in hemorrhagic shock**
- Strong vesicant; causes blisters: Ensure proper catheter placement and avoid extravasation, use a large vein (preferably a central line) and avoid leg veins
- Ensure adequate circulatory volume to minimize the need for vasoconstrictors. Monitor BP closely, avoid hypertension and adjust infusion rate as needed
- **Pregnancy:** Category C **Lactation:** Use caution

Dose / Administration

ADULT

Hypotension / Shock

- IV (Administer as continuous infusion with infusion pump. Do not use in same line as sodium bicarbonate. It will inactivate norepinephrine)
  - **5-15 mcg/min**; titrate to SBP goal
  - Cardiogenic Shock: **5-20 mcg/min**

Post ROSC Hypotension

- IV
  - **0.1-0.5 mcg/kg/min** titrate to effect
  - If unable to maintain SBP > 90 and MAP > 65 mmHg, add **Epinephrine** infusion

Use in Burn Patient

- IV
  - **2-20 mcg/min;** only used when target MAP (> 65 mmHg) and UOP (> 30 mL/hr) fail to be reached with fluid resuscitation alone. Its sequence of use follows administration of **Vasopressin**

(See infusion chart next page for mix and dosage information)

PEDIATRIC

(Always reference BROSELOW Tape)

Hypotension / Shock

- IV Continuous Infusion
  - **0.05-0.2 mcg/kg/min**; titrate to effect (max dose: 2 mcg/kg/min)

NOREPINEPHRINE (LEVOPHED)					
Dosing Range: 2-20 mcg/min (120-1200 mcg/hr)					
MIX 4 mg / 500 mL CONCENTRATION 8 mcg/mL					
Dose	Rate	Micro 60 gtt/mL	Macro		
			20 gtt/mL	15 gtt/mL	10 gtt/mL
mcg/min	mL/hr	gtt/min	gtt/min	gtt/min	gtt/min
2	15	15	5	4	3
3	23	23	8	6	4
4	30	30	10	8	5
5	38	38	13	10	6
6	45	45	15	11	8
7	53	53	18	13	9
8	60	60	20	15	10
9	68	68	23	17	11
10	75	75	25	19	13
11	83	83	28	21	14
12	90	90	30	23	15
13	98	98	33	25	16
14	105	105	35	26	18
15	113	113	38	28	19
16	120	120	40	30	20
17	128	128	43	32	21
18	135	135	45	34	23
19	143	143	48	36	24
20	150	150	50	38	25
Macro-Drip (20 gtt/mL) or Micro-Drip is set of choice for this infusion					
Start at lowest dose and increase rate by 0.5 mcg/min q 2 minutes PRN to target MAP > 60 mmHg					

0.9% Sodium Chloride (Normal Saline)

Class: Isotonic crystalloid solution
Mechanism of Action: Principal extracellular cation; functions in fluid and electrolyte balance, osmotic pressure control, and water distribution.
Indications: Hypovolemia, shock, heat-related injuries, Diabetic Ketoacidosis, TKO IV, a diluent of choice for blood product transfusion.
Contraindications: Avoid for intravascular volume replacement for hemorrhagic shock due to hemodilution and hyperchloremic metabolic acidosis. Use with caution in patients with known congestive heart failure.
Adverse Reactions: Rare
Drug Interactions: Few in the pre-hospital emergency setting.
Dosage and Administration: The specific situation being treated will dictate the rate at which normal saline will be administered. Hypovolemic shock requires rapid bolus (see relevant guidelines). In other cases, it is advisable to administer the fluid at a moderate rate (for example, 100 mL/h).

Hypertonic Saline 3% Sodium Chloride

Class: Hypertonic crystalloid solution
Mechanism of Action: Replaces water and electrolytes, reduces the amount of fluid in the cranial cavity, decreases ICP, increases intravascular sodium concentration, may induce diuresis.
Indications: Refractory elevated intracranial pressure (ICP) due to various etiologies (e.g., subarachnoid hemorrhage, neoplasm); traumatic brain injury with elevated ICP (can be used in place of mannitol).
Contraindications: Do not use in the same line as blood products – cause crenation and lysis of RBC. Caution or avoid use in patients with known congestive heart failure and kidney disease.
Adverse Reactions: Rare
Drug Interactions: Few in the pre-hospital emergency setting.
Dosage and Administration:

- **Dosing (Adult):**
  - **Bolus:** 250 mL IV bolus over 10-20 min
  - **Infusion:** 50-100 mL/hr
- **Dosing (Pediatrics):**
  - **Bolus:** 6.5 to 10 mL/kg IV bolus over 10-20 min
  - **Infusion:** 0.1 to 1 mL/kg/hr titrated to minimal rate required to maintain ICP <20 mmHg
- Should be administered through a central line due to its high osmolarity and tonicity.

ONDANSETRON

(Trade Name: Zofran)

Class / Mechanism of Action

- **Antiemetic**
  Blocks serotonin, peripherally on vagus nerve terminals and centrally.
  - Onset of action: 5-30 minutes dependent on route

Indications

- **Labeled Indications**
  - Prevention of postoperative nausea and vomiting
- **Off-label Indications**
  - Hyperemesis gravidarum (severe or refractory)

Contraindications

- Hypersensitivity to ondansetron or any component of the formulation

Adverse Reactions / Precautions

- Dose dependent QT interval prolongation occurs and IV doses > 16 mg are not recommended. In most patients, QT changes are not clinically relevant; however, if used with other medications that prolong QT intervals (antiarrhythmics) or in those at risk for QT prolongation, arrhythmia can occur. Torsades de points have been reported
- **Pregnancy:** Category B **Lactation:** Use caution

Dose / Administration

ADULT

Nausea and Vomiting

- IV / IO / IM / PO / ODT
  - **4-8 mg**

Treatment of Severe or Refractory Hyperemesis Gravidum (Off-labeled use)

- IV
  - **8 mg** administered over 15 mins q 12 hrs

PEDIATRIC

(Always reference BROSELOW Tape)

Nausea and Vomiting (Children 1 month to 12 Years)

- IV
  - **0.15-0.3 mg/kg** (max SINGLE dose: 8 mg)

Oxygen

Class: Atmospheric gas
Mechanism of Action: Reverses hypoxemia.
Duration of action: Onset: immediate. Peak effect: not applicable. Duration: less than 2 minutes.
Indications: All causes of decreased tissue oxygenation and/or decreased level of consciousness. (Confirmed or expected hypoxemia, ischemic chest pain, respiratory insufficiency, prophylactically during air transport, as an antidote for confirmed or suspected carbon monoxide poisoning).
Contraindications: COPD patients may become hypopneic with high O2 flow rates due to oxygen baroreceptor respiratory drive (relative contraindication).
Adverse Reactions: Potential oxygen toxicity in hyperbaric environments; cerebral vasoconstriction.
Drug Interactions: None
Dosage and Administration:

- Assure adequate ventilation (spontaneous or supported) supplemental oxygen therapy, ideally by end- tidal CO2 measurement (Goal EtCO2 35-45).
- All critically ill and injured transport patients will receive supplemental oxygen to maintain SPO2 of > 94%.
- Administer oxygen 2-6 LPM via nasal cannula.
  - If O2 Saturation remains < 94%, apply non-rebreather face mask with oxygen at 15 LPM.
  - If O2 Saturation remains < 90%, refer to **AIRWAY PROTOCOL**.
- **Patient on Ventilator:**
  - Refer to **VENTILATOR MANAGEMENT PROTOCOL**
- When planning for available O2 during non-pressurized, aeromedical transfer, ensure adequate resources to provide 1.5 to 2 times the ground transport volume of O2 to compensate for increased consumption associated with altitude related physiological impact.

PlasmaLyte A

Class: Isotonic crystalloid solution
Mechanism of Action: Replaces water and electrolytes.
Indications: Hypovolemic shock; compatible with blood or blood components. It may be administered before or following the infusion of blood through the same administration set (i.e., as a priming solution), added to or infused concurrently with blood components, or used as a diluent in the transfusion of packed erythrocytes.
Contraindications: Use with caution for intravascular volume replacement for hemorrhagic shock due to hemodilution and exacerbation of coagulopathy. Use with caution in patients with known congestive heart failure and kidney disease. Excess administration may result in metabolic alkalosis.
Adverse Reactions: Rare
Drug Interactions: Few in the pre-hospital emergency setting.
Dosage and Administration: Hypovolemic shock; titrate according to the patient's physiological response. (See appropriate Protocols)

PHENYLEPHRINE

(Trade Name: Neosynephrine)

Class / Mechanism of Action

- **Alpha Adrenergic Agonist**
  Potent, direct acting alpha adrenergic agonist with virtually no beta-adrenergic activity; causes systemic arterial vasoconstriction.
  - Onset of action - IV: Immediate; Duration: approximately 5-10 min

Indications

- **Labeled Indications**
  - Treatment of hypotension, vascular failure in shock

Contraindications

- Hypersensitivity to Phenylephrine or any component of the formulation

Adverse Reactions / Precautions

- **No applicable use in hemorrhagic shock unless fluid replacement therapy maximized! Maximize use of blood products / crystalloids before considering use in hemorrhagic shock**
- Not recommended for routine use in the treatment of septic shock
- Reflexive bradycardia. Assure adequate circulatory volume to minimize the need for vasoconstrictors. Monitor BP closely, avoid hypertension and adjust infusion rate as needed
- Vesicant (cause blisters): Avoid extravasation, will cause tissue damage / necrosis, ensure proper needle placement
- **Pregnancy:** Category C **Lactation:** Yes, use caution

Dose / Administration

ADULT

Hypotension / Shock

- IV Push
  - **50-200 mcg/dose** q 5-10 min (max dose: 1000 mcg). Titrate to blood pressure, use as temporary support or bridge to Vasopressor drip
  - Mix **10 mg Phenylephrine in 100 mL NS** for a concentration of 100 mcg/mL
- IV Infusion
  - **40-200 mcg/min**; titrate to MAP > 60 mmHg. To titrate, increase rate by 10 mcg/min q 2 mins (max dose: 200 mcg/min)
  - Mix **10 mg Phenylephrine in 250 mL D5W/NS** for a concentration for 40 mcg/mL
  - Cardiogenic Shock: **0.1-10 mcg/kg/min**

PEDIATRIC

(Always reference BROSELOW Tape)

Hypotension / Shock

- IV Push
  - **5-20 mcg/kg/dose** q 10-15 mins PRN
- IV Infusion
  - **0.1-0.5 mcg/kg/min**

PRALIDOXIME CHLORIDE

(Trade Name: 2-Pam Chloride)

Class / Mechanism of Action

- **Antidote for organophosphate anticholinesterase poisoning**
  Reactivates cholinesterase that had been inactivated by phosphorylation due to exposure to organophosphate pesticides and cholinesterase-inhibiting nerve agents by displacing the enzyme from its receptor sites; removes the phosphoryl group from the active site of the inactivated enzyme.
  - Peak plasma concentration – IV: 5-15 mins, IM: about 35 mins

Indications

- **Labeled Indications**
  - Organophosphate Pesticide Poisoning: **Used with Atropine to reverse muscle paralysis**
  - Chemical Warfare Agent Poisoning: **Used with Atropine for treatment of nerve agent** (e.g., sari, soman, tabun, VX [methylphosphonothioic acid])

Contraindications

- There are no absolute contraindications listed within the manufacturer's labeling
  - **Note:** According to the manufacturer, relative contraindications include hypersensitivity to pralidoxime or any component of the formulation and other situations where the risk of administration clearly outweighs possible benefit

Adverse Reactions / Precautions

- Pralidoxime is **Not** indicated for the treatment of poisoning due to phosphorus, inorganic phosphates, or organophosphates without anticholinesterase activity
  - **Renal impairment**: Use with caution in patients with renal impairment; dosage modification required
  - **Adverse Reactions** can include cardiac arrest, hypertension, tachycardia, paralysis, seizure, nausea, vomiting, apnea, hyperventilation, laryngospasm, muscle rigidity. **Provide supportive care when appropriate and PRN**
  - **Pregnancy:** Use if indicated as an antidote **Lactation:** Use caution

Dose / Administration

ADULT

Organophosphate / Nerve Agent Poisoning

- Auto-injector
  - **600 mg per dose**; max: 3 doses (1800 mg)
- ATNAA Auto-injector (provides single IM dose of Atropine (2.1 mg) and Pralidoxime Chloride (600 mg):
  - For ≥ 2 mild symptoms, inject **1 ATNAA** (single dose). If severe symptoms develop, inject 2 additional doses in rapid succession
  - For severe symptoms, inject **3 ATNAAs** in rapid succession
- IV / IO
  - After max dose ATNAA
    - **500 mg** over 5 minutes
      PLUS
      10 mg/kg/hr infusion until clinical improvement is stable

Note: Pralidoxime (2-PAM) ADULT and PEDIATRIC Drip Protocol [given after 1800 mg IM Injection (3 ATNAAs) if symptoms persist]

1. Reconstitute 1 g 2-PAM with 20 mL of sterile water
2. Add 10 mL reconstituted 2-Pam (500 mg) to 100 mL Bag of NS and infuse over 5 minutes
3. Prepare continuous infusion by mixing 1 g (20 mL reconstituted) into 100 mL bag of NS which will provide a 10 mg/mL solution. Can also prepare 10 g in 1 L NS for a 10 mg/mL solution
4. Begin continuous infusion

PEDIATRIC

(Always reference BROSELOW Tape)

Organophosphate / Nerve Agent Poisoning

- IM
  - ≤ 40 kg
    - Mild symptoms: **15 mg/kg** PRN q 15 min (max TOTAL dose: 45 mg/kg)
    - Severe symptoms: **15 mg/kg**, repeat twice in rapid succession for a total dose of 45 mg/kg delivered
  - >40 kg
    - Mild symptoms: **600 mg** PRN q 15 min (max TOTAL dose: 1800 mg)
    - Severe symptoms: **600 mg**, repeat twice in rapid succession for a total dose of 1800 mg delivered
- Auto-injector
  - ≥ 41 kg only: **600 mg per dose**; max: 3 doses
- IV
  - ≤ 16 y/o:
    - Loading Dose: **20-50 mg/kg** (max dose: 2 g)
    - Continuous Infusion: **10-20 mg/kg/hr** (max dose: 500 mg/hr)
    - Intermittent Dosing: **20-50 mg/kg** (max dose: 2 g; may repeat after 1 hr if muscle weakness is not relieved)
  - > 16 y/o:
    - Loading Dose: **30 mg/kg** (max dose: 2 g)
    - Continuous Infusion: **8-10 mg/kg/hr** (max dose: 650 mg/hr)
    - Intermittent Dosing: **1-2 g** administered 1 hr after loading dose if muscle weakness has not been relieved

PROCAINAMIDE

(Trade Name: Procanbid)

Class / Mechanism of Action

- **Antiarrhythmic Agent, Class Ia**
  Decreases myocardial excitability and conduction velocity; may depress myocardial contractility by increasing the electrical stimulation threshold of ventricle, His-Purkinje system and through direct cardiac effects.
  - Onset of action – IV: 5 mins, IM (Not for emergent situations): 10-30 mins; Duration: 4-6 hrs

Indications

- **Labeled Indications**
  - Treatment of refractory tachyarrhythmia with a pulse / hemodynamic compromise
  - Wide-complex tachyarrhythmia / no hemodynamic compromise
- **Off-labeled Indications**
  - Atrial fibrillation (pre-excited); Junctional tachycardia; Stable monomorphic ventricular tachycardia

Contraindications

- Hypersensitivity to Procainamide, procaine, other ester-type local anesthetics or any component of the formulation
- Complete heart block; second-degree AV block or various types of hemiblock
- SLE (Systemic Lupus Erythematosus)
- Torsade's de Pointes

Adverse Reactions / Precautions

- Lupus-like syndrome
- Hypotension
- Skin rash
- Diarrhea, dysgeusia, nausea/vomiting
- May induce Torsade's de Pointes
- Potentially fatal blood dyscrasias (eg, agranulocytosis) have occurred with therapeutic doses
- Avoid in prolonged QT or congestive heart failure
- Avoid use in patients with myasthenia gravis; may worsen condition
- **Pregnancy:** Avoid long term treatment **Lactation:** Use with caution

Dose / Administration

ADULT	**PEDIATRIC**

Ventricular Arrhythmias / Atrial Fibrillation (Pre-Excited)
• IV
  ○ **20-50 mg/min** until:
  ▪ Arrhythmia suppression
  ▪ Hypotension
  ▪ QRS widens by > 50%
  ▪ Total dose 17 mg/kg reached
  ○ Maintenance infusion: **1-4 mg/min**
	(Always reference BROSELOW Tape)
	SVT / Ventricular Arrhythmias
	• IV / IO
	  ○ **15 mg/kg** over 30-60 min
	
	Note: Do not routinely administer Amiodarone and Procainamide together

PROMETHAZINE

(Trade Name: Phenergan)

Class / Mechanism of Action

- **Phenothiazine derivative Antiemetic, Histamine H1 Antagonist, Sedative**
  Blocks postsynaptic dopaminergic receptors in the brain; strong alpha adrenergic blocking effect and depresses release of hypothalamic and hypophyseal hormones; reduces stimuli to the reticular system.
  - Onset of action - IV: 5 mins; Duration: 4-6 hrs

Indications

- **Labeled Indications**
  - Symptomatic treatment for allergic conditions; antiemetic; motion sickness; sedative; adjunct to postoperative analgesia and anesthesia
- **Off-label Indications**
  - Treatment of nausea and vomiting of pregnancy

Contraindications

- Hypersensitivity to promethazine, phenothiazine allergy, or any component of the formulation
- Coma
- Children < 2 years old
- Intra-arterial and SubQ administration
- IV concentrations greater than 1 mg/mL; greater risk for tissue necrosis

Adverse Reactions / Precautions

- May cause bradycardia, hyper / hypotension, nonspecific QT changes, orthostatic hypotension, tachycardia. Life threatening arrhythmia has occurred with normal dosage
- May cause extrapyramidal symptoms (pseudoparkinsonism, acute dystonic reactions, akathisia, etc.)
- Avoid use in severe respiratory disease (asthma, COPD), and in patients using other sedatives or depressants: may lead to respiratory depression
- Vesicant (causes blisters): can cause severe tissue injury regardless of route of delivery
  - Deep IM injection or IV inline
  - For IV, ensure proper needle/catheter venous placement; avoid extravasation. Slow IVP over 1 min
- **Pregnancy:** Category C **Lactation:** Not recommended

Dose / Administration

ADULT

Antiemetic

- IM / IV push over > 1 min
  - **12.5 mg** not to exceed 25 mg. May repeat 12.5 mg once after 10 mins if first dose is ineffective. Subsequent dose of 25 mg may be given q 4-6 hrs
  - Can dilute with 10-20 mL of NS

Sedation, Analgesia / Hypnotic Adjunct

- IM / IV
  - **25-50 mg** in combination with analgesic or hypnotic (at reduced dosage)

Allergic Conditions (Including Allergic Reactions to Blood or Plasma)

- IM / IV
  - **25 mg;** may repeat in 2 hrs PRN

PEDIATRIC

(Always reference BROSELOW Tape)

Antiemetic

- IM / IV
  - Children ≥ 2 years: **0.25-0.5 mg/kg** 4-6 times a day PRN (max: 12.5 mg/dose)

Preoperative Analgesia / Hypnotic Adjunct

- IM / IV
  - Children ≥ 2 years: **1.1 mg/kg** in combination with an analgesic or hypnotic (at reduced dosage) and with an atropine like agent (at appropriate dosage)

Note: Promethazine dosage should not exceed half of suggested adult dosage

PROPOFOL

(Trade Name: Diprivan)

Class / Mechanism of Action

- **General Anesthetic**
  Lipophilic intravenous general anesthetic.
  - Onset of action - IV bolus: 9-51 secs (average 30 sec); Duration – Dose and rate dependent: 3-10 mins, prolonged with continued doses

Indications

- **Labeled Indications**
  - Induction of anesthesia in patients ≥ 3 years of age; maintenance of anesthesia in patients > 2 months of age; sedation in intubated, mechanically ventilated ICU patients

Contraindications

- Hypersensitivity to propofol or any component of the formulation
- Allergy to eggs, egg products, soybeans, soy products, and peanuts

Adverse Reactions / Precautions

- May cause hypotension especially in hypovolemic patients or if bolus dosing is used
  - Hypotension may result in a reduction of MAP exceeding 30%. Head Injury patients or those with suspected or known increased intracranial pressure are at increased risk of decreased cerebral perfusion pressure
- Do not use in pre-hospital trauma environment or in burn transfer patients unless directed by medical director or provided written orders by referring provider
- No Analgesic properties. Must supplement with analgesic agents
- Potential to cause seizures
- Pediatrics: use with opioids may cause serious bradycardia
- **Pregnancy:** Category B **Lactation:** Not recommended

Dose / Administration

ADULT

Sedation / RSI

- IV Push
  - **1-2.5 mg/kg** q 5-10 min PRN

Maintenance of General Anesthesia

- IV Infusion
  - **5-75 mcg/kg/min** via infusion pump or Dial-a-Drip. Titrate to minimum effective dose (max dose: 100 mcg/kg/min). **See infusion chart next page**

Note: Use of Dial-a-Drip tubing in the absence of an infusion pump will increase accuracy of infusion dosage

Note: Wait 3-5 min between dosage changes to clinically assess drug effects. Smaller doses are required when used with opioids

Note: Not preferred in Burn patients in the first 48-72 hrs

PEDIATRIC

(Always reference BROSELOW Tape)

Sedation / RSI

- IV Push
  - **1-2.5 mg/kg** q 5-10 mins

Maintenance of General Anesthesia

- IV Infusion
  - **16-66 mcg/kg/min** (or **1-4 mg/kg/hr**)

TABLE OF CONTENTS

PROPOFOL (DIPRIVAN)

Dosing Range: 10-75 mcg/kg/min (600-3000 mcg/kg/hr)

MIX 500 mg / 50 mL
CONCENTRATION 10 mg/mL

Patient Weight	Dose	Rate	Micro 60 gtt/mL	Macro		
				20 gtt/mL	15 gtt/mL	10 gtt/mL
kg	mcg/kg/min	mL/hr	gtt/min	gtt/min	gtt/min	gtt/min
50	10	3	3	1	1	1
	15	5	5	2	1	1
	20	6	6	2	2	1
	25	8	8	3	2	1
	30	9	9	3	2	2
	35	11	11	4	3	2
	40	12	12	4	3	2
	45	14	14	5	3	2
	50	15	15	5	4	3
	55	17	17	6	4	3
	60	18	18	6	5	3
	65	20	20	7	5	3
	70	21	21	7	5	4
	75	23	23	8	6	4
55	10	3	3	1	1	1
	15	5	5	2	1	1
	20	7	7	2	2	1
	25	8	8	3	2	1
	30	10	10	3	2	2
	35	12	12	4	3	2
	40	13	13	4	3	2
	45	15	15	5	4	2
	50	17	17	6	4	3
	55	18	18	6	5	3
	60	20	20	7	5	3
	65	21	21	7	5	4
	70	23	23	8	6	4
	75	25	25	8	6	4
60	10	4	4	1	1	1
	15	5	5	2	1	1
	20	7	7	2	2	1
	25	9	9	3	2	2
	30	11	11	4	3	2
	35	13	13	4	3	2
	40	14	14	5	4	2
	45	16	16	5	4	3
	50	18	18	6	5	3
	55	20	20	7	5	3
	60	22	22	7	5	4
	65	23	23	8	6	4
	70	25	25	8	6	4
	75	27	27	9	7	5
65	10	4	4	1	1	1
	15	6	6	2	1	1
	20	8	8	3	2	1
	25	10	10	3	2	2
	30	12	12	4	3	2
	35	14	14	5	3	2
	40	16	16	5	4	3
	45	18	18	6	4	3
	50	20	20	7	5	3
	55	21	21	7	5	4
	60	23	23	8	6	4
	65	25	25	8	6	4
	70	27	27	9	7	5
	75	29	29	10	7	5
70	10	4	4	1	1	1
	15	6	6	2	2	1
	20	8	8	3	2	1
	25	11	11	4	3	2
	30	13	13	4	3	2
	35	15	15	5	4	2
	40	17	17	6	4	3
	45	19	19	6	5	3
	50	21	21	7	5	4
	55	23	23	8	6	4
	60	25	25	8	6	4
	65	27	27	9	7	5
	70	29	29	10	7	5
	75	32	32	11	8	5
75	10	5	5	2	1	1
	15	7	7	2	2	1
	20	9	9	3	2	2
	25	11	11	4	3	2
	30	14	14	5	3	2
	35	16	16	5	4	3
	40	18	18	6	5	3
	45	20	20	7	5	3
	50	23	23	8	6	4
	55	25	25	8	6	4
	60	27	27	9	7	5
	65	29	29	10	7	5
	70	32	32	11	8	5
	75	34	34	11	8	6

Macro-Drip (20 gtt/ml) or Micro-Drip is set of choice for this infusion

Titrate to minimum effective dose. Allow 3-5 minutes between dosing changes to sedative and hemodynamic effects

PROPOFOL (DIPRIVAN)

Dosing Range: 10-75 mcg/kg/min (600-3000 mcg/kg/hr)

MIX 500 mg / 50 mL
CONCENTRATION 10 mg/mL

Patient Weight	Dose	Rate	Micro 60 gtt/mL	Macro		
				20 gtt/mL	15 gtt/mL	10 gtt/mL
kg	mcg/kg/min	mL/hr	gtt/min	gtt/min	gtt/min	gtt/min
80	10	5	5	2	1	1
	15	7	7	2	2	1
	20	10	10	3	2	2
	25	12	12	4	3	2
	30	14	14	5	4	2
	35	17	17	6	4	3
	40	19	19	6	5	3
	45	22	22	7	5	4
	50	24	24	8	6	4
	55	26	26	9	7	4
	60	29	29	10	7	5
	65	31	31	10	8	5
	70	34	34	11	8	6
	75	36	36	12	9	6
85	10	5	5	2	1	1
	15	8	8	3	2	1
	20	10	10	3	3	2
	25	13	13	4	3	2
	30	15	15	5	4	3
	35	18	18	6	4	3
	40	20	20	7	5	3
	45	23	23	8	6	4
	50	26	26	9	6	4
	55	28	28	9	7	5
	60	31	31	10	8	5
	65	33	33	11	8	6
	70	36	36	12	9	6
	75	38	38	13	10	6
90	10	5	5	2	1	1
	15	8	8	3	2	1
	20	11	11	4	3	2
	25	14	14	5	3	2
	30	16	16	5	4	3
	35	19	19	6	5	3
	40	22	22	7	5	4
	45	24	24	8	6	4
	50	27	27	9	7	5
	55	30	30	10	7	5
	60	32	32	11	8	5
	65	35	35	12	9	6
	70	38	38	13	9	6
	75	41	41	14	10	7
95	10	6	6	2	1	1
	15	9	9	3	2	1
	20	11	11	4	3	2
	25	14	14	5	4	2
	30	17	17	6	4	3
	35	20	20	7	5	3
	40	23	23	8	6	4
	45	26	26	9	6	4
	50	29	29	10	7	5
	55	31	31	10	8	5
	60	34	34	11	9	6
	65	37	37	12	9	6
	70	40	40	13	10	7
	75	43	43	14	11	7
100	10	6	6	2	2	1
	15	9	9	3	2	2
	20	12	12	4	3	2
	25	15	15	5	4	3
	30	18	18	6	5	3
	35	21	21	7	5	4
	40	24	24	8	6	4
	45	27	27	9	7	5
	50	30	30	10	8	5
	55	33	33	11	8	6
	60	36	36	12	9	6
	65	39	39	13	10	7
	70	42	42	14	11	7
	75	45	45	15	11	8
105	10	6	6	2	2	1
	15	9	9	3	2	2
	20	13	13	4	3	2
	25	16	16	5	4	3
	30	19	19	6	5	3
	35	22	22	7	6	4
	40	25	25	8	6	4
	45	28	28	9	7	5
	50	32	32	11	8	5
	55	35	35	12	9	6
	60	38	38	13	9	6
	65	41	41	14	10	7
	70	44	44	15	11	7
	75	47	47	16	12	8

Macro-Drip (20 gtt/ml) or Micro-Drip is set of choice for this infusion

Titrate to minimum effective dose. Allow 3-5 minutes between dosing changes to sedative and hemodynamic effects

ROCURONIUM

(Trade Name: Zemuron)

Class / Mechanism of Action

- **Nondepolarizing Neuromuscular Blocking Agent (Paralytic)**
  Blocks acetylcholine from binding to motor neuron receptors inhibiting depolarization.
  - Onset of action – IV: 45 sec to 3 min (can be fast with higher doses and / or faster pushes);
    Duration – IV: approximately 20-120 min (increases with higher doses or hypothermia)

Indications

- **Labeled Indications**
  - Rapid Sequence Intubation / paralysis and routine endotracheal intubation, facilitates mechanical ventilation in ICU patients

Contraindications

- Hypersensitivity (e.g., anaphylaxis) to rocuronium, other neuromuscular-blocking agents, or any component of the formulation

Adverse Reactions / Precautions

- Resistance may occur in burn patients (> 30% of body) for period of 5-70 days after injury
- High potential for interactions: numerous drugs either antagonize (e.g., acetylcholinesterase inhibitors) or potentiate (e.g., calcium channel blockers, certain antimicrobials, inhalation anesthetics, lithium, magnesium salts, procainamide, and quinidine) the effects of neuromuscular blockade; use with caution in patients receiving these agents
- **Provides NO analgesia or sedation! Must provide appropriate sedation and analgesia prior to paralytic use and throughout maintenance**
- **Pregnancy:** Category C **Lactation:** Use caution

Dose / Administration

ADULT	**PEDIATRIC**
	(Always reference BROSELOW Tape)
Rapid Sequence Intubation	**Rapid Sequence Intubation**

• IV / IO
  ○ **1 mg/kg** q 30-45 min (Dosing ranges from **0.45-1.2 mg/kg**)
	• IV / IO
	  ○ **1 mg/kg** q 30-45 min (Dosing ranges from **0.6-1.2 mg/kg**)

Note: In adult patients with morbid obesity (BMI > 50), use dose of **1.2 mg/kg** using ideal body weight (IBW)	

SODIUM BICARBONATE

Class / Mechanism of Action

- **Alkalinizing Agent; Antacid**
  Provides bicarbonate ion to neutralize hydrogen ion concentration and raise blood and urinary pH.
  - Onset of action – IV: 15 min; Duration – PO: 1-3 hrs, IV: 15 min

Indications

- **Labeled Indications**
  - Management of metabolic acidosis, hyperkalemia, overdose of certain drugs (including tricyclic antidepressants and aspirin), and gastric hyperacidity

Contraindications

- Chloride loss due to vomiting or from continuous GI suction; concomitant use of diuretics known to produce hypochloremic alkalosis
- Alkalosis, hypernatremia, hypocalcemia

Adverse Reactions / Precautions

- Use should be reserved for documented severe metabolic acidosis and for severe / emergent hyperkalemia (e.g., cardiotoxicity or cardiac arrest). Routine use in cardiac arrest is not recommended
- Avoid extravasation, tissue necrosis can occur
- Can cause hypernatremia, hypocalcemia, hypokalemia, intracranial acidosis, metabolic alkalosis
- Use caution in patients with edema, heart failure, cirrhosis, and kidney impairment
- **Lactation:** Safe

Dose / Administration

ADULT

Tricyclic Antidepressant Overdose

- IV
  - **1-2 mEq/kg**; May repeat to maintain QRS < 100
  - Start Maintenance Infusion: **100-150 mEq** (2-3 amps) in 1 L D5/NS at 100-200 mL/hr

Cardiac Arrest

- IV
  - **1 mEq/kg/dose**; repeat doses should be guided by arterial blood gases

Note: Routine use in cardiac arrest is not recommended. Use may be considered in cases of prolonged cardiac arrest once adequate alveolar ventilation and effective cardiac compressions have been established. In some cardiac arrest situations (e.g., metabolic acidosis, hyperkalemia, or tricyclic antidepressant overdoes), sodium bicarbonate may be beneficial

PEDIATRIC

(Always reference BROSELOW Tape)

Hyperkalemia w/ Widen QRS / Severe Metabolic Acidosis (Prolonged Cardia Arrest/Resuscitation)

- IV / IO
  - **1 mEq/kg**; given slowly

Tricyclic Antidepressant / Sodium Channel Blocker Overdose

- IV
  - Titrate to maintain a serum PH of 7.45 to 7.55; follow with a 150 mEq/L infusion to maintain metabolic alkalosis

Note: Use 0.5 mEQ/mL (4.2%) concentration only for infants < 1 month or dilute available stock to this concentration

SUCCINYLCHOLINE

(Trade Name: Anectine)

Class / Mechanism of Action

- **Depolarizing Neuromuscular Blocking Agent (Paralytic)**
  Acts like acetylcholine. Produces myoneural depolarization causing sustained flaccid skeletal muscle
  paralysis.
  - Onset of action - IV: 30-60 secs; Duration – IV: 4-10 min with single dose

Indications

- **Labeled Indications**
  - Rapid Sequence Intubation and routine endotracheal intubation

Contraindications

- Hypersensitivity to succinylcholine or any component of the formulation
- Acute phase of injury following major burns, multiple trauma (greater than 5 days after injury)
- Skeletal muscle myopathies
- **DO NOT USE IN PATIENTS WITH BURNS, CRUSH INJURIES, OR HYPERKALEMIA**
- Neuromuscular disease (muscular dystrophy, spinal muscular atrophy, etc.)

Adverse Reactions / Precautions

- May cause bradycardia, malignant hyperthermia, and increased intraocular pressure
- Severe hyperkalemia can develop in cases of chronic abdominal infection, burn injury, children with skeletal muscle myopathy, subarachnoid hemorrhage, or conditions which cause degeneration of the nervous system commonly greater than 5 days old. Potassium increase of 0.5 mEq/L is expected with use
- Re-dosing is not advised due to increased risk of hyperkalemia
- **Provides NO analgesia or sedation! Must provide appropriate sedation and analgesia prior to paralytic use and throughout maintenance**
- Pediatrics: risk of ventricular dysrhythmias, cardiac arrest, and death from hyperkalemic rhabdomyolysis
- **Pregnancy:** Category C **Lactation:** Use caution

Dose / Administration

ADULT	**PEDIATRIC** (Always reference BROSELOW Tape)

Rapid Sequence Intubation / Neuromuscular Blockade
• IV / IO
  ○ **1.5 mg/kg**
 	
Note: Pretreatment with 10% dosage of nondepolarizing agents prior to neuromuscular blockade with Succinylcholine is NO LONGER ADVISED
	Rapid Sequence Intubation / Neuromuscular Blockade
	• IV / IO
	  ○ < 5 y/o: **2 mg/kg/dose**
	  ○ > 5 y/o: **1.5 mg/kg/dose**
	
	Note: Pretreatment with 10% dosage of nondepolarizing agents prior to neuromuscular blockade with Succinylcholine is NO LONGER ADVISED

THIAMINE

(Trade Name: Vitamin B1)

Class / Mechanism of Action

- **Vitamin, Water Soluble**
  Essential coenzyme in carbohydrate metabolism.
  - Onset of action – IV / IM: Rapid

Indications

- **Labeled Indications**
  - Treatment of thiamine deficiency including beriberi, Wernicke's encephalopathy, Korsakoff's syndrome, neuritis associated with pregnancy, or in alcoholic patients

Contraindications

- Hypersensitivity to thiamine or any component of the formulation

Adverse Reactions / Precautions

- Administration of dextrose may worsen acute symptoms of thiamine deficiency; use caution when low thiamine is suspected
- Flushing sensation, diaphoresis, pruritus, skin sclerosis or tenderness at IM injection site
- Cyanosis, pharyngeal edema, pulmonary edema
- Nausea
- **Pregnancy:** Category A **Lactation:** Use caution

Dose / Administration

ADULT	**PEDIATRIC** (Always reference BROSELOW Tape)

AMS, Seizure, Syncope, Malnutrition, Vomiting and Diarrhea, w/ Hx of EtOH Abuse
• IV / IM
  ○ **100 mg/day**
	Nutrition Maintenance Requirement
	• IV / IM
	  ○ Infants: **0.35-0.5 mg/kg/day** (max DAILY dose: 1.2 mg/day)
	  ○ Children: **1.2 mg/day**

TRANEXAMIC ACID

(Trade Name: Cyklokapron/Lysteda)

Class / Mechanism of Action

- **Antifibrinolytic Agent, Hemostatic Agent**
  Displaces plasminogen from fibrin resulting in inhibition of fibrinolysis and inhibits the proteolytic activity of
  plasmin.

Indications

- **Off-label Indications**
  - Trauma-associated hemorrhage: casualty likely needing blood transfusion (hemorrhagic shock, elevated lactate, one or more major amputations, penetrating torso trauma, or evidence of severe bleeding)
  - Postpartum hemorrhage (continued bleeding despite Oxytocin and fundal massage)
  - Post-operative hemorrhage by dissection, enteric staples or suspected internal bleeding
  - Signs or symptoms of moderate or severe TBI or altered mental status associated with trauma

Contraindications

- **TXA is contraindicated in trauma if dose is not given within the first 3 hours following traumatic event (ideal dosing timeframe is as soon as possible)**
- Hypersensitivity to tranexamic acid or any component of the formulation
- Non-traumatic subarachnoid hemorrhage
- Thromboembolic disease (Cerebral Thrombosis, DVT, PE)

Adverse Reactions / Precautions

- Disseminated intravascular coagulation (DIC): Use with extreme caution in patients with DIC requiring antifibrinolytic therapy; patients should be under strict supervision of a physician experienced in treating this disorder. TXA should be used in Pt.'s with trauma related DIC however
- Thrombosis (especially when given after 3 hours from injury)
- Seizures have been reported; myoclonus is noted in 20% of patients after administration
- Visual defects have been reported: vision color change, impairment, loss; retinal artery and venous occlusion
- **Pregnancy:** Category B **Lactation:** Use caution

Dose / Administration

ADULT

Trauma-Associated Hemorrhage / Severe TBI (Off-labeled use)

- IV / IO
  - Initial: **2 g** in 100 mL NS or LR bolus over 10 min, or **2 g** IV / IO push (given over 10 min), < 3 hrs from time of injury

Suspected Post-Operative Hemorrhage by Dissection, Enteric Staples or Suspected Internal Bleeding

- IV / IO
  - **2 g** in 100 mL NS or LR bolus over 10 min, or **2 g** IV / IO push (given over 10 min), < 3 hrs from time of injury

PEDIATRIC

(Always reference BROSELOW Tape)

Trauma-Associated Hemorrhage (Off-labeled use)

- IV / IO
  - Loading dose: **15 mg/kg** over 10 minutes (max dose: 1 g), followed by **2 mg/kg/hr** for 8 hrs (max dose: 1 g)

VASOPRESSIN

(Trade Name: Vasostrict)

Class / Mechanism of Action

- **Antidiuretic Hormone Analog-Vasopressor**
  At therapeutic doses used for vasodilatory shock, stimulates the V1 receptor and increases systemic vascular resistance and mean arterial blood pressure; When the V2 receptor is stimulated, cyclic adenosine monophosphate (cAMP) increases, increasing water permeability at the renal tubule resulting in decreased urine volume and increased osmolality. At pressor doses, it causes smooth muscle contraction in GI tract by stimulating muscular V1 receptors and release of prolactin and ACTH via V3 receptors.
  - Onset of action – IV: Rapid with peak effect occurring within 15 mins of initiation of continuous IV infusion; Duration: Within 20 mins after IV infusion terminated

Indications

- **Labeled Indications**
  - Treatment of hypotension, vascular failure in shock

Contraindications

- Hypersensitivity to Vasopressin or any component of the formulation
- Use with caution in patients with asthma**,** cardiovascular disease**,** renal disease**,** or a history of seizure disorder

Adverse Reactions / Precautions

- **Maximize use of Blood products / Crystalloids before considering use in hemorrhagic shock, secondary to norepinephrine**
- Assure adequate circulatory volume to minimize the need for vasoconstrictors. Monitor BP closely, avoid hypertension and adjust infusion rate as needed
- May cause a decrease in heart rate and cardiac output due to V1 receptor stimulation
- Vesicant: Avoid extravasation, will cause tissue damage/necrosis, ensure proper needle placement
- Cardiac arrhythmias are possible, monitor with 12 lead EKG
- **Pregnancy:** Use with caution, clearance in 2nd and 3rd trimester longer due to physiological changes **Lactation:** Unknown

Dose / Administration

ADULT

Hypotension / Shock

- IV Infusion
  - **0.04 units/min** infusion to maintain MAP > 65 mmHg

Note: Vasopressors should be used if patient is hypotensive after fluid resuscitation to maintain mean arterial pressure (MAP) ≥ 65 mmHg

Note: Use in addition to norepinephrine for raising MAP to target or to decrease norepinephrine dosage

Note: Titrate to lowest effective dose

PEDIATRIC

(Always reference BROSELOW Tape)

Hypotension / Shock (Limited data available; efficacy results have varied)

- IV / IO Infusion
  - **0.0002-0.002 units/kg/min (0.2-2 milliunits/kg/min)**

Note: Titrate to lowest effective dose

VECURONIUM

(Trade Name: Norcuron)

Class / Mechanism of Action

- **Nondepolarizing Neuromuscular Blocking Agent (Paralytic)**
  Blocks acetylcholine from binding to motor neuron receptors inhibiting depolarization.
  - Onset of action – IV: 2-5 mins; Duration – IV: approximately 35-65 mins

Indications

- **Labeled Indications**
  - Rapid sequence intubation and neuromuscular blockade

Contraindications

- Hypersensitivity to vecuronium or any component of the formulation

Adverse Reactions / Precautions

- Resistance may occur in burn patients (> 30% of body) for period of 5-70 days after injury
- High potential for interactions: Numerous drugs either antagonize (e.g., acetylcholinesterase inhibitors) or potentiate (e.g., calcium channel blockers, certain antimicrobials, inhalation anesthetics, lithium, magnesium salts, procainamide, and quinidine) the effects of neuromuscular blockade; use with caution in patients receiving these agents
- Provides NO analgesia or sedation! Must provide appropriate sedation and analgesia prior to paralytic use and throughout maintenance
- **Pregnancy:** Use with caution **Lactation:** Unknown

Dose / Administration

ADULT	**PEDIATRIC**
	(Always reference BROSELOW Tape)
RSI and Maintenance of Paralysis	**RSI and Maintenance of Paralysis**

• IV Push
  ○ Induction: **0.1 mg/kg** (dose range: **0.08-0.1 mg/kg**) q 30-60 mins PRN
	• IV Push
	  ○ Induction: **0.1 mg/kg** (dose range: **0.08-0.1 mg/kg/dose**)

Y-SITE AND SOLUTION COMPATABILITY

PURPOSE:

The following contains the compatibility information presented on the following two charts:

- Y-site Compatibility: A single drug that is administered simultaneously at a Y-site connection with another drug in a solution
- Solution Compatibility: A single drug in a solution

**Note: The resource utilized can provide additional information containing the specific studies noted in the Incompatible or Uncertain categories. It can also perform additional drug mixture compatibility (ex, admixture and syringe compatibility).

Compatible "C"	No change in visible or electronically determined particulates, haziness or turbidity, frank precipitation, color, or evolution of a gas
	All drug components in the test samples were found to be chemically stable (<10% loss of intact drug) for at least 24 hours under the conditions being tested.
	All drug components in the test samples were found to be chemically stable (<10% loss of intact drug) for the entire period of the study under the conditions being tested, even if the study period was <24 hours.
Incompatible "N"	A change in visible or electronically viewed (even if not visible) particulates; haziness or turbidity, frank precipitation, or color or gas evolution occurred
	One or more drug components in the test samples exhibited a loss of intact drug >10% within 24 hours under the conditions being tested.
Uncertain "U"	For research results that do not fit these conventional guidelines, the research results are designated as Uncertain or Variable. Apply judgment in using these results. Examples include:
	• A transient precipitation formed upon mixing but then disappeared. The precipitate may or may not show up again later.
	• Among repeat test samples, microparticulate formation was electronically determined to have formed in some samples but not others.
	• The test drug in a solution was stable in one container type but not another or with some drug delivery devices but not others.
	• Compatibility of a drug(s) is dependent on the manufacturer(s) of the products and/or the use of specific product formulations.
	• When both compatible and incompatible study results are available for the same drug pair. Many of these may be due to differences in concentrations of either drug or in the solution diluent.
	• Any other research result that does not fit the conventional guidelines of compatibility or incompatibility
No data "NA"	No data for administration methods chosen
N/A "/"	Not applicable

Reference: UpToDate® Lexidrug™ Trissel's™ 2 IV Compatibility

Y-SITE COMPATABILITY CHART

	Y-Site	Amiodarone	Calcium Chloride	Calcium Gluconate	Dexmedetomidine	Diltiazem	DOBUTamine	DOPamine	Epinephrine	Fentanyl	Furosemide	Heparin	Insulin (regular)	Ketamine	Ketorolac	Levetiracetam	Lorazepam	Magnesium Sulfate	Metoprolol	Midazolam	Morphine Sulfate	Nicardipine	Nitroglycerin	Norepinephrine	Pantoprazole	Phenylephrine	Phenytoin	Potassium Chloride	Propofol	Vasopressin
		MEDICATIONS																												
SOLUTIONS	0.9% NS	U	/	/	C	/	/	/	/	/	/	/	/	/	/	/	/	/	C	/	/	/	U	/	C	/	/	/	/	/
	D5W	/	/	/	C	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	C	/	/	/	C	/
	LR	U	C	C	C	/	C	C	C	C	C	C	U	**N**	C	/	**N**	C	C	C	C	C	U	C	/	C	**N**	C	U	C
	3% Hypertonic Saline	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Albumin	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Plasma Lyte-A	**N**	C	C	/	/	C	C	C	C	C	C	/	C	/	/	/	C	C	U	C	C	C	C	**N**	/	**N**	C	**N**	/
MEDICAITONS	Amiodarone		C	U	C	C	U	C	C	U	U	**N**	U	C	**N**	/	C	U	C	C	C	C	C	U	U	C	**N**	U	/	C
	Calcium Chloride	C		C	C	C	C	C	C	C	C	U	C	/	**N**	/	C	**N**	C	C	C	C	C	C	**N**	C	**N**	U	**N**	C
	Calcium Gluconate	C	C		C	C	C	C	C	C	C	U	C	C	U	/	C	C	C	C	C	C	C	C	U	C	**N**	C	C	C
	Dexmedetomidine	C	C	C		C	C	C	C	C	C	C	C	**N**	C	C	C	C	C	C	C	C	C	C	**N**	C	**N**	C	C	C
	Diltiazem	C	C	C	C		C	C	C	C	**N**	U	U	/	**N**	/	C	C	C	C	C	C	C	C	**N**	C	**N**	C	/	C
	DOBUTamine	U	C	C	C	C		C	C	C	U	U	U	C	**N**	/	C	C	C	U	C	C	C	C	**N**	C	**N**	C	U	C
	DOPamine	C	C	C	C	C	C		C	C	U	C	U	C	C	/	C	C	C	C	C	C	C	C	U	C	**N**	C	U	C
	Epinephrine	C	C	C	C	C	C	C		C	C	C	U	C	C	/	C	C	C	C	C	C	C	C	U	C	**N**	C	U	C
	Fentanyl	U	C	C	C	C	C	C	C		C	C	C	/	C	/	C	C	C	C	C	C	C	C	U	C	**N**	C	C	C
	Furosemide	U	C	C	C	**N**	U	U	C	C		U	U	**N**	C	/	C	U	C	U	U	**N**	U	U	U	U	**N**	C	C	U
	Heparin	**N**	U	U	C	U	U	C	C	C	U		U	**N**	C	**N**	C	C	C	U	C	U	C	C	U	C	**N**	C	C	C
	Insulin (regular)	U	C	C	C	U	U	U	U	C	U	U		**N**	C	/	C	C	C	U	U	/	C	U	U	**N**	**N**	C	C	U
	Ketamine	C	/	C	**N**	/	C	C	C	/	**N**	**N**	**N**		/	/	U	C	/	C	/	/	U	/	/	/	**N**	C	C	/
	Ketorolac	**N**	**N**	U	C	**N**	**N**	C	C	C	C	C	C	/		/	C	C	C	**N**	C	**N**	C	C	**N**	C	**N**	C	/	C
	Levetiracetam	/	/	/	C	/	/	/	/	/	/	**N**	/	/	/		/	/	/	/	/	/	/	C	/	/	/	/	C	C
	Lorazepam	C	C	C	C	C	C	C	C	C	C	C	C	U	C	/		C	C	C	C	U	C	C	**N**	C	**N**	C	C	C
	Magnesium	U	**N**	C	C	C	C	C	C	C	U	C	C	C	C	/	C		C	C	C	C	C	C	U	C	**N**	C	U	C
	Metoprolol	C	C	C	C	C	C	C	C	C	C	C	C	/	C	/	C	C		C	C	C	U	C	**N**	C	**N**	C	/	C
	Midazolam	C	C	C	C	C	U	C	C	C	U	U	U	C	**N**	/	C	C	C		C	C	C	C	U	C	**N**	C	U	C
	Morphine	C	C	C	C	C	C	C	C	C	U	C	U	/	C	/	C	C	C	C		C	C	C	U	C	**N**	C	U	C
	Nicardipine	C	C	C	C	C	C	C	C	C	**N**	U	/	/	**N**	/	U	C	C	C	C		C	C	**N**	C	**N**	C	/	C
	Nitroglycerin	C	C	C	C	C	C	C	C	C	U	C	C	U	C	/	C	C	U	C	C	C		C	U	C	**N**	C	U	C
	Norepinephrine	U	C	C	C	C	C	C	C	C	U	C	U	/	C	C	C	C	C	C	C	C	C		U	C	**N**	C	C	C
	Pantoprazole	U	**N**	U	**N**	**N**	**N**	U	U	U	U	U	U	/	**N**	/	**N**	U	**N**	U	U	**N**	U	U		C	**N**	C	U	C
	Phenylephrine	C	C	C	C	C	C	C	C	C	U	C	**N**	/	C	/	C	C	C	C	C	C	C	C	C		**N**	C	U	C
	Phenytoin	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	/	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**		**N**	**N**	**N**
	Potassium Chloride	U	U	C	C	C	C	C	C	C	C	C	C	C	C	/	C	C	C	C	C	C	C	C	C	C	**N**		C	C
	Propofol	/	**N**	C	C	/	U	U	U	C	C	C	C	C	/	C	C	U	/	U	U	/	U	C	U	U	**N**	C		/
	Vasopressin	C	C	C	C	C	C	C	C	C	U	C	U	/	C	C	C	C	C	C	C	C	C	C	C	C	**N**	C	/	

SOLUTION COMPATABILITY CHART

	Solution	MEDICATIONS																													
		Amiodarone	Calcium Chloride	Calcium Gluconate	Dexmedetomidine	Diltiazem	DOBUTamine	DOPamine	Epinephrine	Fentanyl	Furosemide	Heparin	Insulin (regular)	Ketamine	Ketorolac	Levetiracetam	Lorazepam	Magnesium Sulfate	Metoprolol	Midazolam	Morphine Sulfate	Nicardipine	Nitroglycerin	Norepinephrine	Pantoprazole	Phenylephrine	Phenytoin	Potassium Chloride	Propofol	Vasopressin
SOLUTIONS	0.9% NS	U	C	C	C	C	C	C	C	C	C	U	U	C	C	C	C	U	C	C	C	C	C	/	C	C	C	U	C	U	C
	D5W	C	C	C	/	C	C	C	C	C	C	U	C	C	C	C	C	U	C	C	C	C	C	U	C	C	C	**N**	C	U	C
	LR	/	/	C	/	/	C	C	C	/	C	U	/	/	C	C	U	C	/	U	C	U	U	C	/	C	**N**	C	/	/
	3% Hypertonic Saline	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	C	/	/
	Albumin	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
	Plasma Lyte-A	/	/	/	/	/	C	C	C	/	C	/	/	/	C	/	/	/	/	**N**	C	/	/	/	/	/	/	/	/	/

mcg/ml
mg/ml

Fluid volume for Dilution

DRUG DOSE	5cc	10cc	20cc	50cc	100cc	250cc	500cc	1000cc
1mcg	0.20mcg/ml	0.1mcg/ml	0.05mcg/ml	0.02mcg/ml	0.01mcg/ml	0.004mcg/ml	0.002mcg/ml	0.001mcg/ml
5mcg	1mcg/ml	0.5mcg/ml	0.25mcg/ml	0.1mcg/ml	0.05mcg/ml	0.02mcg/ml	0.01mcg/ml	0.005mcg/ml
10mcg	2mcg/ml	1mcg/ml	0.5mcg/ml	0.2mcg/ml	0.1mcg/ml	0.04mcg/ml	0.02mcg/ml	0.01mcg/ml
25mcg	5mcg/ml	2.5mcg/ml	1.25mcg/ml	0.5mcg/ml	0.25mcg/ml	0.1mcg/ml	0.05mcg/ml	0.025mcg/ml
50mcg	10mcg/ml	5mcg/ml	2.5mcg/ml	1mcg/ml	0.5mcg/ml	0.2mcg/ml	0.1mcg/ml	0.05mcg/ml
100mcg	20mcg/ml	10mcg/ml	5mcg/ml	2mcg/ml	1mcg/ml	0.4mcg/ml	0.2mcg/ml	0.1mcg/ml
250mcg	50mcg/ml	25mcg/ml	12.5mcg/ml	5mcg/ml	2.5mcg/ml	1mcg/ml	0.5mcg/ml	0.25mcg/ml
500mcg	0.1mg/ml	50mcg/ml	25mcg/ml	10mcg/ml	5mcg/ml	2mcg/min	1mcg/ml	0.5mcg/ml
1mg	0.2mg/ml	0.1mg/ml	50mcg/ml	20mcg/ml	10mcg/ml	4mcg/ml	2mcg/ml	1mcg/ml
2mg	0.4mg/ml	0.2mg/ml	0.1mg/ml	40mcg/ml	20mcg/ml	8mcg/ml	4mcg/ml	2mcg/ml
3mg	0.6mg/ml	0.3mg/ml	0.15mg/ml	60mcg/ml	30mcg/ml	12mcg/ml	6mcg/ml	3mcg/ml
4mg	0.8mg/ml	0.4mg/ml	0.2mg/ml	80mcg/ml	40mcg/ml	16mcg/ml	8mcg/ml	4mcg/ml
5mg	1mg/ml	0.5mg/ml	0.25mg/ml	0.1mg/ml	50mcg/ml	20mcg/ml	10mcg/ml	5mcg/ml
6mg	1.2mg/ml	0.6mg/ml	0.3mg/ml	0.12mg/ml	60mcg/ml	24mcg/ml	12mcg/ml	6mcg/ml
7mg	1.4mg/ml	0.7mg/ml	0.35mg/ml	0.14mg/ml	70mcg/ml	28mcg/ml	14mcg/ml	7mcg/ml
8mg	1.6mg/ml	0.8mg/ml	0.4mg/ml	0.16mg/ml	80mcg/ml	32mcg/ml	16mcg/ml	8mcg/ml
9mg	1.8mg/ml	0.9mg/ml	0.45mg/ml	0.18mg/ml	90mcg/ml	36mcg/ml	18mcg/ml	9mcg/ml
10mg	2mg/ml	1mg/ml	0.5mg/ml	0.2mg/ml	0.1mg/ml	40mcg/ml	20mcg/ml	10mcg/ml
15mg	3mg/ml	1.5mg/ml	0.75mg/ml	0.3mg/ml	0.15mg/ml	60mcg/ml	30mcg/ml	15mcg/ml
25mg	5mg/ml	2.5mg/ml	1.25mg/ml	0.5mg/ml	0.25mg/ml	0.1mg/ml	50mcg/ml	25mcg/ml
50mg	10mg/ml	5mg/ml	2.5mg/ml	1mg/ml	0.5mg/ml	0.2mg/ml	0.1mg/ml	50mcg/ml
75mg	15mg/ml	7.5mg/ml	3.75mg/ml	1.5mg/ml	0.75mg/ml	0.3mg/ml	0.15mg/ml	75mcg/ml
100mg	20mg/ml	10mg/ml	5mg/ml	2mg/ml	1mg/ml	0.4mg/ml	0.2mg/ml	0.1mg/ml
250mg	50mg/ml	25mg/ml	12.5mg/ml	5mg/ml	2.5mg/ml	1mg/ml	0.5mg/ml	0.25mg/ml
500mg	100mg/ml	50mg/ml	25mg/ml	10mg/ml	5mg/ml	2mg/ml	1mg/ml	0.5mg/ml
750mg	150mg/ml	75mg/ml	37.5mg/ml	15mg/ml	7.5mg/ml	3mg/ml	1.5mg/ml	0.75mg/ml
1Gram	200mg/ml	100mg/ml	50mg/ml	20mg/ml	10mg/ml	4mg/ml	2mg/ml	1mg/ml

Value equals amount of fluid in each ml of dilution

Each ml of medication diluted into your chosen fluid still counts towards total solution volume (i.e. 1ml of drug + 4ml fluid = 5ml solution; 1ml drug + 9ml fluid = 10ml solution). Small volume medications (1-2ml) are inconsequential above dilutions >50ml

1mg=1000mcg	0.1mg=100mcg	0.01mg=10mcg

VASOPRESSOR PRIORITY CHART

	HYPOVOLEMIC SHOCK	SEPTIC SHOCK	CARDIOGENIC SHOCK	NEUROGENIC SHOCK	BURN SHOCK
1°	Vasopressors are not recommended in the initial stabilization of hypovolemic shock	Norepinephrine	Norepinephrine	Norepinephrine	Vasopressin
2°	Norepinephrine	Epinephrine (add-on)	Dobutamine[5]	Vasopressin (add-on)	Norepinephrine
3°	Vasopressin (add-on)	Phenylephrine	Epinephrine	Epinephrine	Epinephrine

- Vasopressors should only be initiated with/after adequate resuscitation is provided with crystalloids, colloids, and/or blood products.
- Maintain mean arterial pressure (MAP) 65 mmHg or as needed to achieve adequate end-organ perfusion (e.g. cerebral perfusion pressure, abdominal perfusion pressure, urinary output).

1. Norepinephrine: Vasopressor of choice in septic, cardiogenic, and hypovolemic shock.
2. Epinephrine: Vasopressor of choice for Anaphylactic Shock. Used as an add-on agent to norepinephrine in septic shock when an additional agent is required to raise MAP to target and occasionally an alternative first-line agent if norepinephrine is contraindicated.
3. Vasopressin: Add-on to norepinephrine to raise blood pressure to target MAP or decrease norepinephrine requirement. Not recommended as a replacement for a first-line vasopressor.
4. Phenylephrine: Alternative vasopressor for patients with septic shock who: (1) develop tachyarrhythmias on norepinephrine, epinephrine, or dopamine, (2) have persistent shock despite use of two or more vasopressor/ inotropic agents including vasopressin (salvage therapy), or (3) high cardiac output with persistent hypotension.
5. Dobutamine: Initial agent of choice in cardiogenic shock with low cardiac output and maintained blood pressure. Add-on to norepinephrine for cardiac output augmentation in septic shock with myocardial dysfunction (eg, in elevated left ventricular filling pressures and adequate MAP) or ongoing hypoperfusion despite adequate intravascular volume and use of vasopressor agents.
6. Due to the physiologic nature of Neurogenic Shock, vasopressors may be initiated earlier to avoid volume overload.

HEMORRHAGE CONTROL PROCEDURES

CLINICAL INDICATIONS:

- Hemorrhage

CONTRAINIDICATIONS:

- None

PROCEDURE:

- Rapid bleeding and/or arterial source recognized (extremities, axial, inguinal)
    - immediate application of extremity and/or junctional tourniquets, as appropriately needed, to stop bleeding.
- For compressible (external) hemorrhage not amenable to limb tourniquet, use Combat Gauze, the CoTCCC hemostatic dressing of choice.
    - Alternative hemostatic adjuncts:
        - Celox Gauze, ChitoGauze, XStat (best for deep, narrow-tract junctional wounds) or iTCLamp (may be used alone or in conjunction with hemostatic dressing or XStat).
- Hemostatic dressings should be applied with at least 3 minutes of direct pressure (optional for XStat). Must apply adequate force to compress vessels. If size of wound and bleeding are concerning for adequate control, place hemostatic dressing as close to the bleeding vessel as possible followed by 5 min of direct pressure. Each dressing works differently, so if one fails to control bleeding, it may be removed and a fresh dressing of the same type or a different type applied. (Note: XStat is not to be removed in the field, but additional XStat, other hemostatic adjuncts, or trauma dressings may be applied over it.) If bleeding continues, apply a pressure dressing to the wound if applicable.
- If unable to control bleeding in extremity wounds with above, apply tourniquet. Note: immediate transition to a tourniquet in an extremity hemorrhage is preferred.
- In penetrating injuries to the abdomen, after clearing blood, hemostatic dressings should be pushed into the wound and pressure held for 5 minutes to encourage clotting. Do not remove bandage after placement. Penetrating abdominal/thoracic injuries require a large amount of pressure to compress vessels.

HEMORRHAGE CONTROL PROCEDURES (cont.)

- In pelvic wounds – utilize pelvic binding to limit capacity for hemorrhage (tie pelvis with sheet/commercial binder).
    - For external hemorrhage of the head and neck where the wound edges can be easily re-approximated, the iTClamp may be used as a primary option for hemorrhage control. Wounds should be packed with a hemostatic dressing or XStat, if appropriate, prior to iTClamp application. DO NOT APPLY on or near the eye or eyelid (within 1cm of the orbit).
    - The iTClamp does not require additional direct pressure, either when used alone or in combination with other hemostatic adjuncts.
    - If the iTClamp is applied to the neck, perform frequent airway monitoring and evaluate for an expanding hematoma that may compromise the airway. Consider placing a definitive airway if there is evidence of an expanding hematoma.
- **Document procedure, results, and vital signs.**

Hemorrhage Classification (ATLS)

	Class 1	Class 2	Class 3	Class 4
Estimated Blood Loss (mL)	<750 15%	750-1500 15-30%	1500-2000 30-40%	>2000 >40%
Heart Rate (min)	Normal to slightly elevated	Mild Tachycardia >100-119	Tachycardia 120-140	Tachycardia >140
Respiratory Rate (min)	Normal 12-20	Mild Tachypnea 20-24	Tachypnea 24-40	Tachypnea >40
Blood Pressure (from baseline)	Normal or slightly elevated	SBP with mild decline	SBP decreased*	SBP decreased (<90mmHg)
Urine Output (mL/hr)	Normal > 30	Slight decrease 20-30	Decreased 5-15	Negligible <5
Capillary Refill	1-2 seconds	2 seconds	>2 seconds	> 3 seconds
Mental Status and Skin (color/texture)	Normal or slightly anxious	Mildly anxious, skin may become cool, clammy	Anxious, confused, skin cool, clammy	Confused, lethargic, skin will be cool/cold, pale

Revised/reviewed March 2025 IAW current published JTS TC3 CPG guidelines.

TOURNIQUET APPLICATION

CLINICAL INDICATIONS:

- Extremity trauma with continued hemorrhage or amputation.

CONTRAINDICATIONS:

- None

PROCEDURE: All medical personnel should be regularly practiced in deploying and applying all CoTCCC approved tourniquets (TQ). Tourniquets in kit should be pre-set and removed from wrapping (ready for immediate use and application).

Initial HASTY placement ok over clothing, clearly proximal to bleeding. If site of life-threatening bleeding is not readily apparent, place the tourniquet "high and tight" as proximal as possible on the injured limb.) HASTY tourniquet placement is appropriate for initial treatment of massive hemorrhage or hemorrhage while in Care Under Fire phases. Reassess all HASTY placement tourniquets and asses if hemorrhage is manageable by other methods while in tactical field care or transition to tactical evacuation care. If tourniquet is necessary to manage hemorrhage**, replace all HASTY placement tourniquets with DELIBERATE placement tourniquets**, preferably prior to patient evacuation or movement, per the following steps:

- Remove clothing as necessary to visualize bleeding area.
- Place TQ directly on skin proximal to wound. It should be placed at least 2-3" above bleeding site, avoiding placement directly over a joint (place above or below).
- Tighten TQ by twisting included rod until bleeding stops. If converting from HASTY to DELIBERATE TQ placement, loosen hasty TQ after deliberate TQ is placed, but keep it in place as a back-up. If bleeding is not well controlled with the first TQ, apply a second side-by-side with the first.
- Secure ends of tension bar to prevent unwinding (such as with tape).
- Document TQ time of placement. ("T" signifies tourniquet). Do not cover TQ. Recheck intermittently (q 15min) and after any movements or re-positioning to ensure no new bleeding/loosening has occurred.
- **TCCC recommendations on TQ removal/conversion (clearly document timing and effectiveness):**
  - Convert all necessary HASTY tourniquets to DELIBERATE tourniquets as soon as tactically feasible as outlined above.
  - Limb TQs should be converted to hemostatic or pressure dressings as soon as able if three criteria are met:
    - The casualty is **not in shock**;
    - It is possible to **monitor the wound closely** for bleeding; and
    - The tourniquet is **not being used to control bleeding from an amputation**.
  - Every effort should be made to convert tourniquets in less than 2 hours if bleeding can be controlled with other means.

Revised/reviewed March 2025 IAW current published JTS TC3 CPG guidelines.

JUNCTIONAL TOURNIQUET APPLICATION

CLINICAL INDICATIONS:

- High level amputation not amendable to a standard tourniquet, non-compressible hemorrhage in a transition zone (inguinal and axilla), and pelvic immobilization.

CONTRAINDICATIONS:

- None

PROCEDURE: All medical personnel should be proficient in deploying and applying all available tourniquets. Junctional tourniquets (JT) should be pre-set and removed from wrapping (ready for immediate use and application). Junctional tourniquets should be applied according to manufacturer's instructions.

- Remove clothing as necessary to visualize area of application if possible. Remove objects from patient's pockets or pelvic area. Slide device into place as necessary to proper position.
- Tighten tourniquet by twisting or pumping up balloon/bladder until bleeding stops. (depends on JT used)
- Secure all straps in order to ensure security of device.
- Document presence of tourniquet and time of placement on patient (forehead). (³T' signifies tourniquet). Do not cover tourniquet.
- Recheck tourniquet intermittently (q 15min) and after any movements to ensure no new bleeding/loosening has occurred.
- **If using a JT with pump device, additional inflation may be necessary with changes in altitude.
- **The uniqueness of junctional tourniquets do not lend themselves to conversion well and should be left to Roles with surgical capability. Use caution if attempting Junctional Tourniquet Conversion. Must have high index of suspicion that injury is compressible and can be managed by more appropriate adjuncts.**

****Document procedure, results, and vital signs.****

Revised/reviewed March 2025 IAW current published JTS TC3 CPG guidelines and (High Bilateral) Amputations and Dismounted Complex Blast Injury, 05 August 2024.

TOURNIQUET CONVERSION

CLINICAL INDICATIONS:

- Wounds that have high possibility of compressible hemorrhage control with hemostatic or pressure dressings where hemorrhage was originally controlled by a tourniquet

CONTRAINDICATIONS:

- Patient showing signs and symptoms of hypotensive/hemorrhagic shock
- Tourniquets controlling hemorrhage for amputated or partial-amputated extremity.
- Tourniquets that have been in place >6 hours.
- Unable to monitor wound for bleeding post tourniquet conversion due to task saturation, limited visibility or poor positioning.

PROCEDURE:

Limb tourniquets and junctional tourniquets should be converted to hemostatic or pressure dressings as soon as possible if no above contraindications are present.

Every effort should be made to convert tourniquets in less than 2 hours if bleeding can be controlled with other means. **Do not remove a tourniquet that has been in place more than 6 hours**.

- Confirm patient is not showing any signs of hypotensive/hemorrhagic shock.
- With Tourniquet in place, attempt to pack wound with hemostatic dressing and apply a pressure dressing.
    - Combat Gauze is the CoTCCC hemostatic dressing of choice
    - Alternate hemostatic adjuncts:
        - Celox Gauze
        - ChitoGauze
        - XStat (best for deep, narrow-tract junctional wounds)
        - iTClamp (may be used alone or in conjunction with hemostatic dressing or XStat)
- Loosen but don't remove the tourniquet by unwinding the windlass until pulses return and closely monitor for return of bleeding for 5 minutes.
- If bleeding returns, retighten tourniquet until loss of distal pulse and document procedure failure.
- If no bleeding returns, loosen tourniquet completely but leave loosely looped around limb and monitor for return of bleeding.

****Document procedure, results, and vital signs.****

Revised/reviewed March 2025 IAW current published JTS TC3 CPG guidelines; (High Bilateral) Amputations and Dismounted Complex Blast Injury, 05 August 2024; Damage Control Resuscitation in Prolonged Field Care, CPG: 73 01 October 2018.

ZOLL 731 VENTILATOR: PRE-MISSION CHECKS AND TROUBLESHOOTING

Routine Care

- Keep the ventilator and its accessories clean at all times.
- Clean the unit's housing and hose connections with a damp, soapy cloth
- For general decontamination, apply a 10% bleach solution with a damp cloth.
- After cleaning, thoroughly dry the unit with a lint free cloth. Make sure all exposed surfaces are cleaned and dried.

Duty Inspection

- Ensure the ventilator is clean and free of visible damage
- Inspect all accessories and connectors for signs of damage or excessive wear. Replace worn or defective items.
- Examine high pressure hose for cracking, discoloration, or disfigurement. Examine end connection fittings for damaged threads and sharp edges. Replace worn or defective hoses. *DO NOT ATTEMPT TO REPAIR HOSE*
- Examine the ventilator circuit for damage or wear including cracking or discoloration. If there are signs of physical degradation or the unit is indication ventilator circuit problems, replace the circuit
- Examine the filters and replace them if dirty or clogged
- Inspect the external AC/DC adapter, line cords, and DC power cables for wear or damage. Replace if worn or damaged.

Notes:

- Recommended to use a disposable external filter when operating in areas where fin e dust or dirt is airborne due to wind.
- The Zoll Ventilator can operate over the range of **-13** to **120** degrees **Fahrenheit** in emergency situations. When operating at high temperatures, you should remove the unit from its padded case, which allows the unit to pass heat into the surrounding environment.

ZOLL 731 VENTILATOR: PRE-MISSION CHECKS AND TROUBLESHOOTING (cont.)

Operational Test Procedure - 731 Ventilator

Before attaching the patient to the ventilator, the operator should perform an Operational Test to ensure that the breathing circuit is properly attached and that the primary patient safety alarms (PATIENT DISCONNECT, HIGH AIRWAY PRESSURE LIMIT) are
functioning properly. The test should be performed following connection of the breathing circuit.

Procedure:

1. With the breathing circuit connected, turn the POWER switch to ON, to allow the ventilator to complete Self Check and begin operation with its default values.

2. The PATIENT DISCONNECT alarm should be active. (The audible alarm will be muted during the 2 minute initial mute.)

3. Press the MANUAL BREATH button; gas should flow out of the patient connection each time the button is pressed. Note: The minimum period between manual breaths is limited by the tidal volume and the time required to complete a full exhalation based on the I:E ratio.)

4. Close the patient port with a clean hand or gloved hand. During inspiratory phase, the HIGH AIRWAY PRESSURE LIMIT alarm should activate after 2 breaths that reach the PIP High Limit.

5. If the HIGH AIRWAY PRESSURE LIMIT alarm fails to activate, ensure that all of the tubing connections are secure, the exhalation valve is closing during inhalation, and that the High Airway Pressure Limit is set to 35 cm H2O or less.

6. After a breath or two, release the patient port while allowing the ventilator to operate. The PATIENT DISCONNECT alarm should activate.

7. Partially close the patient port to reset the PATIENT DISCONNECT alarm. With no other alarms occurring, remove external power from the ventilator. The EXTERNAL POWER LOW/DISCONNECT alarms should activate. Reconnect external power to reset alarms.

   If either the HIGH AIRWAY PRESSURE, PATIENT DISCONNECT, or EXTERNAL POWER LOW/DISCONNECT alarms fail to activate, continue to manually ventilate the patient, replace the ventilator, and send the unit in for service.

IMPACT 754 VENTILATOR: PRE-MISSION CHECKS AND TROUBLESHOOTING

Routine Care

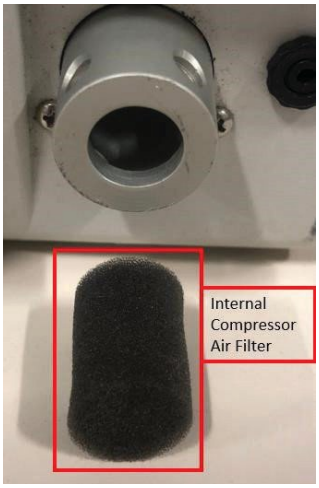
Clean unit and hose attachments with damp soapy cloth and wipe dry. Inlet filter may be removed to check for dirt or debris. Check metal hose couplings for thread wear and debris.

Duty Inspection

Power Off Checks

1. Within calibration date (6 month maintenance cycle)

2. Air inlet clear and filter in place (Right side of vent)

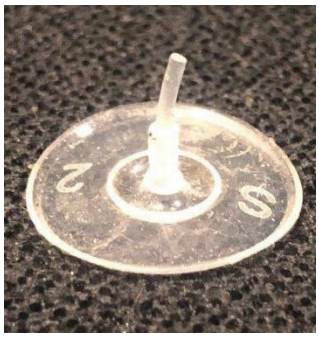


3. Gas ("OXYGEN IN" and "AIR IN") and Patient ("EXHALATION VALVE" and "TRANSDUCER") connections clear and tight (Top of vent)

IMPACT 754 VENTILATOR: PRE-MISSION CHECKS AND TROUBLESHOOTING (cont.)

4. GAS OUT clear leaf valve installed and seated (Reseat if loose, replace if missing) See replacement instructions at the end of this document.





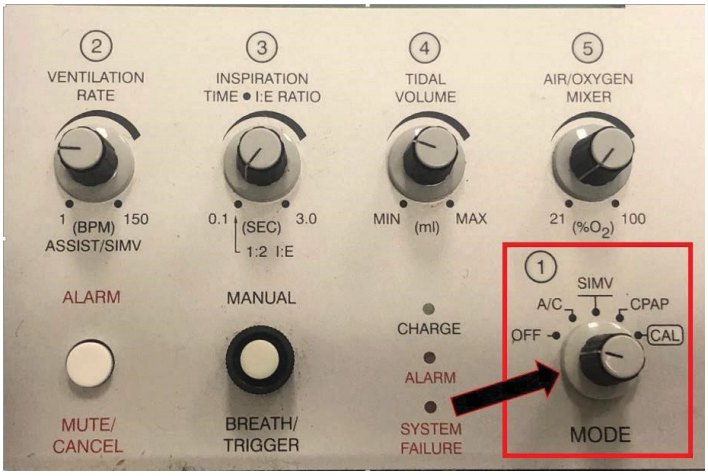
5. Inspect green high pressure oxygen hose for cracks, dry rot, threads, Black O-ring (Replace if damaged).


6. Connect ventilator to high pressure oxygen source, turn on Oxygen tank and ensure no leaks are present. Turn off O2 when complete. (Conduct in environment conducive to hearing leaks)

IMPACT 754 VENTILATOR: PRE-MISSION CHECKS AND TROUBLESHOOTING (cont.)

Power On Checks

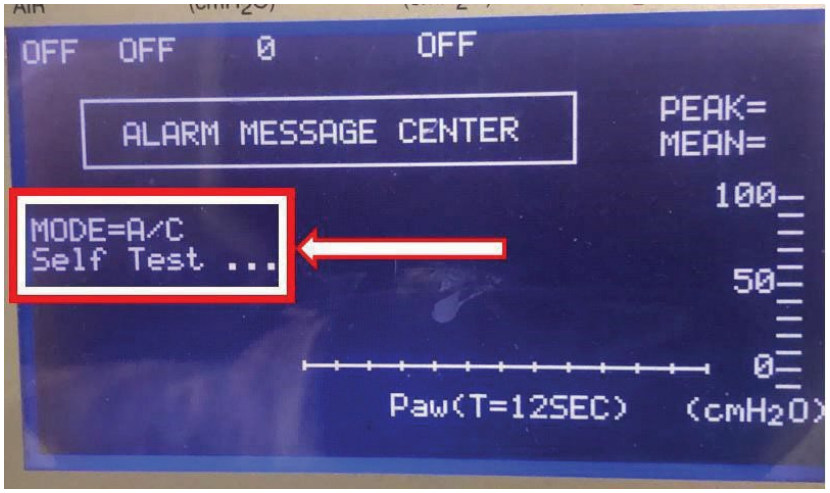
1. Turn "MODE" knob (1) to desired setting (A/C, SIMV, CPAP)



2. The ventilator will run a SELF-TEST upon set up. **CAUTION:** SELF- CHECK must be performed with the disposable ventilator circuit disconnected.

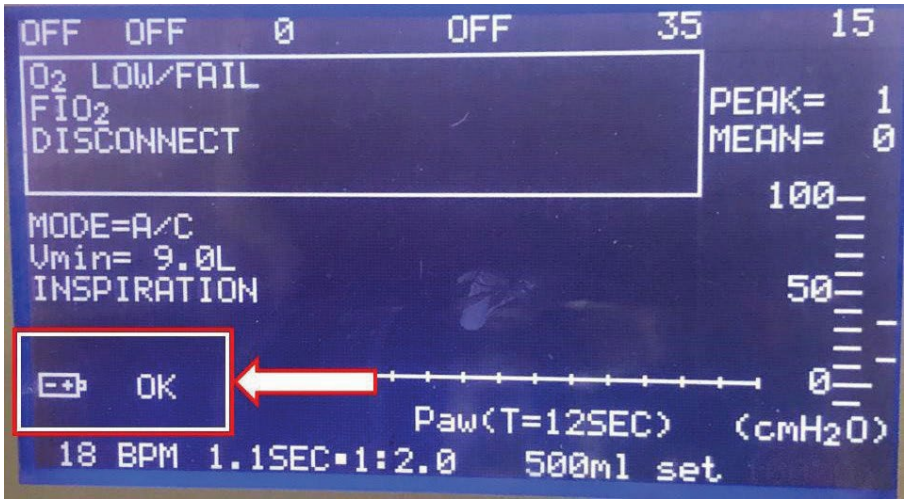
   Ignoring this requirement could cause the SELF- CHECK process to sense a residual airway pressure leading to a SELF-CHECK failure.

   At this point, CAL is not required. If SELF-TEST results in a Calibration Failure, place (1) to CAL until CAL OK is displayed. If calibration fails, ventilator is deadlined.



IMPACT 754 VENTILATOR: PRE-MISSION CHECKS AND TROUBLESHOOTING (cont.)

3. Check BATT OK



4. Preset ventilator knobs to:
    a. Rate (2) 18
    b. Inspiration Time (3) 1:2
    c. Vt (4) 500
    d. FiO2 (5) 100%
    e. HIGH pressure alarm to 35 cmH2O vi. LOW pressure to 15 cmH2O

5. Turn OFF
6. Store Ventilator with Air Inlet and Gas Out Ports protected and covered.

Ventilator is now pre-set for duty and able to be rapidly employed as needed with minor adjustments to Vt based on patient ideal body weight and turning on O2 source

IMPACT 754 VENTILATOR: PRE-MISSION CHECKS AND TROUBLESHOOTING (cont.)

Weekly Inspections

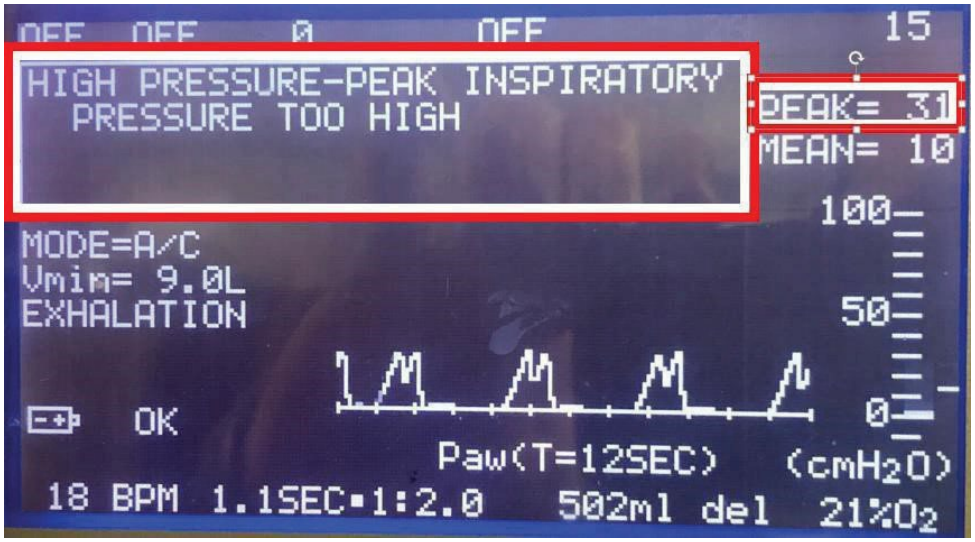
ALL CAUTIONS, WARNINGS, AND NOTIFICATIONS THAT CORRESPOND WITH THE 754 SCREEN WILL BE IN ALL CAPS AND HIGHLIGHTED YELLOW

1. Complete Duty Inspection
2. Set FiO2 to 21%
3. Attach vent circuit to vent and field expedient training lung:
   a. Slide one large exam glove inside another.
   b. Wrap open end of the gloves around the patient end of the circuit tube.
   c. Secure with rubber band (DD1380) / Cut-off wrist bead of another glove / Penrose drain / Tape

4. Connect high pressure oxygen source and turn on O2
5. Turn vent on and allow respirations to begin (listen for compressor)
6. Set FiO2 to 100%
   a. Internal compressor will stop (audible)
7. Turn off oxygen source
   a. Ventilator will alarm and show
      "O2 LOW/FAIL-CHECK OXYGEN SOURCE/CONNECTIONS"
      and
      "FIO2-GAS MIX ERROR. CHECK SOURCE/SETTINGS/CONNECTIONS"
   b. Compressor will turn on (audible)

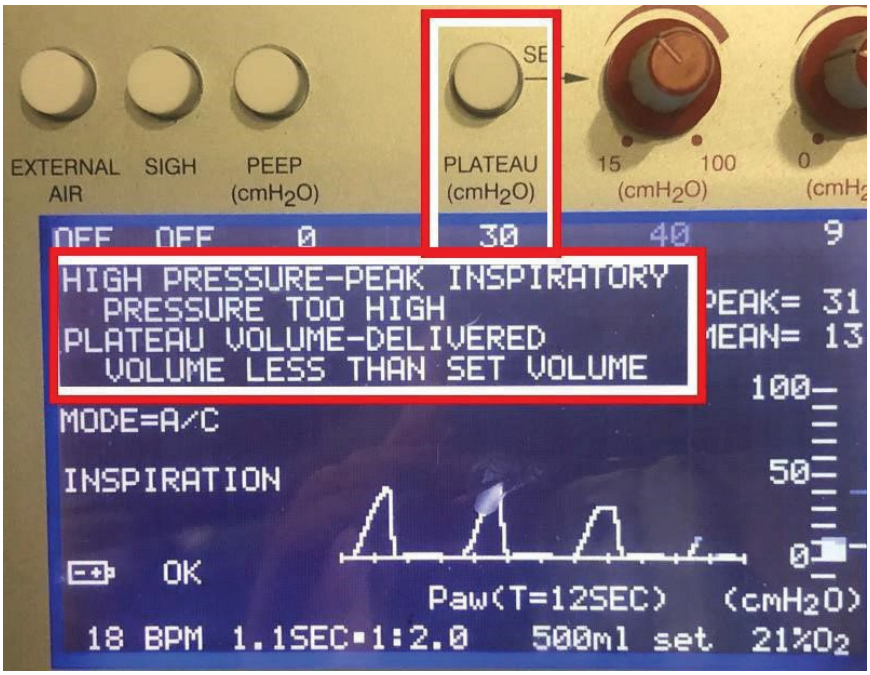
IMPACT 754 VENTILATOR: PRE-MISSION CHECKS AND TROUBLESHOOTING (cont.)

8. Set FiO2 to 21%.
9. Set HIGH pressure alarm to 5 cmH2O **below** PEAK.
   a. Ventilator will "stutter" and show "HIGH PRESSURE-PEAK INSPIRATORY PRESSURE TOO HIGH" warning and signal an alarm.

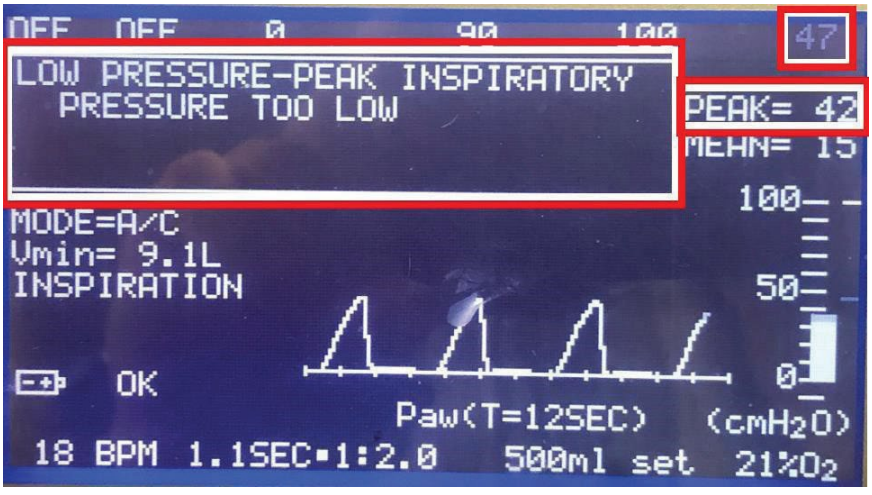


10. Turn PLATEAU pressure ON
    a. Ventilator will display the following and trigger an alarm
       "HIGH PRESSURE-PEAK INSPIRATORY
       PRESSURE TOO HIGH"
       "PLATEAU VOLUME-DELIVERED
       VOLUME LESS THAN SET VOLUME"

IMPACT 754 VENTILATOR: PRE-MISSION CHECKS AND TROUBLESHOOTING (cont.)

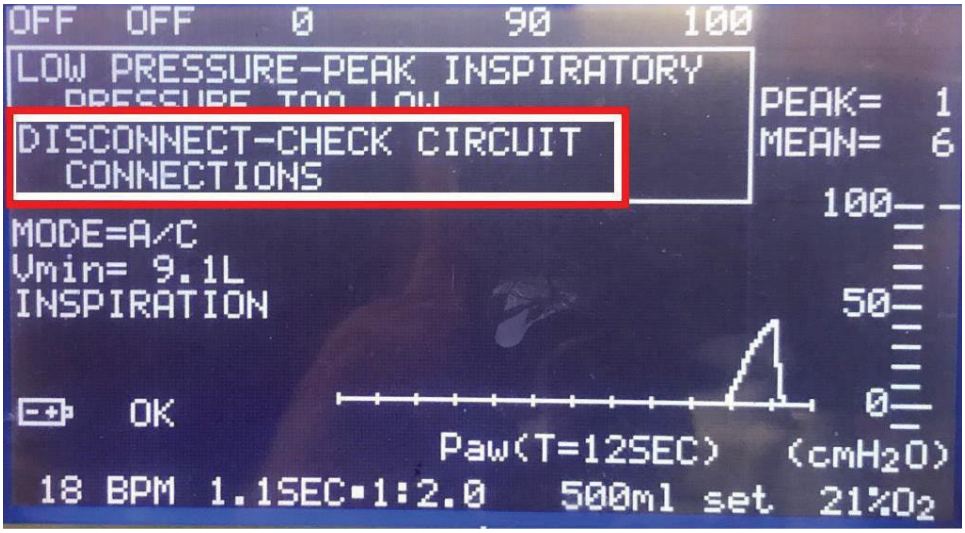


11. Turn HIGH Pressure alarm to 100.
12. Set LOW pressure alarm to 5 cmH2O **above** PEAK
    a. Ventilator will display the following and trigger an alarm.
    "LOW PRESSURE-PEAK INSPIRATORY PRESSURE TOO LOW"



IMPACT 754 VENTILATOR: PRE-MISSION CHECKS AND TROUBLESHOOTING (cont.)

13. Remove circuit from ventilator.
    1. Ventilator will display "DISCONNECT-CHECK CIRCUIT CONNECTIONS" and trigger an alarm.



14. Preset ventilator for use per Duty Inspection Power On Checks and turn off.

IMPACT 754 VENTILATOR: IN-FLIGHT EMERGENCIES

****THESE PROCEDURES SHOULD BE PRACTICED BEFORE PERFORMED ON LIVE PATIENTS****

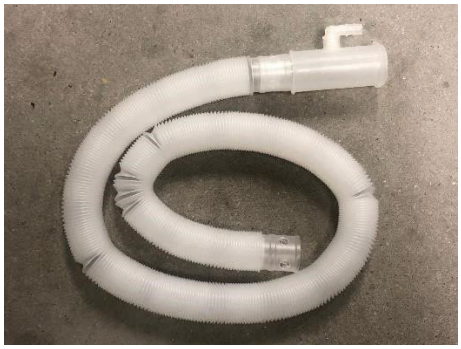
****Any known malfunction of ventilator should be addressed prior to flight. The following are not for routine use but for emergencies when alternate ventilitory measures are not available and long term BVM is not practical****

Loss of high pressure O2 delivery when needs exceed 21% FiO2 (i.e. missing/unserviceable green high pressure hose.) will alarm and show the following on screen:
"O2 LOW/FAIL- CHECK OXYGEN SOURSE/CONNECTIONS"

NOTE: First Place Patient on BVM with supplemental O2. Second, check oxygen tank volume. Third, check the O2 lines and connections

Alternative methods to increase delivered oxygen content

1. Commercial oxygen reservoir kit for low pressure supply is available (Part # 820- 0097-15)



2. Oxygen reservoir fashioned from primary circuit and BVM
   a. Connect short portion of main circuit tube to the BVM and to the air inlet port.
   b. Connect BVM O2 hose to the BVM and the regulator.
   c. Set regulator to desired setting (~10 LPM, but no lower than total minute volume.

IMPACT 754 VENTILATOR: IN-FLIGHT EMERGENCIES (cont.)

3. Oxygen reservoir fashioned from second ventilator patient circuit.

1) Cut/disconnect exhalation valve off of second ventilator circuit.
2) Remove transducer fitting from exhalation valve at attach it to the main circuit.
3) Connect the transducer hose to the original transducer fitting and the other end to regulated oxygen source.
4) Connect the transducer fitting (still attached to the circuit) to the air inlet port.
5) Set regulator on O2 source to 10 LPM to deliver up to 99% FIO2.

NOTE: Ventilator circuit tubing will provide reservoir for 650-700 ml of O2. Vt of greater than 650-700ml may result in lower FIO2.

IMPACT 754 VENTILATOR: IN-FLIGHT EMERGENCIES (cont.)

Missing or damaged "GAS OUT" leaf valve

1. Missing "GAS OUT" leaf valve will trigger an alarm, give a "DISCONNECT- CHECK CIRCUIT CONNECTIONS", no "PEAK" value will display, and little to no volume will be delivered to patient.
   a. Place patient on BVM with supplemental O2
   b. Perform DOPE (Dislodgment, Obstruction, Pneumothorax, and Equipment) assessment.
   c. Check "GAS OUT" leaf valve for installation and proper seating.
      i. If folded, use small object to gently unfold or push valve back into place
      ii. If missing, replace ventilator immediately if able. If unable to replace, cover GAS OUT side ports with occlusive dressing. (Replacing GAS OUT leaf valve is optimal but time consuming.)

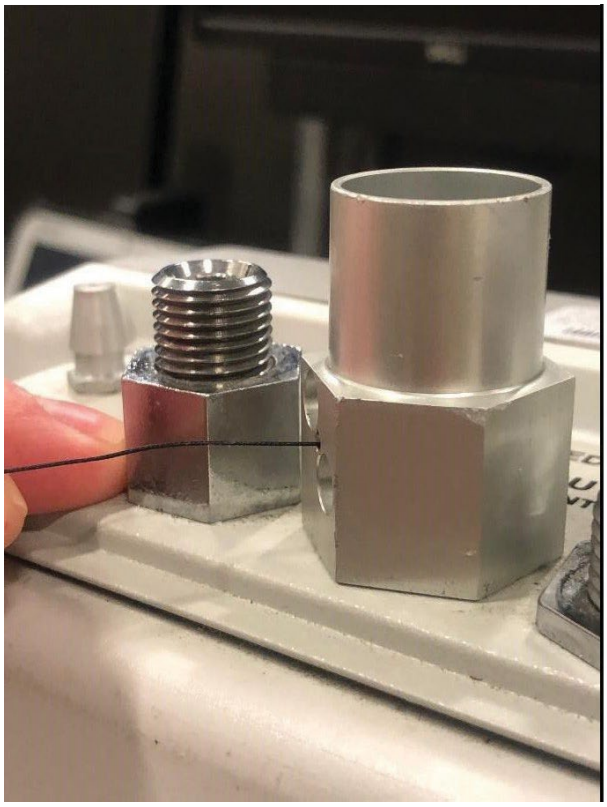
WARNING: Occluding GAS OUT side ports will enable ventilator to provide full respirations, however, this will eliminate the antiasphyxia function these ports provide (Ventilator failure will result in increased resistance in spontaneous respiration) and strict surveillance must be kept on ventilator to ensure any further failure is caught immediately. Patient must immediately be transitioned to BVM in the event of any failure.

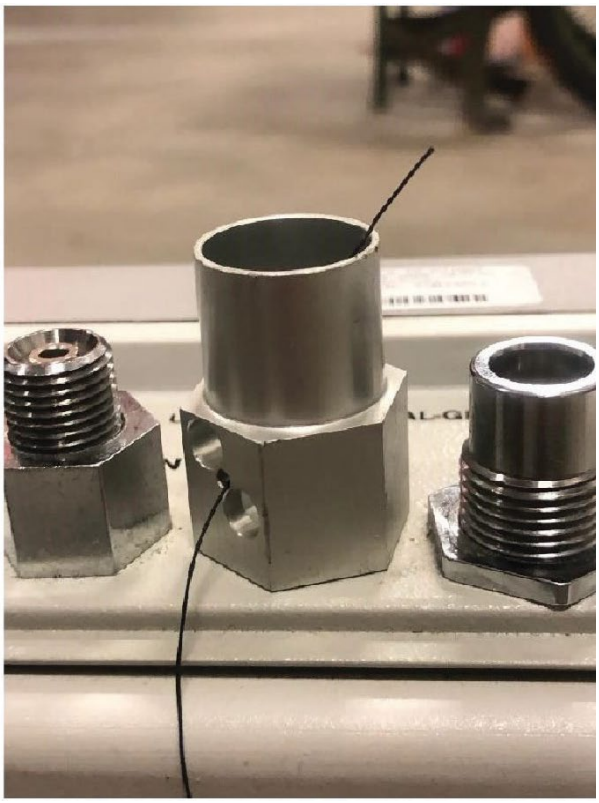
IMPACT 754 VENTILATOR: IN-FLIGHT EMERGENCIES (cont.)

Replacing “GAS OUT” leaf valve

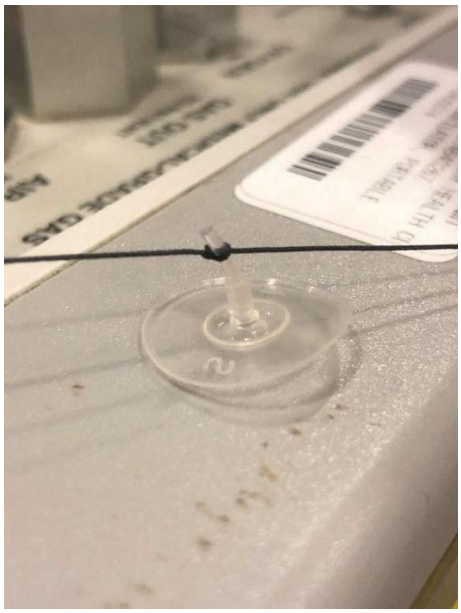
1. Feed suture through small center hole.

2)





2. Tie small square knot over end of tail of leaf valve.



IMPACT 754 VENTILATOR: IN-FLIGHT EMERGENCIES (cont.)

3. Pull gentle tension on suture while guiding the leaf valve into place.

4. Maintain gentle traction against suture while applying pressure against the leaflet valve inside gas port with finger. Remove string once valve is seated. (Use caution to not apply too much tension to suture as leaf valve tail can tear.)

IMPACT 754 VENTILATOR: IN-FLIGHT EMERGENCIES (cont.)

Compressor failure/alarms (may show Code 2)

1. Place patient on BVM with supplemental O2
2. Cycle ventilator to OFF
3. Turn FiO2 knob (#5) to 100%
4. Cycle back on and to desired settings leaving FiO2 at 100%
   a. PEEP will have to be reset when vent is cycled on.

Note: This technique will transition the ventilator to using oxygen pressure instead of the compressor to drive ventilation and may hasten oxygen usage

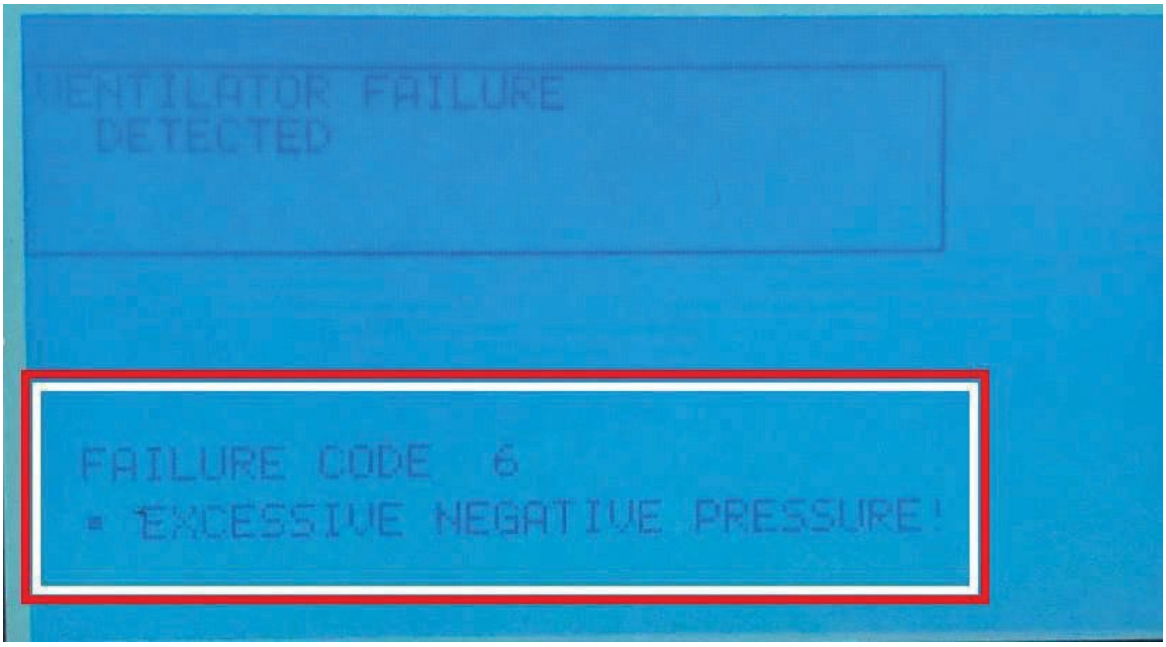
Battery Failure

1. Place patient on BVM with supplemental O2
2. Turn ventilator OFF
3. Replace ventilator battery with battery from 326M suction apparatus. (Per the manufacturer, they are the exact same!)
   a. 326M battery is in the same location as the 754.
4. Resume normal operations
   a. PEEP will have to be reset when vent is cycled on.

IMPACT 754 VENTILATOR: IN-FLIGHT EMERGENCIES (cont.)

Failure Code 6

Suctioning to long with inline suction and/or patient inspiratory effort is significant enough to trigger.



1. Place Patient on BVM with O2
2. Assess Patient
3. Cycle Vent “OFF” and “ON” (will have to reset Peep)
4. Check vent settings
5. Place patient on ventilator

Document all failures of equipment and solutions on DD Form 1380, DA Form 4700, and in Joint Patient Safety Reporting (JPSR) registry https://patientsafety.csd.disa.mil

IMPACT 754 VENTILATOR: IN-FLIGHT EMERGENCIES (cont.)

Alternative for missing internal compressor air filter

Ventilator inspiratory bacteria filter can be attached to air inlet (Missing air filters allow dust, debris, and/or moisture to be pulled into the ventilator compressor. This results in increased work-load of the ventilator leading to diminished battery life and eventual compressor failure)

COMMON REPLACEMENT PARTS

ZoII/ NSN Part Numbers

-Zoll Part #: 820-0097-15 Oxygen reservoir kit for low pressure supply

-MEDSILS: OXYGEN ADAPTER BLEED-IN RESERVOIR FOR VENTILATORS

NSN: 6515-01-518-5060

-Zoll Part #: 704-0754-01 Battery Pack

-MEDSILS: BATTERY POWER SUPPLY USED ON VENTILATOR

NSN: 6130-01-468-8361

-Zoll Part #: 490-0005-00 Valve, Leaf

-MEDSILS: VALVE REGULATING SYSTEM PRESSURE

NSN 6530-01-464-0267

NASOGASTRIC AND OROGASTRIC TUBE INSERTION

CLINICAL INDICATIONS:

- Enabling gastric decompression, decreasing risk of vomiting and aspiration, obtain sample of gastric contents
- Allows for gastric lavage in drug overdose or poisoning

CONTRAINDICATIONS:

- Nasogastric tubes contraindicated in the presence of massive facial trauma or suspicion of basilar skull fracture (CSF otorrhea, Battle's sign, raccoon eyes, mechanism). May insert orogastric tube instead

PROCEDURE:

- If possible, sit patient upright for optimal neck and stomach alignment
- Measure tubing from bridge of nose to earlobe, then to the point halfway between the end of the sternum and the navel. Mark measured tube with marker
- Select most patent nare (or the throat) and pass lubricated tube in a posterior – NOT SUPERIOR – direction. If resistance is met, attempt to corkscrew slightly or remove and attempt in other nare
- Withdraw tube immediately if changes occur in patient's respiratory status, if tube coils in mouth, if the patient begins to cough, or becomes cyanotic
- Advance tube until mark is reached

CONFIRMATION:

1. Position stethoscope over patient's stomach (about 2 inches below the sternum)
2. Inject air into tube and check for gastric sounds. (Confirm with 2nd provider if needed)
    a. 10 ml of air for Nasogastric
    b. 30 - 60 ml of air for Orogastric
3. Visual assessment of aspirate color and volume.
    a. Gastric aspirate appears cloudy, green, tan, off-white, or brown
    b. Lung aspirate is usually clear and small volume
4. Check pH of aspirate if possible
5. X-ray confirmation

NASOPHARYNGEAL AIRWAY

CLINICAL INDICATIONS:

- Depressed mental status with need for airway augmentation to ensure patency / access

RELATIVE CONTRAINDICATIONS:

- Patient at high-risk of aspiration and / or unable to protect airway
- Massive facial trauma, facial / inhalation burns, burns > 40% TBSA, or suspicion of basilar skull fracture (e.g., CSF otorrhea, Battle's sign, raccoon eyes, mechanism)

PROCEDURE:

- Position patient in the sniffing position
- Select appropriately sized NP tube and lubricate with water-soluble jelly [can measure tube by placing exterior (lipped) end next to nare and tip should reach to angle of mandible]
- Select most patent nare, orient open angle medially, and pass tube in a posterior **- not superior -** direction. If resistance is met, attempt to corkscrew slightly or remove and attempt in other nare. If unsuccessful, try the next smallest sized tube
- Pass tube until lip of NP tube rests against nare
- Bag patient with BVM / mask as needed

****Document procedure, results, and vital signs****

BLIND INSERTION AIRWAY DEVICE (BIAD)

CLINICAL INDICATIONS:

- Patient with inadequate respiratory drive or respiratory failure due to any reason (e.g., altered mental status, trauma, infection) other than airway burns, anaphylaxis, or other causes of airway swelling / obstruction.

CONTRAINDICATIONS:

- Massive upper airway trauma distorting anatomy
- Penetrating neck trauma
- Anaphylaxis
- Airway burns or > 40% TBSA

PROCEDURE:

Prior to attempting any Blind Insertion Airway Device (BIAD), follow requirements of the Rapid Sequence Intubation Protocol

- Select appropriate size BIAD and ensure proper cuff inflation / deflation
- Lubricate with water-soluble jelly
- Insert according to manufacturer's guidance
- Confirmation of correct placement through ETCO2 waveform and secure tube

WARNING:

BIADs may not prevent or block aspiration of gastric contents.

PERFORM CRICOTHYROIDOTOMY

Body Isolation Precautions, if situation permits

1. Gather, assemble, and test all necessary equipment
2. Consider sedation if patient is conscious
3. Identify the cricothyroid membrane between the cricoid and thyroid cartilage
4. Cleaned site with antiseptic
5. Stabilize the larynx with non-dominant hand
6. Make a 1 ½ inch vertical incision through the skin over the cricothyroid membrane
7. Maintain the opening of the skin incision by pulling the skin taut with the fingers of the non-dominant hand
8. Stabilize the larynx with one hand while cutting horizontally through the cricothyroid membrane
9. Insert a commercially designed cricothyrotomy hook or bougie to stabilize the opening
10. Insert the end of the endotracheal tube into the trachea and direct towards the lungs. Carefully remove hook after inserting tube (maintain positive control of tube until secure)
11. Inflate the cuff with 10 mL of air
12. Assess patient for spontaneous respirations
13. Confirm placement with chest rise and fall and placement of ETCO2
14. Attach pulse oximeter to patient, if available
15. Assist with ventilations when respirations are < 8 or > 30 or a pulse oximeter reading in < 90%
16. Secure the tube, using tape, cloth ties, or other measures, while applying dressing to further protect the tube and incision

****Document procedure, results, and vital signs****

NEEDLE CRICOTHYROIDOTOMY

CLINICAL INDICATIONS:

- Child < 10 y/o in whom open cricothyroidotomy is contraindicated with the following:
  - Failed intubation attempts x 3 by the most experienced provider present with inability to ventilate with BVM / high risk to ventilate with BVM
  - Inability to place / ventilate with blind insertion airway device (BIAD)
  - Massive facial trauma or neck trauma precluding the use of orotracheal intubation / BIAD

CONTRAINDICATIONS:

- Ability to ventilate adequately with BVM
- Prolonged time to definitive care (relative)

NOTE: this technique requires a minimum of 50 psi O_2 or pressurized air flow and a special adapter to connect the line to the catheter hub; do not attempt otherwise.

PROCEDURE:

- Maintain patient in sniffing position or place them into sniffing position. Utilize inline stabilization if indicated.
- Oxygenate the patient with 100% O_2. Identify and cleanse the cricoid area with betadine / alcohol while oxygenating if possible
- Using a 14 Ga IV attached to a 3ml syringe, puncture the cricothyroid membrane at a 90° angle. **Do not advance needle once air returned**
- Change angle to 45° and **advance Catheter only.** Should advance with no resistance. Remove needle and syringe
- Secure catheter in place. Remove needle and plunger from syringe and place an adapter from a 7-0 ETT on end of syringe in place of plunger. Attach this to the catheter
- Attach a BVM attached to 100% O_2 to the adapter / syringe and ventilate. A large amount of resistance will be felt due to the small catheter size. Evaluate for chest rise and oxygenation. The provider needs to allow a 1:3 ratio of inhalation / exhalation

****Document procedure, results, and vital signs****

****NOTE: Needle Cricothyroidotomy only allows for oxygenation, not ventilation**. It is meant as a temporizing measure until definitive care – tracheostomy – can be performed at an MTF.

This airway should be used for only 20-30min maximum if able.

- Start working alternatives immediately after initiation - such as retrograde wire intubation, surgical cric with needle as an anatomical landmark.**

NEEDLE THORACOSTOMY

CLINICAL INDICATIONS:

Suspect a tension pneumothorax and treat when a casualty has significant torso trauma or primary blast injury and one or more of the following:

- Severe or progressive respiratory distress or tachypnea, absent or markedly decreased breath sounds on one side of the chest, chest pain, distended neck vessels, hemoglobin oxygen saturation < 90% on pulse oximetry, shock, traumatic cardiac arrest without obviously fatal wounds

*** Note: If not treated promptly, tension pneumothorax may progress from respiratory distress to shock and traumatic cardiac arrest**

PROCEDURE:

**** Note: This intervention is a BRIEF stopgap utilized in order to buy time for a definitive tube thoracostomy. It is not a solution unto itself.****

- Decompress the chest on the side of the injury with a 14-gauge or a 10-gauge, 3.25-inch needle / catheter
- If a casualty has significant torso trauma or primary blast injury and is in traumatic cardiac arrest: decompress both sides of the chest before discontinuing treatment. Clean area if possible with betadine / alcohol, but do not delay treatment for this step

****Note:** Either the 5th intercostal space (ICS) in the anterior axillary line (AAL) or the 2nd ICS in the mid-clavicular line (MCL) may be used for needle decompression (NDC) If the anterior (MCL) site is used, do not insert the needle medial to the nipple line.

- The needle / catheter unit should be inserted at an angle perpendicular to the chest wall and just over the top of the lower rib at the insertion site. Insert the needle/catheter unit all the way to the hub and hold it in place for 5-10 seconds to allow decompression to occur
- After the NDC has been performed, remove the needle and leave the catheter in place.
- The NDC should be considered successful if:
  - Respiratory distress improves; there is an obvious hissing sound as air escapes from the chest when NDC is performed (this may be difficult to appreciate in high-noise environments); hemoglobin oxygen saturation increases to 90% or greater (note that this may take several minutes and may not happen at altitude); casualty with no vital signs has return of consciousness and/or radial pulse
- If the initial NDC was successful, but symptoms later recur:
  - Perform another NDC at the same site that was used previously. Use a new needle/catheter unit for the repeat NDC
- If the second NDC is also not successful:
  - Fix appropriate circulation issues and consider finger / tube thoracostomy

****Document procedure, results, and vital signs.****

PERFORM SIMPLE FINGER THORACOSTOMY

1. Position the casualty on their back and raise the arm on the affected side above the casualty's head
2. Mark the insertion site at the mid-axillary line over the 4th or 5th intercostal space
3. Cleanse the site with antiseptic solution
4. Liberally infiltrate the area with 2% lidocaine solution
5. Make a 2-3 cm transverse incision on the marked site (Incision should be 2 to 3 cm transverse incision over the selected site and extend it down to the intercostal muscles and 1 to 2 cm below the interspace through which the tube will be placed)
6. Use a finger to widen the tract confirming access to the intercostal space
   Note: Identify the rib below the insertion site to find the pleural space above the rib
7. Perforate the pleura by advancing a blunt instrument such as hemostats
   Note: Hold the forceps with two finger curved side down 1/2 inch from the tip. The fingers will be used to prevent the forceps from going too far into the pleural space
8. Spread the hemostat clamps, forcing the tissue apart
9. Perform a finger sweep to ensure access to the pleural space
   Note: You may not be able to palpate the lung parenchyma and detect lung inflation / deflation if casualty is receiving positive pressure ventilation.
10. Assess the release of air and / or blood
11. Apply a vented chest seal to complete a finger thoracostomy

****Document procedure, results, and vital signs.****

VASCULAR ACCESS (INTRAVENOUS)

CLINICAL INDICATIONS:

- Need for intravascular access to provide resuscitative fluids and / or medications
- Anticipated need for intravenous access in emergency patients

CONTRAINDICATIONS:

- Injuries proximal to IV site / ipsilateral to IV site (relative)

PROCEDURE:

- Prepare all necessary equipment: PPE, tourniquet, IV catheters, alcohol / betadine wipe, saline lock or IV tubing, IVFs if administering, and tape / securing device
- Ensure all IV tubing / saline locks flushed prior to attempting IV
- Place venous tourniquet proximal to anticipated IV puncture site
- Identify vein to be cannulated and cleanse overlying area with alcohol / betadine
- While holding traction on skin / vessel, cannulate the vessel (use a shallow angle of attack with the needle). Once flash returned, advance slightly to ensure catheter in vessel, then advance catheter only fully into vessel (should pass without resistance)
- While holding pressure proximally on vein and maintaining catheter position, remove tourniquet and needle. Attach NS flush and flush IV - this fluid should flow easily into the vein – any resistance suggests missed attempt or "blown" vein. [Note: If blood samples being drawn – they should be taken prior to removing tourniquet and always prior to flush (after flushing - may obtain dilute sample which will alter results)]
- Secure catheter using transparent dressing or tape
- Repeat until 2 IV sites have been established and are functional

****Document procedure, results, and vital signs.****

VASCULAR ACCESS (INTRAOSSEOUS)

CLINICAL INDICATIONS:

- Need for intravascular access to provide resuscitative fluids and / or medications with inability to obtain adequate peripheral intravascular access (2 failed attempts or greater than 90sec)
- Anticipated need for intravenous access in emergency patients

CONTRAINDICATIONS:

- Only absolute contraindication is fracture at affected site or prior IO attempt in the same bone
- Cellulitis overlying puncture site (relative contraindication)
- Injury (not fracture) proximal to puncture site (relative - site dependent)
- FAST Tactical™ device contraindicated in pediatric patients less than 18 years old

PROCEDURE:

- Prepare all necessary equipment: PPE, IO device, betadine scrub, and IV tubing
- Ensure all IV tubing/saline locks flushed prior to attempting IV
- Identify appropriate puncture area as follows:
  - FAST Tactical™
    - Sternum - follow manufacturer instructions or training guidelines
  - EZ IO™
    - Proximal Humerus (YELLOW 45mm) – 1 to 2 cm above the surgical neck into the most prominent aspect of the greater tubercle lateral to intertubercular (bicipital) groove, aiming 45-degrees downward towards contralateral hip
    - Distal Femur (peds, BLUE 25mm) – Proximal to patella (max 1cm) and 1-2cm medial to midline
    - Proximal tibia (BLUE 25mm or PINK 15mm) - 2cm (2 finger widths) distal to tibial tuberosity on medial aspect
    - Distal tibia (BLUE or PINK) - 2cm (2 finger widths) proximal to medial malleolus
  - Manual IO
    - Proximal tibia and distal tibia - same as EZ IO™ site
- Cleanse site well as failure to appropriately disinfect the area can lead to bone infections
- Applying firm pressure, puncture skin at 90° angle (45 degree down for Humeral IO), puncture bone (felt as loss of resistance, give or "pop")
  - Confirm placement by (1) needle feeling firm in bone and (2) aspiration of blood/bone marrow. If unable to aspirate blood, attempt to aspirate after the flush
  - Flush IO catheter with normal saline. May add 2% preservative-free Lidocaine without Epinephrine to flush to decrease pain (2 mL or 40 mg in adults, 0.5 mg/kg not to exceed 40 mg in pediatric)
  - Constantly monitor for increased tension in muscular compartments as misplacement into a compartment with subsequent fluid administration can lead to iatrogenic compartment syndrome
  - With the exception of adult proximal humerus insertions, routinely inserting the needle set to the hub is not recommended technique

****Document procedure, results, and vital signs.****

VASCULAR ACCESS via External Jugular Vein Cannulation

CLINICAL INDICATIONS:

- In the presence of a life-threatening condition, with clear indications for immediate use of medication, blood or fluid bolus. It should only be used when a peripheral IV site cannot be established (Not for prophylactic IV access)

EQUIPMENT:

- IV start kit (alcohol swabs 4 x 4s, tourniquet, tape)
- Large bore IV catheter (14 or 16 gauge)
- IV fluid tubing

PROCEDURE:

- Explain the procedure to the patient
- Select the insertion site
- Find the landmarks midway between the angle of the jaw and the midpoint of the clavicle
- Turn the patient's head away from the intended site of insertion. Consider placing the patient in the Trendelenburg position or holding the thumb over the vein to facilitate insertion
- Palpate for pulse of carotid artery and ensure that IV catheter is not inserted into carotid artery. Insertion should be lateral to the carotid artery
- Insert the IV catheter pointing towards the ipsilateral acromioclavicular joint until a flash fills the chamber of the catheter, then advance the catheter over the stylet and remove the stylet
- Attach the IV fluids to the catheter and infuse to verify the intravenous line is patent and does not infiltrate
- Secure the IV catheter using tape and Tegaderm dressing or a clear occlusive dressing
- Dispose of sharps in an approved biohazard container

COMPLICATIONS:

- Infiltration
- Hematoma formation
- Cellulitis / infection
- Thrombosis
- Phlebitis

****Document procedure, results, and vital signs****

VASCULAR ACCESS via CENTRAL CATHETERS

CLINICAL INDICATIONS:

- In the presence of a life threatening condition, with clear indications for immediate use of medication or fluid bolus. (Not for prophylactic IV access)

CONTRAINDICATIONS:

- Suspected infection at skin site

PROCEDURE:

- Determine the type of catheter present: PICC, Broviac, Hickman, Groshong Mediport, etc

Procedure for peripherally inserted central catheter (Cook, Neo-PICC, etc.) and tunneled catheter (Broviac, Hickman, Groshong, etc.):

- Prepare equipment:
  - 2-3 10 mL prefilled syringes of 0.9% NaCl
  - Sterile gloves (if available)
- If more than one lumen is available (PICCs, Hickmans and Broviacs can have one, two, or three lumens), select the largest lumen available
- Vigorously cleanse the cap of the lumen with chlorhexidine or 70% alcohol prep pad, allow to dry
- Unclamp the selected catheter lumen and using a prefilled 10 mL syringe:
  - Vigorously flush the catheter using a pulsating technique and maintaining pressure at the end of the flush to prevent reflux of fluid or blood
  - If catheter does not flush easily (note that a PICC line will generally flush more slowly and with greater resistance than a typical intravenous catheter), re-clamp the selected lumen and attempt to use another lumen (if present)
  - If unable to flush any of the lumens, the catheter is unable to be used
- Attach primed IV administration set and observe for free flow of IV fluid

****Document procedure, results, and vital signs.****

VASCULAR ACCESS via CENTRAL CATHETERS (cont.)

Procedure for implanted catheter (Port-a-Cath, P.A.S. port, Medi-port):

- Prepare all necessary equipment:
  - Non-coring, right angle needle specific for implanted vascular access ports
  - 2-3 prefilled 10 mL syringes of 0.9% NaCl
  - Sterile infusion port cap
  - Sterile gloves (if available)
  - Sterile occlusive dressing large enough to completely cover the insertion site
- Identify the access site; usually located in the chest
- Vigorously cleanse the cap of the lumen with chlorhexidine or 70% alcohol prep pad, allow to dry
- Attach the infusion port cap to the end of the non-coring, right angle needle tubing
- Prime the non-coring needle with attached tubing with saline using one of the prefilled 10 mL syringes. Leave the syringe attached to the tubing
- Palpate the port to determine the size and center of the device
- Secure the access point port firmly between two fingers and firmly insert the non-coring needle into the port, entering at a direct 90° angle
- Aspirate 3-5 mL of blood with the syringe
  - If unable to aspirate blood, re-clamp the catheter and do not attempt further use
  - Asking the patient to cough may facilitate access of the port
- Flush the catheter with 3-5 mL 0.9% NaCl using a prefilled 10 mL syringe
  - If catheter does not flush easily, do not attempt further use
- Attach IV administration set and observe for free flow of IV fluid
- Cover the needle and insertion site with the sterile occlusive dressing

****Document procedure, results, and vital signs.****

VASCULAR ACCESS via CENTRAL CATHETERS (cont.)

CATHETER	SIZE	MAX FLOW RATE
PICC	Less than 2.0 fr	125 mL/hr
PICC	Greater than 2.0 fr	250 mL/hr
Groshong PICC	3 fr	240 mL/hr
Groshong PICC NXT	4 fr	540 mL/hr
Groshong PICC NXT	5 fr	200 mL/hr
Hickman/Broviac	8 – 9.5 fr	3000 mL/hr

PEARLS:

- Do not exceed recommended flow rates.
- Avoid taking a blood pressure reading in the same arm as the PICC.
- Only non-coring, right angle needles specific for implanted ports are to be used for vascular access devices that are implanted in the patient. These are generally not carried MEDEVAC units but may be provided by the patient.
- Priming the tubing of the non-coring needle **is essential** to prevent air embolism.
- There are many peripherally inserted, tunneled and/or implanted ports options. Providers should do their best to discern what option the patient has. Patient may be carrying a reference/wallet card about their device.
- PICC lines will not tolerate rapid infusions or infusions under pressure.

****Document procedure, results, and vital signs.****

INVASIVE PRESSURE MONITORING

PURPOSE:

MEDEVAC Crews are required to monitor invasive pressure on any patient with central venous or arterial access

PROCEDURE:

- If the referring facility's transducer unit is not compatible with transport unit's cable, replace with compatible transducer setup using aseptic technique
- Ensure IV pressure bag is preset and inflated to 300 mmHg with stopcock closed
- Place transducer at phlebostatic axis and secure with tape
- Zero the line to obtain a "zeroed" reading on the transport monitor
- Flush the line and perform a square waveform test
    - Evaluate the waveform and numeric values for correlation with recent patient trends

NOTES:

- Evaluate the insertion site for bleeding, swelling, hematoma, or dislodgement
- Tightly secure stopcocks and cover openings with non-vented endcaps
- Continue monitoring correlation between NIBP and ABP
- Zero the line after movement of patient, at mission altitude, and if suspected erroneous reading
- If waveform dampened, check pressure bag inflation and reassess position of leg / wrist
- If invasive line is in the femoral artery, keep patient head < 30° and leg straight. Reassess distal pulses with any patient movement
- Flush line and evaluate square waveform test as needed
- If invasive line becomes dislodged, immediately apply direct pressure

****Document procedure, results, and vital signs.****

REBOA MANAGEMENT

Purpose:

Surgical Team or SOF Medic placement for trauma arrest or non-compressible hemorrhage in the pelvis. Secondary to emergency thoracotomy or external junctional tourniquets

Procedure:

- Receive report from team that placed device
  - Who inserted the device?
  - What type of device (ER-REBOA)?
  - Where located (Zone 1 or Zone 3)? How confirmed? (xray, ultrasound)
  - When was the balloon inflated?
  - Why was it placed (Arrest? Peri-arrest? Pelvic bleed?)
  - How is the device secured?
- Confirm vital sign trends with sending team
- Confirm security of REBOA device with sutures, commercial securing device, or tape
- Record the length measurement at insertion site
- Confirm balloon pressure
- Check distal circulation and any external hemorrhage (Doppler)
- Connect Arterial line to hemodynamic monitoring device
- Verbalize plan to move patient to next level of care. Ensure time of balloon inflation
- Continue to closely monitor until patient is secured in the next level of care (hemodynamic monitoring, distal circulation, device security, catheter depth)

CONCERNS:

- Changes in altitude
- Transient drop in blood pressure
- Change in balloon pressure
- Dislodge of device
- Loss of distal circulation
- Distal external hemorrhage
- Zone 1 REBOA patients will not be transported via rotary wing aircraft with REBOA inflated; balloon must be deflated prior to transport
- A medical provider trained on manipulation of the occlusion balloon should accompany the patient at all times

****Document procedure, results, and vital signs.****

Reference: CPG ID 38 (Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) for Hemorrhagic Shock)

FOLEY CATHETER PLACEMENT

CLINICAL INDICATIONS:

- Bladder distention in an unconscious person, or for blockage / inability to urinate in conscious person.
- Allows for accurate monitoring of output for fluid management.

CONTRAINDICATIONS:

- Known or suspected urethral disruption resulting from pelvic trauma.
- Combative or uncooperative patient.

PROCEDURE:

- Choose appropriate catheter (16-18 for adults) and ready equipment.
- Position patient. Females in supine position with legs abducted. Cleanse urethra and surrounding area with antiseptic solution. Isolate area with drapes provided.
- Insert xylocaine jelly provided into urethra with the syringe provided.
- Insert catheter into urethra. For **females** advance the catheter approx. 3 inches. For **males**, pass catheter into the bladder the full length to the junction of the catheter and inflation port for balloon.
- Once urine is obtained, inflate balloon with 5 mL NS, then pull catheter outward until balloon against bladder neck. If no urine return is given and procedures to induce urine return (bladder palpation) do not work, DO NOT inflate the balloon.
- Secure catheter to leg with tape to prevent trauma to urethra.

****Document procedure, results, and vital signs.****

BLOOD GLUCOSE ANALYSIS

CLINICAL INDICATIONS:

- Suspicion of blood glucose abnormalities – hyperglycemia / hypoglycemia

CONTRAINDICATIONS:

- None

PROCEDURE:

- Gather and prepare equipment
- Obtain blood samples for analysis as per manufacturer's recommendations
- Place blood sample onto reagent strip and place into machine for analysis as per manufacturer recommendations
- Record result and treat any glucose abnormalities per appropriate protocol
- Perform quality assurance on glucometers weekly. If any suspicious recordings are noted, follow manufacturer's recommendations

****Document procedure, results, and vital signs.****

CARDIAC DEFIBRILLATION

CLINICAL INDICATIONS:

- Patient who is in pulseless cardiac arrest with either ventricular fibrillation or ventricular tachycardia seen on monitor

CONTRAINDICATIONS:

- None

PROCEDURE:

- Ensure patient attached to monitor / defibrillator. If paddles used, ensure that they are several centimeters away from monitor leads to prevent arcing. Use pediatric paddles as indicated – if unavailable and pads used, should place in anterior / posterior position for pediatric patients
- Set energy level to appropriate level. Start 200 J adult (biphasic) or 360 J adult (monophasic), or 2 J/kg pediatric
- Press "charge" button 30 seconds prior to end of compressions. This maneuver minimizes time between compressions and defibrillation. Compressions should continue until end of cycle
- Ensure all personnel clear of patient and pilots aware of cardioversion
- Press and hold "shock" button until energy delivered
- If rhythm converts - treat as per post resuscitation protocol
- Following shock delivery, immediately begin / return to CPR for 2 minutes before checking for pulse
- If pediatric patient fails to convert - repeat steps 2-7 above using escalating energy levels

****Document procedure, results, and vital signs****

AUTOMATED EXTERNAL DEFIBRILLATOR (AED):

- Turn on power to machine and follow prompts to attach pads to patient and machine
- Ensure no one touching / moving patient and press the "Analyze" or equivalent button. (If not present, the machine will automatically check the rhythm at dedicated time intervals. A vocal warning will tell you when this is occurring)
- If shock advised, press button to deliver shock and return to CPR for 2 minutes
- After analysis, if subsequent shocks advised, repeat steps 2-3 up to 3 shocks, until further care arrives, or until no further shock advised. **If no shock advised at any time, CHECK PULSE**. Continue CPR if no pulse. If pulse present, place patient in recovery position and transport

****Document procedure, results, and vital signs.****

12-LEAD ELECTROCARDIOGRAM

CLINICAL INDICATIONS:

- Suspicion of arrhythmia
- Chest pain believed to be of cardiac origin
- Toxic ingestion with cardiac side effects

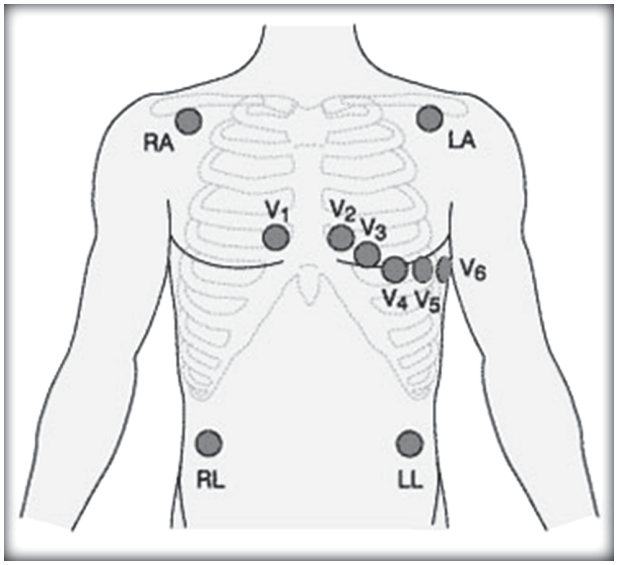
CONTRAINDICATIONS:

- None

PROCEDURE:

- Ensure patient lying flat on bed and place leads as per diagram
- If patient is unstable, address any emergent issues prior to attempting the 12-lead EKG
- May have to shave and / or dry patient for pad adhesion
- Once leads are in place, instruct the patient to remain still and limit any movements around the patient (as possible)
- Press button to obtain 12-lead EKG

****Document procedure, results, and vital signs.****



- V1 - 4th intercostal space, right sternal border
- V2 - 4th intercostal space, left sternal border
- V3 - placed equally between V2 & V4
- V4 - 5th intercostal space, mid-clavicular line
- V5 - placed along transverse line between V4&V6
- V6 - transverse from V4, 5th intercostal space, mid-axillary line

SYNCHRONIZED CARDIOVERSION

CLINICAL INDICATIONS:

- Unstable patient with tachycardia-dysrhythmia noted on monitor / EKG
- Patient who has failed conservative and / or chemical cardioversion
- Pulse present

CONTRAINDICATIONS:

- None

PROCEDURE:

- Ensure patient attached to monitor / defibrillator with synchronized cardioversion capability
- Time-permitting, ensure adequate IV / IO access present. Ensure that unsynchronized cardioversion / defibrillation capabilities present in case patient degenerates into another dysrhythmia
- Consider use of sedating medication (e.g., Midazolam 0.5-2 mg q 5 mins) prior to delivery of shock. **Note: This step is not mandatory and should not delay appropriate management of emergent condition**
- Set energy level IAW appropriate ALS / PALS Protocol
- Select **Synchronized Cardioversion** option. This should result in machine displaying **"SYNC"** as well as tracking electrical activity (arrow or highlighted segment of EKG)
- Ensure all personnel clear of patient and pilots aware of cardioversion
- Press and hold "Shock" button until energy delivered (this may take several seconds for machine to synchronize with cardiac cycle. Shock is not immediately delivered as in defibrillation)
- If rhythm converts - monitor and treat as appropriate
- If fails to convert – repeat steps 4-7 above using escalating energy levels. If patient degenerates, treat as per appropriate ALS / PALS protocol **(Note: most machines require pushing the "SYNC" after each shock if synchronized cardioversion to be repeated, failure to do so will result in delivery of an unsynchronized shock.)**

****Document procedure, results, and vital signs.****

TRANSCUTANEOUS (EXTERNAL) CARDIAC PACING

CLINICAL INDICATIONS:

- Patients with pulse rate < 60 (or appropriate for age) and signs of inadequate cerebral or end-organ perfusion

CONTRAINDICATIONS

- None

PROCEDURE:

- Severe hypothermia - focus on active rewarming and resuscitation first, wait at least 1 minute to feel pulse during rewarming (Follow Cold Weather Injury Protocol)
- Ensure patient attached to monitor and defibrillator with external cardiac pacing capabilities
- Time-permitting, ensure adequate IV / IO access prior to pacing. Also, may consider sedation (Midazolam 0.5-2 mg q 5 mins) prior to beginning pacing
- Turn selector switch to "Pace"
- Set rate to twice the patient's intrinsic rate (often 70-80 for adult, 100 for pediatric)
- Set energy level to lowest setting and gradually increase until capture is obtained (each pacer spike followed by QRS)
- Once capture obtained, ensure pulse and vital signs correspond with pacing. Evaluate patient for improvement. Monitor and continue sedation as needed
- If fails to capture at maximal setting, discontinue pacer
- At any time, if patient degenerates and needs CPR – begin compressions immediately. Pacer pads are insulated and it is okay to perform compressions with pacer running

****Document procedure, results, and vital signs.****

Lund-Browder Burn Estimate Chart - Adult

Total Area front/back (circumferential)		one side--anterior	one side--posterior	Do not include in total TBSA			
	Adult	adult	adult	1st °	2nd °	3rd °	TBSA
Head	7	3.5	3.5				0
Neck	2	1	1				0
Anterior trunk*	13	13	0				0
Posterior trunk*	13	0	13				0
Right buttock	2.5	na	2.5				0
Left buttock	2.5	na	2.5				0
Genitalia	1	1	na				0
Right upper arm	4	2	2				0
Left upper arm	4	2	2				0
Right lower arm	3	1.5	1.5				0
Left lower arm	3	1.5	1.5				0
Right hand	2.5	1.25	1.25				0
Left hand	2.5	1.25	1.25				0
Right thigh	9.5	4.75	4.75				0
Left thigh	9.5	4.75	4.75				0
Right leg	7	3.5	3.5				0
Left leg	7	3.5	3.5				0
Right foot	3.5	1.75	1.75				0
Left foot	3.5	1.75	1.75				0
	100	48	52	0	0	0	0

Age:	
Sex:	
Weight:	

Patient Identification

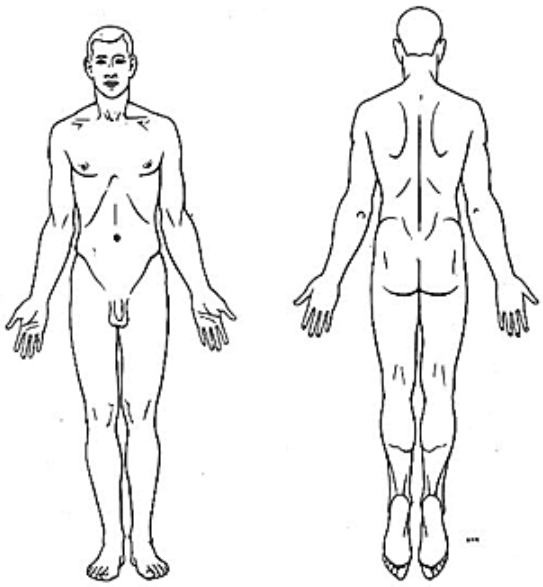


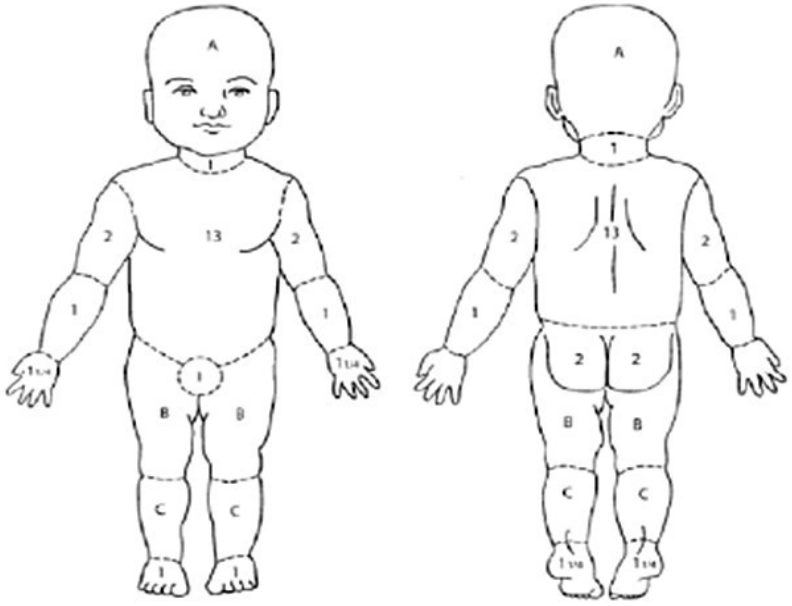
DIAGRAM A

Lund-Browder Burn Estimate Chart - Infant

Pediatric Lund Browder Burn Estimate & Diagram

Total Area front/back (circumferential)	1 to 4 years	5 to 9 years	10 to 14 years	15 years	Do not include in total TBSA 1st	2nd °	3rd °	TBSA
Head	17	13	11	9				0
Neck	2	2	2	2				0
Anterior trunk*	13	13	13	13				0
Posterior trunk*	13	13	13	13				0
Right buttock	2.5	2.5	2.5	2.5				0
Left buttock	2.5	2.5	2.5	2.5				0
Genitalia	1	1	1	1				0
Right upper arm	4	4	4	4				0
Left upper arm	4	4	4	4				0
Right lower arm	3	3	3	3				0
Left lower arm	3	3	3	3				0
Right hand	2.5	2.5	2.5	2.5				0
Left hand	2.5	2.5	2.5	2.5				0
Right thigh	6.5	8	8.5	9				0
Left thigh	6.5	8	8.5	9				0
Right leg	5	5.5	6	6.5				0
Left leg	5	5.5	6	6.5				0
Right foot	3.5	3.5	3.5	3.5				0
Left foot	3.5	3.5	3.5	3.5				0

1	
2	
3	



ESCHAROTOMY

DESCRIPTION:

Escharotomies are performed on deep partial-thickness (2nd degree) or full-thickness (3rd degree) burns to alleviate restriction from damaged tissue. This procedure should only be done prior to transport of patient by a trained provider or for emergency in-flight treatment by trained medical personnel. Medical Directors that sign the SMOG should only allow this procedure to be conducted by individuals underneath their direction on an individual or case by case basis. Immediately notify a burn center or receiving physician if escharotomies are performed prior to transport.

CLINICAL INDICATIONS:

- Deep partial-thickness or full-thickness circumferential burns to arms or legs
  - This may mimic compartment syndrome or act like a tourniquet, reducing arterial circulation resulting in ischemia or necrosis of the limb.
  - Pulses will feel diminished on exam even after elevation.
- Circumferential, full thickness burns to the chest wall
  - This can result in restriction of chest wall expansion and decreased compliance causing difficulty oxygenating and ventilating of intubated patients.
  - Clinical manifestations of chest wall restriction include rapid, shallow respirations; poor chest wall excursion; and severe agitation.

CONTRAINIDICATIONS:

No contraindications

EQUIPMENT:

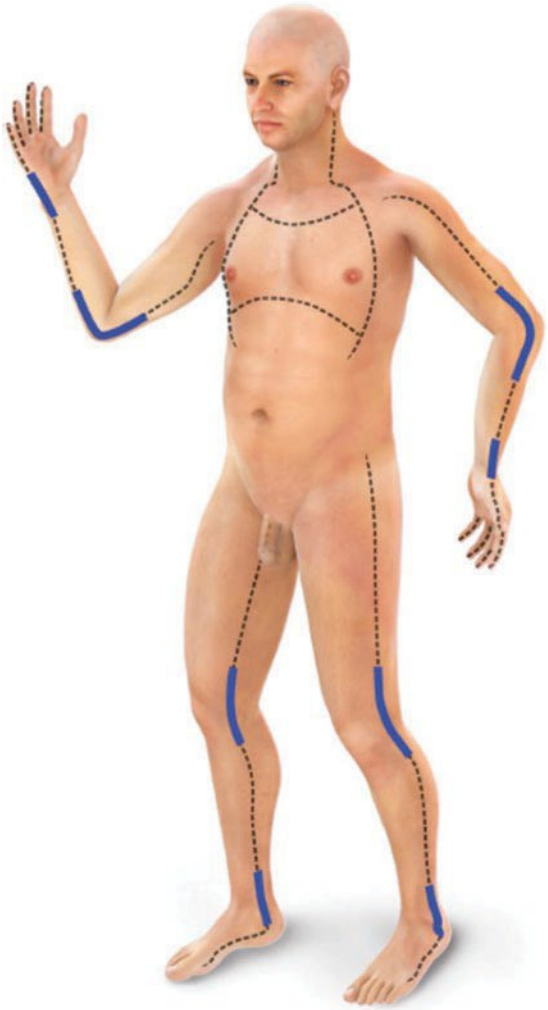
1. Scalpel, an electrocautery device, or both
2. Chlorhexidine prep
3. Combat gauze and Kerlex
4. Sterile towels

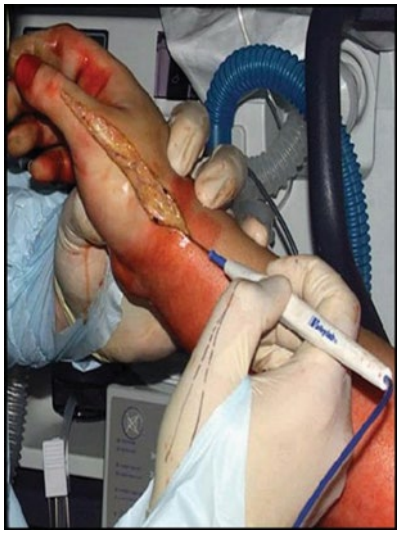
PROCEDURE:

1. Remove patient's rings, watch, and other jewelry during the initial examination.
2. Prep sterile items/equipment.
3. Outline or identify landmarks.

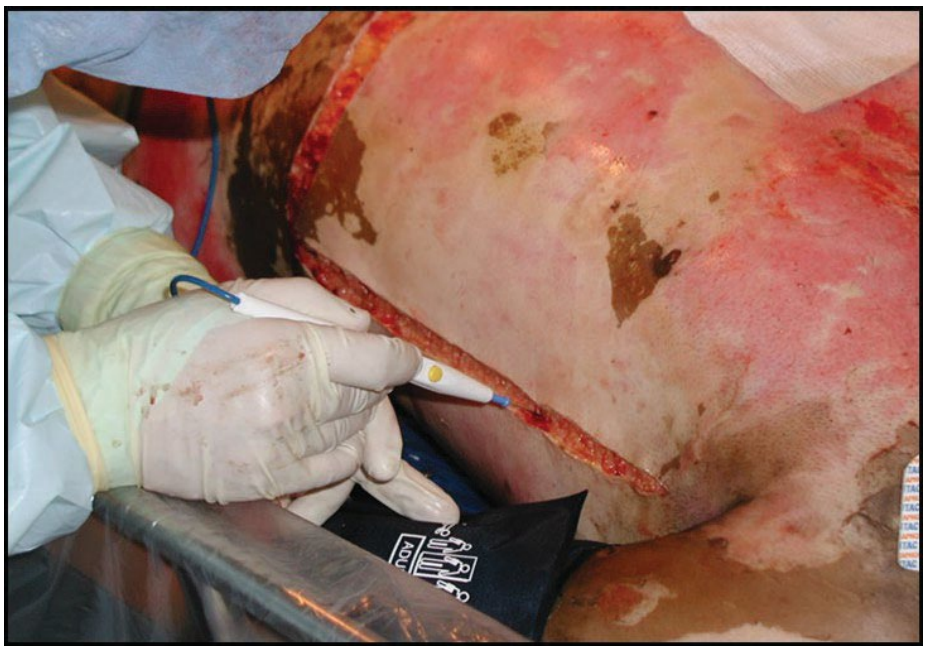
ESCHAROTOMY (cont.)

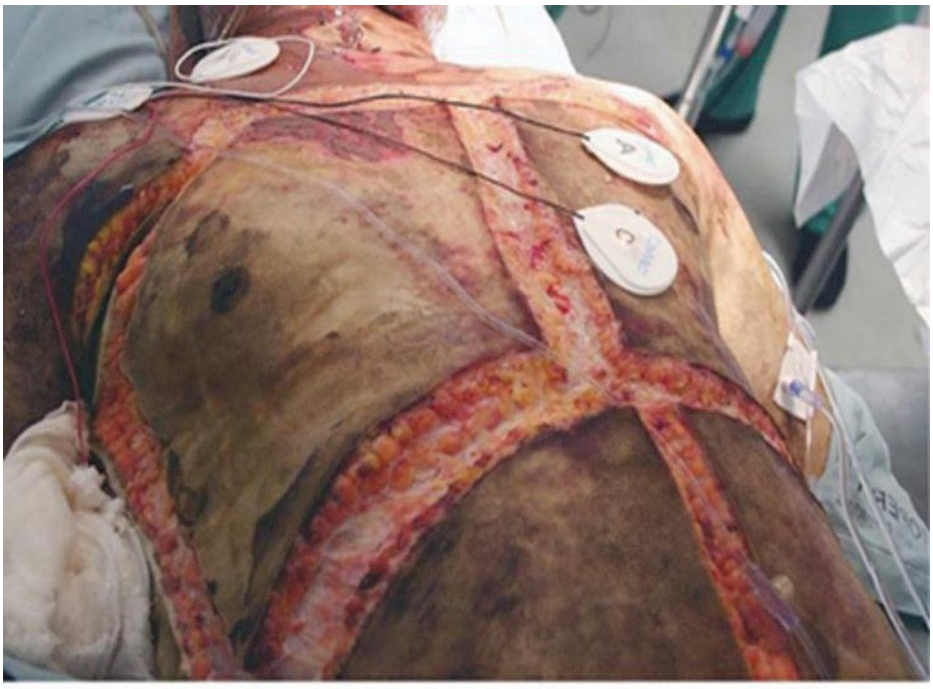
4. Follow guidelines to make escharotomies bilaterally (medial and lateral) down to the subcutaneous tissue.
    a. Preferred sites of escharotomy (dashed and solid lines). Particular care is needed to divide eschar over involved joint (solid lines). Care must be taken to avoid major nerves, vessels, and tendons.
    b. The incision along the extremities should extend through the length of the eschar, over joints, and down to the subcutaneous fat, laterally and medially.
    c. Chest incisions usually are made bilaterally along the anterior axillary lines and are connected by a transverse incision at the costal margin.
5. Repeat pulse exam in all extremities, if there is no return of circulation return to step 4.
6. Achieve hemostasis with combat gauze and dry kerlex
7. Skin color, sensation, capillary refill, and peripheral pulses are assessed and documented hourly.





ESCHAROTOMY (cont.)





ALTITUDE PHYSIOLOGY AND PATIENT TRANSFER

ALTITUDE CONCERNS FOR AEROMEDICAL TRANSFERS:

- **Gas expansion** occurs as altitude above sea level increases. Gas volume doubles at 18,000' mean sea level (½ sea level atmospheric pressure) and increases 25% from 5,000'-10,000'. This will typically not affect the operational ceiling for the UH-60 Blackhawk during aeromedical evacuation operations. Certain conditions and precautions to note:
  - **Air embolism / Decompression illness** – This is the only absolute contraindication to transport of patients at altitude. These patients should be transferred at sea level or in an A/C capable of cabin pressurization to sea level.
  - **Pneumothorax** – There is little risk of developing a tension PTX due to gas expansion from altitude during typical aeromedical evacuation flights in rotary-wing A/C. However, altitude should be limited when possible to < 5,000' MSL. If mission requirements mandate higher altitudes, the use of aeromedical evacuation platforms with pressurized cabins should be considered as applicable and tactically capable. Prophylactic chest tubes (for altitude-related concerns) are recommended for any flights above 10,000' mean sea level.
  - **Gastric distention** – Gas expansion does increase the risk of vomiting and, therefore, aspiration. Therefore, all patients with decreased LOC should have an NG / OG tube placed prior to transfer.
  - **Head injury** – As with PTX, there is little concern of altitude related elevation of elevated ICP in head injured patients although penetrating intracranial or maxillofacial injuries may set conditions for an entrapped-gas phenomenon with adverse clinical consequences. Any evidence of elevated ICP should result in treatment per guideline. Altitude restrictions do not differ from those listed for PTX. Constant vigilance should be maintained for evidence of elevation of ICP.
  - **Eye injury** – Penetrating eye injuries or surgeries may introduce air into the globe. Again, the altitudes obtained for rotary-wing A/C does not pose a risk of elevating the IOP during normal operations.
  - **Gas filled equipment** – Medical equipment with gas filled bladders also may suffer from interference at high-altitudes. Primarily, endotracheal tube cuffs and pressure bags which should be evaluated at altitude by testing the pressure of the exterior bladder or filled with air. If able, utilize manometer to verify tube pressure. A cuff pressure between 20-30 cmH2O is recommended to provide adequate seal and reduce the risk of complications or tissue damage. Verify with supervising physician or flight surgeon before filling endotracheal tube with saline. Routine filling of endotracheal tubes with saline is no longer recommended.
- **Flow Rates:** Decreased atmospheric pressure may interfere with IV flow rates and / or pump function. These must be monitored continuously.
- **Invasive Blood Pressure:** Adjust / re-calibrate monitor every 1000' if required based upon monitoring device.

ALTITUDE PHYSIOLOGY AND PATIENT TRANSFER (cont.)

- **Hypothermia:** As altitude increases, the temperature will drop about 3.5° F per 1000 feet. This is further complicated in the H-60 due to rotor-wash, forward air speed, and normal lapse rate. Therefore, patients must be protected from hypothermia at all times. This includes use of the Hypothermia Prevention and Management Kit (HPMK), blankets, heaters if available, and closing cabin doors / crew windows during transport.
- **Hypoxia:** Patients are at increased risk of hypoxia during transport at altitude. If transfers are taking place in high-altitude locations, pulse oxygenation should be monitored at all times, and the medic / provider should maintain a low threshold for the use of supplemental O2. At no time should the patient's O2 be allowed to go below 92 percent (commercial pulse oximeters read up to 3 percent off, therefore a sat of 91 percent may be seen in a patient who is really at 88 percent.). Patients who smoke or have underlying cardiopulmonary disease are at increased risk even at low altitudes.
- **Dysbarism:** Patients may experience discomfort due to gas expansion in air-filled body spaces (e.g., ears, sinuses, teeth) during ascent / descent. Patients and aircrew may experience pressure changes resulting from descent from altitude. Typically, inner ear pressure is most common – alleviated by performing a proper Valsalva maneuver. These are typically mild during RW transport, however, if severe, altitude should be held and attempts made to alleviate pain and / or slow rate of ascent / descent.

Document procedure, results, and vital signs.

Reference: CPG ID #27 (Interfacility Transfer of Patients Between Theater MTFs)

PATIENT REFUSAL

Clinical Indication:

- If a patient [or person(s) responsible for a minor] refuses treatment or transport, after pre-hospital providers have arrived on the scene, the following procedures should be carried out:

Treatment

- Complete primary assessment, obtain set of vitals and determine mental status
- Any injuries or illnesses found to immediately threaten life, limb, or eyesight (or can be assumed will deteriorate enroute) should be addressed and treated immediately
- Patients that prevent treatment of these injuries, should be encouraged. Any doubt of capacity should prompt treatment/transport under implied consent. Patient with decision- making capacity refusing treatment of life-threatening injury or illness require further clinical judgement and consultation with medical director prior to informed refusal
- Injuries or illnesses that do not represent imminent threats to life, limb, or eyesight (or considered unlikely to deteriorate enroute) may be addressed in accordance with the following:
  - Determine decision making capacity (patient / parent)
  - Is the patient AOx4 and understands issues with their medical condition/status? If no, treat IAW Altered Mental Status Protocol
- Clearly and repeatedly explain to the patient/parent of concerns and risks of refusal
- Document all findings and discussions with the patient / parent regarding refusing treatment and / or transportation
- Obtain a signature from a witness (crewmember) and the patient / parent / parties responsible for the patient as to refusal of care

****Notes:** Clearly explain to **Military Personnel** why the treatment is needed**.** Notify them that refusal of treatment may bring judicial or administrative adverse action upon them under UCMJ.**

POST-OPERATIVE AND CC INTERFACILITY TRANSFER

CLINICAL INDICATIONS:

- Patient at outlying MTF requiring transfer to higher role of care for more definitive surgery/treatment

PRE-TRANSFER Patient Status Requirements:

a. JTS CPG – Intra-theater Transfer and Transport – recommends clinical parameters that should be met prior to transfer; if parameters are not met, they should be addressed and en-route mitigation plans formulated BEFORE departure / transfer:

1. Heart Rate 50-120 /min
2. SBP >90 mm Hg (MAP >60 mm Hg)
3. SpO2 >90-96%,1 FiO2 required <50%
4. Temp > 95ºF/35ºC
5. Urine Output > 50 mL/h
6. Hemoglobin > 8.0 g/dL
7. Platelets > 50k/mm³
8. INR < 2.0
9. Base Deficit < 6
10. Lactate < 2.5 mmol/L

If these criteria are not met, the transferring physician should continue resuscitation or provide documentation indicating limitations that compel urgent transfer. Do **NOT** transport if the patient has the following:

HR < 50 or >120, systolic BP < 90, core temperature < 35°C, SpO2 < 90% on supplemental O2, Hct < 21, base deficit below -5, or pH < 7.3. Patient may be transported IF documentation indicates the need for transfer prior to restoration of physiology to more normal parameters.

b. Attempt to keep patient packaging time at < 25 minutes; use of warming devices in accordance with the JTS Hypothermia Prevention CPG.

c. Movement of Deceased Patients:

1. In general, patients who meet clinical criteria for death are not to be transported by MEDEVAC, with the exception of extreme extenuating circumstances, such as emergency exfiltration during CSAR.

POST-OPERATIVE AND CC INTERFACILITY TRANSFER (cont.)

2. If vital signs are absent prior to launch, make all reasonable attempts to resuscitate as clinical and tactical circumstances permit. If unsuccessful, consider basic cardiac ultrasound (as available) to determine whether any signs of cardiac activity are present. If absent, mission abort is warranted.
3. In such circumstances, contact and consultation with medical control or other available physician is suggested, in order to facilitate field determination of death and cessation of resuscitative efforts.

PROCEDURE:

a. **Role 2/3 provider responsibilities:**
It is the responsibility of the transferring physician to write enroute care orders appropriate for the transport environment and individualized for each patient in consultation with the Critical Care Flight Paramedic and/or the ECCN (or attending Flight Provider) prior to launch. The Flight Paramedic / Provider should be given a Standard Order Set for Critical Care Transfers or similar document with en route care orders signed by the transferring physician.

1. Provide a complete report to Flight Paramedic / Provider.
2. Provide all patient-specific related medical records.
3. Assist Flight Paramedic / Provider with packaging patient for transport as requested.
4. Complete specified areas on the appropriate patient care report
    a. Administrative data
    b. Most current laboratory data
    c. Mechanism of Injury (MOI)
    d. Diagnosis
    e. Procedures
5. Place patient on ventilator at least 30 minutes prior to flight. Obtain pre-flight ABG to ensure patient tolerates ventilator settings.
6. It is strongly suggested that the transferring physician make every possible attempt to contact and discuss the case with the receiving physician or facility representative. Flight Paramedics and ECCNs should confirm or encourage this vital "physician-to-physician hand-off" if practicable.

b. **FLIGHT PARAMEDIC / PROVIDER responsibilities prior to transfer**:

1. Obtain orders for en route care from transferring physician; review orders and discuss potential en route problems with transferring physician, reconcile medications (ensure needed medications, specific to patient's condition, are obtained and prepared), allergies and patient's weight, confirm patient's identification, and secure personal effects.
2. Perform primary & secondary assessment ensuring an understanding of the patient's injuries / illness / procedures performed.

POST-OPERATIVE AND CC INTERFACILITY TRANSFER (cont.)

3. Spinal immobilization is indicated during transfer if ordered by transferring physician.
4. Assess placement and secure all tubes, lines, and drains & ensure proper functioning.
5. Ensure endotracheal tube is secure; secure pulse oximeter / $ETCO_2$ monitor.
6. Review ABG – ABG should be done within 30 minutes of flight; patient should be on transport ventilator with vent settings for transport; ABG obtained 15 minutes after being placed on transport ventilator.
7. Ensure vascular access X 2 - peripheral, central or IO and A-line as needed.
8. Check all bandages, splints, dressing, fixation devices and tourniquets for placement and ensure no evidence of ongoing hemorrhage.
9. If indicated, insert OG/NG tube for gastric decompression, especially in intubated patients; cap or place to suction.
10. Empty Foley catheter bag prior to flight; ensure UOP documentation by transferring facility.
11. For an intubated patient, provide adequate analgesia and sedation PRIOR to giving additional paralytic medications. Re-dose medications as needed prior to flight in accordance with transferring physician's orders.
12. Continue administration of blood products if ordered by transferring physician. If anticipated administration of blood products enroute, Flight Paramedic/Provider should request orders for blood products and appropriate blood products from the transferring physician and use FDA approved fluid warming device as appropriate for warming fluids.
13. Collect all patient care documentation for transport with patient, i.e. pre-hospital, transport, labs, x-rays, transferring facility notes, etc.
14. Remove all air from IV fluid bags and place all free flowing bags in pressure bags.
15. Ensure patient is properly packaged in a warming device unless contraindicated prior to transfer. Follow directions specific to each warming device ensuring over heating or thermal burns do not occur. Hypothermia, acidosis and coagulopathy constitute the "triad of death" in trauma patients.
16. Securely affix all equipment, supplies, loose tubing and lines to NATO litter prior to moving the patient to the vehicle or aircraft.
17. Once patient is packaged, ensure all lines are leveled and monitors are zeroed.
18. Provide eye and ear protection to patient.

POST-OPERATIVE AND CC INTERFACILITY TRANSFER (cont.)

c. SPECIAL CONSIDERATIONS:

1. Eye Trauma: Fox shields should be placed for any patient with a suspected or confirmed open globe, possible intraocular foreign body or eye injury. **DO NOT remove impaled or stubborn foreign bodies from the eyes.** (even contact lens**) SHIELD AND SHIP. DO NOT PLACE ANY DRESSINGS UNDER RIGID EYE SHIELD** or manipulate the injured eye. Also want to avoid nausea/vomiting in these patients. Normal Saline may be used to rinse eyes in awake patient with no penetrating injury. Shield ONLY injured eye. (JTS CPG - Eye Trauma: Initial Care)
2. Compartment Syndrome: Patients with extremity injuries, abdominal injuries/surgery, burns, coagulopathy and those who have received massive transfusion are at risk for compartment syndrome. Ensure proper assessment prior to flight. If compartment syndrome is suspected during flight, place extremity at the level of the heart. Pain out of proportion to the injury and paresthesia are symptoms of compartment syndrome, as well as pallor, paralysis, pulselessness, and poikilothermia. Patients who are sedated, paralyzed or have an epidural or block in place are at increased risk and require judicious hands on assessment of at risk abdomen and extremities. (JTS CPG – Compartment Syndrome and Fasciotomy)
3. Burns: For patients with partial and/or full-thickness burns to > 20% TBSA, use of the Burn Patient Admission Orders and **JTS Burn Resuscitation Flow Sheet** are REQUIRED and should be continued during transfer to another facility. (JTS CPG – Burn)
4. Advanced pain management modalities: For patients with epidurals, continuous peripheral nerve blocks, PCA infusions, or other pain medicine infusions, a pain note should be completed prior to transport as it is a vital part of provider communication. (JTS CPG – Management of Pain, Anxiety and Delirium in Injured Warfighters)
5. Sedation and pain management must be maintained at appropriate levels throughout transport. As appropriate and as directed by transferring physician, attempt to maintain sedation target as follows using the Richmond Agitation Sedation Scale (RASS)

Richmond Agitation Sedation Scale (RASS): Used as sedation target goal for Post Surgical / CC (See chart on next page).

POST-OPERATIVE AND CC INTERFACILITY TRANSFER (cont.)

APPENDIX D: RICHMOND AGITATION SEDATION SCALE (RASS)

Score	Term	Description	
+4	Combative	Overtly combative, violent, immediate danger to staff.	
+3	Very Agitated	Pulls or removes tube(s) or catheter(s); aggressive.	
+2	Agitated	Frequent non-purposeful movement, fights ventilator.	
+1	Restless	Anxious but movements not aggressive vigorous.	
0	Alert, Calm		
-1	Drowsy	Not fully alert but has sustained awakening (eye-opening/eye contact) to voice (>10 seconds).	Verbal Stimulation
-2	Light Sedation	Briefly awakens with eye contact to voice (<10 seconds).	
-3	Moderate Sedation	Movement or eye opening to voice (but no eye contact).	
-4	Deep Sedation	No response to voice, but movement or eye opening to physical stimulation.	Physical Stimulation
-5	Unarousable	No response to voice or physical stimulation.	
Procedure for RASS Assessment			
1. Observe patient: Patient is alert, restless, or agitated.			Score 0 to+4
2. If not alert, state patient's name and say to open eyes and look at speaker			
- Patient awakens with sustained eye opening and eye contact.			Score -1
- Patient awakens with eye opening and eye contact, but not sustained.			Score -2
- Patient has any movement in response to voice but no eye contact.			Score -3
3. When no response to verbal stimulation, physically stimulate patient by shaking shoulder and/or rubbing sternum.			
- Patient has any movement to physical stimulation.			Score -4
- Patient has no response to any stimulation.			Score -5

*Sessler CN, Gosnell M. Grap MJ, Brophy GT, O'Neal PV, Keane KA et al. The Richmond Agitation-Sedation Scale: validity and reliability in adult intensive care patients. Am J Respir Crit Care Med 2002; 166:1338-1344.
*Ely EW, Truman B, Shintani A., Thomason JWW, Wheeler AP, Gordon S et al. Monitoring sedation status over time in ICU patients: the reliability and validity of the Richmond Agitation Sedation Scale (RASS). JAMA 2003; 289:2983-2991.

Analgesia and Sedation Management, CPG ID 61

d. Patient Care Enroute to the Receiving Hospital

1. Patient vital signs will be monitored continuously enroute and documented at least every 5–15 minutes (q 5min if on pressors) per transferring physician's orders.
2. Reassess patient at least every 15 minutes and address events as necessary following transferring physician's orders and protocols for the specific illness or injury.
3. Assess pain control, sedation and need for paralysis. Re-dose medications as needed in accordance with transferring physician's orders. Ideally, paralytic medication should not be administered near the end of the flight. Significant, adjunctive analgesia may be required to compensate for initial lift, landing and in flight combat maneuvers, therefore Flight Paramedic / Provider should consider carrying higher volumes of analgesia that would be normally used in ground transport or fixed facilities.
4. All events will be addressed with appropriate interventions according to transferring physician's orders and protocols. All interventions require reassessment for patient response to the intervention.
5. All enroute care, including ventilator changes, medications, events, interventions, and patient's response will be documented on the appropriate patient care documentation.

POST-OPERATIVE AND CC INTERFACILITY TRANSFER (cont.)

e. Patient Report and Transfer of Care at the Receiving Hospital

1. A verbal and written patient report will be given to the receiving nurse or physician upon delivery of the patient.
2. Routinely, the responsibility of care will be transferred at the receiving ED. On rare occasions (i.e. mass casualty incidents, pending emergency flights, etc.), care may need to be transferred on the helipad rather than at the bedside.
3. For Tail-to-Tail transfers, the Flight Paramedic/Provider initiating transport will send all documentation from the transferring facility and the patient care documentation from the first leg of the flight with the Flight Paramedic/Provider completing the second leg of the transfer. The Flight Paramedic/Provider completing the second leg of the transfer will initiate their own patient care documentation, circling "2nd Leg" at the top of the form and ensure all documentation is turned over to the MTF upon arrival and hand off of patient care.
4. The patient care documentation will be completed and left with the patient at the receiving facility at the time of patient handover. If unable to complete documentation due to extensive mission requirements, the patient care documentation will be forwarded to the appropriate medical information receiving facility/person IAW local / theater policy.

Any in-flight problems should be addressed per appropriate protocol and per written instruction from transferring physician. Continued problems should prompt contacting medical control as soon as it is possible.

****Document procedure, results, and vital signs.****

Reference: CPG ID #27 (Interfacility Transfer of Patients Between Theater MTFs)

FACILITY TRANSFER CHECKLIST

DO NOW	TAKE WITH	IN FLIGHT
M: □ Check all bandages, splints, dressings and tourniquets for placement / evidence of ongoing hemorrhage □ Mark bleeding strikethrough □ Measurement of abdomen □ Request orders for type and cross-matched blood or O-negative blood	**M:** □ Additional Blood products (1:1:1) □ Tubing □ Warmer □ Golden Hour Container	**M:** □ Blood products administration □ Check all bandages, splints, dressings and tourniquets for placement / evidence of ongoing hemorrhage □ Measurement of abdomen
A: □ Assess / document ETT size, depth, security, cuff pressure, bite block □ Attach ETCO2 monitor □ Insert / Assess and document NG / OG tube placement, size, depth, security □ Review chest radiograph for ET confirmation and NG / OG placement □ Apply C-collar for airway stability	**A:** □ Extra ETT / King LT / IGEL □ Suction soft-tip □ 10ml syringe □ Bite block □ Tape □ BVM	**A:** □ Confirm ETT is in appropriate position □ Look / feel for symmetric chest wall rise □ Verify tube position at teeth □ Check ETCO2 □ DOPE
R: □ Setup Ventilator and confirm ventilator settings □ Check baseline lung compliance / resistance with BVM □ Auscultate heart / lung sounds □ Check placement and function of chest tube / drainage system / Heimlich valve □ Request ABG after transport ventilator is attached to patient	**R:** □ O2 for transport □ Backup ventilator □ Suction □ Needle for decompression	**R:** □ Look and feel for chest excursion □ Check pulse oximeter □ Check patient's color
C: □ Setup monitor and zero all pressure lines □ Assess distal pulses and neurovascular status □ Ensure IV access x 2 (minimum) □ Remove air from IV bags and pressurize □ IV medications arranged for easy access (20ml, 10ml, 5ml, 3ml) □ Review CBC/Chemistry results □ Check Foley catheter placement, measure output amount, empty bag	**C:** □ Vasoactive medications (Dopamine, Neo, Norepinephrine) □ Pressure bags □ IV fluids and tubing	**C:** □ Check temp, pulse, BP, and cardiac rhythm □ Assess distal pulses and neurovascular status during transport. □ Assess IV access □ LZC pressure lines
H / I: □ Conduct baseline neurologic exam □ Provide eye and ear protection to patient; HPMK, warmed IV fluids, blankets and/or chemical heat packs. □ Review orders and discuss potential en-route problems with the transferring physician. □ Ensure patient and all equipment secured □ Place transport ventilator on transport O2 □ Assess pain control, sedation and need for paralysis. Re-dose medications if needed before flight □ Patient loading considerations	**H / I:** □ Collect all labs, x-rays, pre-aid station / hospital documentation for transport □ Reconcile medications; verify allergies and patient's weight □ Secure personal effects □ Sedation meds (Propofol, Versed, Ketamine) □ Pain meds (Fentanyl, Morphine, Ketamine) □ Paralytic meds (Vecuronium, Rocuronium) □ 3% NaCl	**H /I:** □ Assess neurologic and sedation □ Check placement of all tubes, lines and drains & ensure proper functioning □ Ensure all wires and tubing are accessible and have adequate slack to allow monitors and IVs to be properly positioned and secured □ Serial assessments □ Prepare patient and give report to receiving facility
□ Altitude considerations	□ Medications	□ Patient packaging
□ Required waiting time before transport	□ Type and number of patients	□ Additional support (medical / non-medical)
□ Respiratory support	□ Monitoring (body systems, medical interventions, etc.)	□ Telephonic consultation
□ Equipment	□ Thermal considerations	□ Transport time and route of transfer

EXAMPLE Standing Order Sheet for Critical Care Patient Transfers

PATIENT IDENTIFICATION

(Last, First, Middle Initial; SSN/Identification Number; grade; DOB; treatment facility)

Date:

Sending Facility:

Sending Physician:

Receiving Facility:

Diagnosis:

Condition:

Patient Category:

Allergies:

Height:

Weight (kg):

Fluids: [ ] LR mL/hr [ ] NS mL/hr [ ] 3% Saline mL/hr [ ] D5W [ ] Other_____

[ ] PRBC [ ] FWB [ ] Plasma [ ] LTOWB

Monitoring: [ ] Vital Signs [ ] Every 5 min Vital Signs [ ] Every 15 min Vital Signs [ ] Every 30 min

[ ] Continuous cardiac monitoring, document rhythm strips pre-flight and with any rhythm changes

[ ] ICP/CPP [ ] CVP [ ] GCS [ ] ETCO2 [ ] UO____mL hourly

Activity: [ ] Bed rest

[ ] Spine precautions: C-Collar/C-Spine TLS Spine

Nursing: [ ] Wound VAC dressing to _____mm Hg suction

[ ] NGT to low continuous suction OR [ ] Clamp NGT

[ ] OGT to low continuous suction OR [ ] Clamp OGT

[ ] Chest tube 1 to: water seal (circle: R L Both) OR _____cm H2O Suction (circle: R L Both)

[ ] Chest tube 2 to: water seal (circle: R L Both) OR _____cm H2O Suction (circle: R L Both)

[ ] Chest tube 3 to: water seal (circle: R L Both) OR _____cm H2O Suction (circle: R L Both)

[ ] Chest tube 4 to: water seal (circle: R L Both) OR ____cm H2O Suction (circle: R L Both)

[ ] Keep HOB elevated _____ degrees [ ] Keep HOB flat

Respiratory: [ ] Keep O2Sat >_____ %

Oxygen: [ ] Nasal Cannula at _____LPM [ ] Non-rebreather at _____ LPM

Ventilator Settings: Mode: [ ] SIMV [ ] AC [ ] CPAP [ ] BiPAP

Rate: _____breaths per minute I:E ratio:_____

Tidal Volume: _____ mL FiO2:_____ % PEEP: _____cm H2O PIP: _____

EXAMPLE Standing Order Sheet for Critical Care Patient Transfers (cont.)

PATIENT IDENTIFICATION

(Last, First, Middle Initial; SSN/Identification Number; grade; DOB; treatment facility)

Vasoactive Medications:

[ ] Dopamine ___mg/___mL at____mcg/kg/min IV; titrate to MAP >_____mm Hg

[ ] Norepinephrine 4mg/___mL at____mcg/min IV; titrate to MAP >_____ mm Hg

[ ] Phenylephrine 10mg/____mL at____mcg/min IV; titrate to MAP > _____mm Hg

[ ] Epinephrine ___mg (1:10,000)/____mL at___mcg/min IV; titrate to MAP >____ mm Hg

[ ] Other_____

Sedation and Analgesics:

[ ] Ketamine ___mg/kg q____minutes IVP PRN sedation to Riker Sedation-Agitation Scale of 1-2

[ ] Midazolam ___mg q____minutes IVP PRN sedation to Riker Sedation-Agitation Scale of 1-2

[ ] Haloperidol ____mg q____minutes IVP PRN sedation to Riker Sedation-Agitation Scale of 1-2

[ ] Lorazepam ____mg q____minutes IVP PRN sedation to Riker Sedation- Agitation Scale of 1-2

[ ] Fentanyl ____mcg q___minutes IVP PRN pain

[ ] Morphine ____mg q____minutes IVP PRN pain

[ ] Other_____

Paralytics:

[ ] Rocuronium _____mg IVP

[ ] Vecuronium _____mg IVP

Intracranial Hypertension:

[ ] 3% Hypertonic Saline 250 cc bolus for any signs of herniation

[ ] Mannitol Infusion Rate: _____

Labs:

[ ] ABG 15 minutes prior to departing sending facility

[ ] Other:

Additional critical information:

Physician Signature:

CUI (when filled in)

Prescribed by: DoDI 6040.45, DoDD 6490.02E, DHA-PI 6040.01 *(Updated 20250721)*

TACTICAL COMBAT CASUALTY CARE (TCCC) CARD

BATTLE ROSTER #: _____

EVAC: ☐ **Urgent** ☐ **Priority** ☐ **Routine**

NAME *(Last, First)*: _____ **LAST 4:** _____

SEX: ☐ **M** ☐ **F** **DATE** *(DD-MMM-YY)*: _____ **TIME:** _____

SERVICE: _____ **UNIT:** _____ **ALLERGIES:** _____

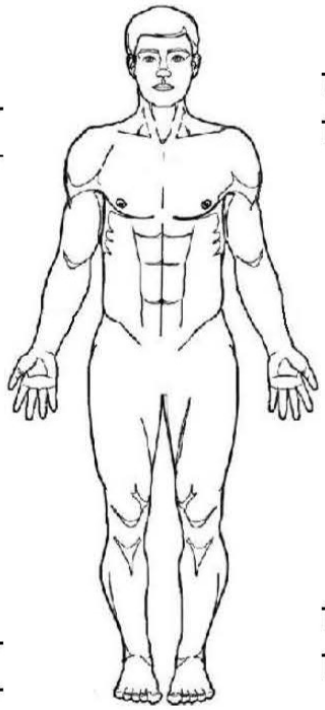
Mechanism of Injury: *(X all that apply)*

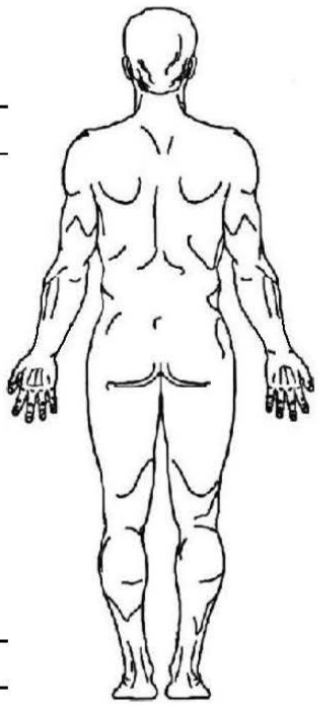
☐ **Artillery** ☐ **Blunt** ☐ **Burn** ☐ **Fall** ☐ **Grenade** ☐ **GSW** ☐ **IED**
☐ **Landmine** ☐ **MVC** ☐ **RPG** ☐ **Other:** _____

Injury: *(Mark injuries with an X)*

TQ: R Arm
TYPE: _____
TIME: _____

TQ: L Arm
TYPE: _____
TIME: _____





TQ: R Leg
TYPE: _____
TIME: _____

TQ: L Leg
TYPE: _____
TIME: _____

Signs & Symptoms: *(Fill in the blank)*

Time				
Pulse (Rate & Location)				
Blood Pressure	/	/	/	/
Respiratory Rate				
Pulse Ox % O2 Sat				
AVPU				
Pain Scale (0-10)				

DD FORM 1380, JUL 2025 **TCCC CARD**

CUI (when filled in)

Controlled by: DHA
CUI Category: PRVCY
Distribution/Dissemination Control: FEDCON
POC: dha.ncr.bus-ops.mbx.dha-formsmanagement@health.mil

CUI (when filled in)

(Updated 20250721)

BATTLE ROSTER #: _____

EVAC: ☐ Urgent ☐ Priority ☐ Routine

Treatments: *(X all that apply, and fill in the blank)*

	Type
C: TQ- ☐Extremity ☐Junctional ☐Truncal	
Dressing- ☐Hemostatic ☐Pressure ☐Other	
A: ☐Intact ☐NPA ☐CRIC ☐ET-Tube ☐SGA	
B: ☐O2 ☐Needle-D ☐Chest-Tube ☐Chest-Seal	

C:	***Name***	***Volume***	***Route***	***Time***
Fluid				
Blood Product				

MEDS:	***Name***	***Dose***	***Route***	***Time***
Analgesic *(e.g., Ketamine, Fentanyl, Morphine)*				
Antibiotic *(e.g., Moxifloxacin, Ertapenem)*				
Other *(e.g., TXA)*				

OTHER: ☐Combat-Pill-Pack ☐Eye-Shield (☐R ☐L) ☐ Splint
☐Hypothermia-Prevention **Type:** _____

NOTES:

FIRST RESPONDER
NAME *(Last, First)*: _____ **LAST 4:** _____

DD FORM 1380, JUL 2025 (Back) **TCCC CARD**

CUI (when filled in)

(Updated 20250423)

K9 TACTICAL COMBAT CASUALTY CARE (K9TCCC) CARD

EVAC CAT: ☐ Urgent ☐ Priority ☐ Routine

EVAC TYPE: ☐ Fixed ☐ Rotary ☐ Ground ☐ MEDEVAC ☐ CASEVAC

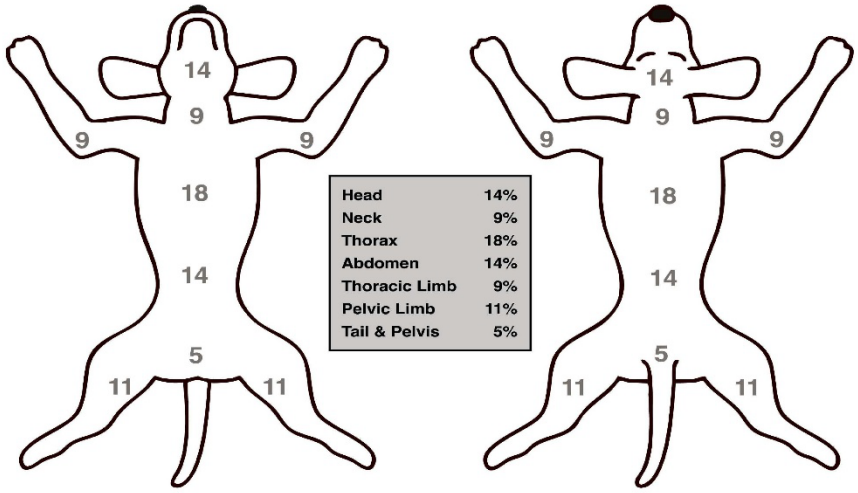
UNIT: _____ **K9 NAME:** _____ **TATTOO:** _____

DATE: *(DD-MM-YY)* _____ **TIME:** _____ **SEX:** ☐ M ☐ F

Mechanism of Injury: *(Mark **X** all that apply)*

☐ IED ☐ GSW ☐ MINE ☐ BURN ☐ GRENADE ☐ ARTILLERY ☐ FALL ☐ MVC ☐ OTHER: _____

Injury: *(Mark all injuries that apply with an **X**)*



Head	14%
Neck	9%
Thorax	18%
Abdomen	14%
Thoracic Limb	9%
Pelvic Limb	11%
Tail & Pelvis	5%

Vital Signs: *(fill in the blank)*

Time					
Pulse Rate/Location (60-80)					
Respiratory Rate (16-30)					
Temperature (99-102.5°F)					
Capillary Refill (< 2 sec)					
Blood Pressure (120/80)					
Pulse Ox% (> 95%)					
Pain Score (0-10)					

NOTES: _____

_____

_____

FIRST RESPONDER NAME *(Last, First)*: _____ **AOC/MOS:** _____

DD FORM 3073, APR 2025 (Send card to dha.mwdtraumaregistry@health.mil) **Page 1 of 2**

PREVIOUS EDITION IS OBSOLETE.

(Updated 20250423)

K9 TACTICAL COMBAT CASUALTY CARE (K9TCCC) CARD

Treatments: *(Mark X all that apply, and fill in the blank)*

M: Muzzle - ☐ Handler provided ☐ Hasty ☐ Other: _____

M: Dressing - ☐ Hemostatic ☐ Pressure ☐ Other: _____

TQ - ☐ Wide Elastic ☐ Extremity _____ Time _____ ☐ Other: _____

A: ☐ Intact ☐ ETI/OTI ☐ TRACH ☐ CRIC ☐ Other: _____

R: ☐ O^2 ☐ Chest Seal ☐ NDC ☐ Chest Tube ☐ Other: _____

C: Catheter - ☐ IV ☐ IO Location: _____

RESUSCITATION	Name	Volume/Dose	Route	Time
K9 Blood Product				
Crystalloid Fluid 500ml IV bolus, repeat only once				

H: ☐ Hypothermia – Prevention ☐ Hyperthermia – External Cooling

H: ☐ Head Injury ☐ Elevate Head/Neck/Torso ☐ Other: _____

Medications for a 30kg K9 *(Mark X if given and write route and time)*

DRUG OPTIONS	DRUG NAMES	DOSE (30kg)	ROUTE	TIME
ANALGESIA Mild Pain: ketamine + benzo **OR** opioid alone; Mod/Severe Pain: ketamine + opioid OR ketamine + benzo + opioid	☐ **Ketamine (analgesia) IV/IO/IM**	**50mg**		
	☐ **Ketamine (sedation) IV/IO/IM**	**100mg**		
	☐ **Midazolam IV/IO/IM**	**10mg**		
	☐ **Hydromorphone IV/IO/IM**	**3mg**		
SEDATION ketamine + benzo **OR** ketamine + opioid	☐ **Fentanyl IV/IO IM**	**150mcg 300mcg**		
	☐ **Morphine IM**	**10mg**		
	☐ **Other:**			
ANTIBIOTIC	☐ **Cefazolin/Ceftriaxone IV/IM**	**750mg**		
	☐ **Cefotaxime IV/IM**	**750mg**		
	☐ **Ertapenem IV/IM**	**750mg**		
	☐ **Other:**			
OTHER	☐ **TXA IV/IO**	**0.5gm**		
	☐ **Naloxone IV/IO IM/IN**	**2mg 4mg**		
	☐ **Calcium IV/IO**	**1 gram**		
	☐ **3 or 5% Hypertonic Saline (HTS) IV/IO**	**150ml**		
	☐ **Other:**			

OTHER: ☐ Splint ☐ Wound Dressing ☐ Other: _____

LINE	ITEM	EVACUATION REQUEST MESSAGE
1	Location of Pickup Site.	
2	Radio Frequ., Call Sign, & Suffix.	
3	No. of Patients by Precedence.	
4	Special Equipment Required.	
5	Number of Patients by Type.	
6	Security of Pickup Site (Wartime).	
6	Number and Type of Wound, Injury, or Illness (Peacetime).	
7	Method of Marking Pickup Site.	
8	Patient Nationality and Status.	
9	NBC Contamination (Wartime).	
9	Terrain Description (Peacetime).	

August 2016 Use of previous version authorized until exhausted

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DISTRIBUTION: US ARMY TRAINING SUPPORT CENTERS (TSCs)
HEADQUARTERS, DEPARTMENT OF THE ARMY,
ATTN: ATIC-SAA, GTA Program, Fort Eustis, VA 23604-5166

LINE ITEM	EXPLANATION
1. Location of Pickup Site.	Encrypt grid coordinates. When using *DRYAD Numeral Cipher, the same SET line* will be used to encrypt grid zone letters and coordinates. To preclude misunderstanding, a statement is made that grid zone letters are included in the message (unless unit SOP specifies its use at all times).
2. Radio Frequency, Call Sign, Suffix.	Encrypt the frequency of the radio at the pickup site, *not* a relay frequency. The call sign (and suffix if used) of person to be contacted at the pickup site may be transmitted in the clear.
3. No. of Patients by Precedence.	Report only applicable info & encrypt brevity codes. A = Urgent, B = Urgent-Surg, C = Priority, D = Routine, E = Convenience. (If 2 or more categories reported in same request, insert the word "break" btwn. each category.)
4. Spec Equipment.	Encrypt applicable brevity codes. A = None, B = Hoist, C = Extraction equipment, D = Ventilator.
5. No. of Patients by Type.	Report only applicable information and encrypt brevity code. If requesting MEDEVAC for both types, insert the word *"break"* between the litter entry and ambulatory entry: L + # of Pnt -Litter; A + # of Pnt - Ambul (sitting).
6. Security Pickup Site (Wartime).	N = No enemy troops in area, P = Possibly enemy troops in area (approach with caution), E = Enemy troops in area (approach with caution), X = Enemy troops in area (armed escort required).
6. Number and type of Wound, Injury, Illness (Peacetime).	Specific information regarding patient wounds by type (gunshot or shrapnel). Report serious bleeding, along with patient blood type, if known.
7. Method of Marking Pickup Site.	Encrypt the brevity codes. *A* = Panels, *B* = Pyrotechnic signal, *C* = Smoke Signal, *D* = None, *E* = Other.
8. Patient Nationality and Status.	Number of patients in each category need not be transmitted. Encrypt only applicable brevity codes. A = US military, B = US civilian, C = Non-US mil, D = Non-US civilian, E = EPW.
9. NBC Contamination, (Wartime).	Include this line only when applicable. Encrypt the applicable brevity codes. N = nuclear, B = biological, C = chemical.
9. Terrain Description (Peacetime).	Include details of terrain features in and around proposed landing site. If possible, describe the relationship of site to a prominent terrain feature (lake, mountain, tower).

Reference: ATP 4-02.2, *Medical Evacuation.*

COMMON LABORATORY VALUES

LABORATORY				
Anion Gap	14 – 18 mEq/L			
BUN	6 – 23 mg/dL			
Calcium	8.5 – 10.5 mg/dL			
Creatinine	0.6 – 1.4 mg/dL			
Glucose	70 – 100 mg/dL			
Sodium	135 – 145 mEq/L			
Potassium	3.5 – 5.0 mEq/L			
MISCELLANEOUS				
D-Dimer	< 250 mcg/mL			
Lactate	0.5 – 2.2 mmol/L			
HEMATOLOGY				
Hemoglobin	Male	14 – 18 g/dL	Female	12 – 16 g/dL
Hematocrit	Male	40 – 54%	Female	38 – 48%
Platelets	150,000 – 440,000/mcl			
CARDIAC MARKERS				
Troponin I* < 0.04 ng/mL	Onset	3 – 12 hrs	Peak	24 hrs
CK – MB* 0 – 5 ng/mL	Onset	3 – 12 hrs	Peak	24 hrs
Myoglobin	Male	10 – 95 ng/mL	Female	10 – 65 ng/mL
	Onset	1 – 3 hrs	Peak	6 – 10 hrs
INR (only if Tx for DVT)	< 1.1			

*Troponin assays are becoming more analytically sensitive. Each device has different reference ranges associated. Correlate cTn with reference lab. Point of care readers are less sensitive.

NORMAL BLOOD GASSES	
pH	7.35 – 7.45
Pco2	35 – 45 mmHg
HCO3	22 – 26 mmol/L
Base Excess	(-2) – (+2) mEq/L
CO2	19 – 24 mEq/L
SaO2	> 92%

Coagulation Factors

- **Prothrombin Time:** 11-13 sec
- **Activated Partial Prothromboplastin Time (APPT):** 21-35 sec
- **International Normalized Ratio:** < 1.1

OXYGEN CYLINDER LIFE

Cylinder	D	E	G	H
Liters	356	622	5260	6900
Flow (LPM)	**Length of use (min)**	**Length of use (min)**	**Length of use (min)**	**Length of use (min)**
2	178	311	2630	3450
4	89	155	1315	1725
6	59	104	876	1150
8	44	78	658	862
10	35	62	526	690
12	30	52	438	575
15	23	41	350	460

NOTE: Current MEDEVAC Oxygen Cylinder is "D" type.

To estimate duration of use for Oxygen Cylinders:

- Duration of Flow = Contents of cylinder / Flow rate.

Cylinder Factors for Calculation of Duration of Oxygen Flow:

Cylinder Size	D	E	G	H and K
Factor	0.16	0.28	2.41	3.14

Once you have the cylinder factor and the amount of pressure remaining in the cylinder, the duration of flow can be calculated with the following equation.

Duration of flow (min) = Pressure (psig) x Cylinder Factor/Flow (L/min)

VITAL FUNCTIONS ASSESSMENT REFERENCE CHART

GLASGOW COMA SCALE			
SCORE	**ADULT**	**CHILD**	**INFANT**
Eye Opening			
4	Spontaneous	Eye Opening Response Same as Adult	
3	To Speech		
2	To pain		
1	None		
Verbal Response			
5	Oriented	Oriented	Coos and babbles
4	Confused Conversation	Confused Conversation	Irritable, Cries
3	Inappropriate Words	Inappropriate Words	Cries in Response to pain
2	Incomprehensible Sounds	Incomprehensible Words/Sounds	Moans in Response to Pain
1	None	None	None
Best Motor Response			
6	Obeys Commands	Obeys Commands	Moves Spontaneously
5	Localizes Pain	Localizes Pain	Withdraws to Touch
4	Flexion Withdrawal to Pain	Flexion Withdrawal to Pain	Withdraws from Pain Stimulus
3	Abnormal Flexion (Decorticate)	Abnormal Flexion (Decorticate)	Abnormal Flexion (Decorticate)
2	Extension (Decerebrate)	Extension (Decerebrate)	Extension (Decerebrate)
1	None (Flaccid)	None (Flaccid)	None (Flaccid)
For Intubated Patient use **Verbal "T"** (Example: Eyes open to pain, Intubated, and Localizes would be E2,V1,M5, or **GCS 8T**)			

VITAL FUNCTIONS ASSESSMENT REFERENCE CHART (cont.)

MUSCULOSKELETAL INJURY and PERIPHERAL NERVE ASSESSMENT			
UPPER EXTREMITIES			
INJURY to Consider	**MOTOR Testing**	**SENSATION Testing**	**NERVE**
Elbow Injury	Index and Little Finger Abduction	Little Finger	Ulnar
Wrist Fracture or Dislocation	Thenar Contraction with Opposition	Index Finger	Median Distal
Supracondylar Fracture of Humerus	Index Tip Extension	None	Median, Anterior Interoseous
Anterior Shoulder Dislocation	Elbow Flexion	Radial Forearm	Musculocutaneous
Distal Humeral Shaft, Anterior Shoulder Dislocation	Thumb, Finger group Extension	First Dorsal Web Space	Radial
Anterior Shoulder Dislocation, Proximal Humerus Fracture	Deltoid	Lateral Shoulder	Axillary
LOWER EXTREMITIES			
Pubic Rami Fractures	Knee Extension	Anterior Knee	Femoral
Obturator Ring Fractures	Hip Adduction	Medial Thigh	Obturator
Posterior Tibial	Toe Flexion	Sole of Foot	Knee Dislocation
Fibular Neck Fracture, Knee Dislocation	Ankle Eversion	Lateral Dorsum of Foot	Superficial Peroneal
Fibular Neck Fracture, Compartment Syndrome	Ankle / Toe Dorsiflexion	Dorsal 1st-2nd Web Space	Deep Peroneal
Posterior Hip Dislocation	Plantar Flexion	Foot	Sciatic Nerve
Acetabular Fracture	Hip Abduction	Upper Buttocks	Superior Gluteal
Acetabular Fracture	Hip Extension	Lower Buttocks	Inferior Gluteal

MUSCULAR STRENGTH GRADING	
SCORE	**EXAM RESULTS**
0	Total Paralysis
1	Palpable or Visible Contraction
2	Full Range of Motion Without Gravity
3	Full Range of Motion Against Gravity
4	Full Range of Motion, but Less than Normal Strength
5	Normal Strength
NT	Not Testable

VITAL FUNCTIONS ASSESSMENT REFERENCE CHART (cont.)

PEDIATRIC ALS EQUIPMENT

(Always use a Broselow Pediatric Emergnecy Tape if available)

BROSELOW cm / (approx) weight	<61cm 3-5kg	61cm 6-7kg	67cm 8-9kg	75cm 10-11kg	87cm 12-14kg	96cm 15-18kg	109cm 19-23kg	122cm 24-29kg	138cm 30-36kg	149+cm 37>kg
AGE	MONTHS			YEARS						
	0 1 2	3 4 5 6 7 8 9 10 11		1	2	3 4	5 6	7 8 9	10 11	12-16
RESUSCITATION BAG	Infant	Child					Child/Adult			Adult
O2 MASK	Newborn			Pediatric				Adult		
ORAL AIRWAY	Infant/Small Child			S Child	Child			Child/S Adult		Med Adult
BAG MASK	Infant	Pediatric						Peds/Adult		
LARYNGOSCOPE	0-1	1 Straight			2 Strait	2Straight/Curved		2-3 St/Curv		3 St/Curved
ET TUBE	2.5-3 Uncufd	3.5 Uncuffed		4 Un cuffed	4.5 Un cuffed	5 Un cuffed	5.5 Un cuffed	6 Cuffed	6.5 Cuffed	
STYLET	6						14			
SUCTION	6-8	8		8-10	10				12	
BP CUFF	Newborn/Infant			Infant/ Child	Child			Child/ Adult	Adult	
IV CATHETER	22-24			20-24	18-22		18-20		16-20	
OG/NG TUBE	5-8			8-10	10	10-12	12-14	14-18	18	
CHEST TUBE	10-12			16-20	20-24		24-32	28-32	32-40	
URINARY CATHETER	5-8			8-10	10	10-12		12		
CERVICAL COLLAR	N/A	Small					S/M	Medium	M/L	

Weights and lengths in above chart are estimates. To achieve most accuracy, utilize Broselow tape on patient.

ZOLL DEFIBRILLATION ENERGY SETTINGS FOR PEDIATRIC PATIENTS

BROSELOW cm / (approx) weight / pounds	<61cm 3-5kg 6-11	61cm 6-7kg 13-15	67cm 8-9kg 17-20lbs	75cm 10-11kg 22-25	87cm 12-14kg 27-32	96cm 15-18kg 34-41	109cm 19-23kg 42-52	122cm 24-29kg 54-65	138cm 30-36kg 67-80	149+cm 40kg 90	45 101
AGE	MONTHS			YEARS							
	0 1 2	3 4 5 6 7 8 9 10 11		1	2	3 4	5 6	7 8 9	10 11	12-16	
FLUID BOLUS	80ml	130	170ml	210ml	260ml	340ml	420ml	500ml			
ZOLL DEFIB ENERGY 1st	8J	10J	15J	20J		30J		50J		75J	
2nd	15J	20J	30J		50J		75J	100J	120J	150J	
MAXIMUM	30J	50J	75J	100J	120J	150J		200J			

Weights and lengths in above chart are estimates. To achieve most accuracy, utilize Broselow tape on patient.

VITAL FUNCTIONS ASSESSMENT REFERENCE CHART (cont.)

AVERAGE VITAL FUNCTIONS BY AGE

BROSELOW cm	<61cm	61cm	67cm	75cm	87cm	96cm	109cm	122cm	138cm	149+cm
(approx) weight	3-5kg	6-7kg	8-9kg	10-11kg	12-14kg	15-18kg	19-23kg	24-29kg	30-36kg	37>kg
AGE	MONTHS									
	0	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8	9	10	11	12-16
HEART RATE	107-181					93-161							88-156	70-142	59-131					52-115				43-108
RESP RATE	25-66					22-64							19-53	17-38	16-29					14-25				12-23
SYSTOLIC BP	60					79-105							85-108		88-110		91-119				97-137			
DIASTOLIC BP						34-81							40-69		45-68		51-89				59-86			
URINE (mL/kg/hr)	2												1.5		1									0.5

Weights and lengths in above chart are estimates, to achieve most accuracy utilize Broselow tape on patient

USEFUL CALCULATIONS

PEDIATRIC FORMULAS

- **ETT Size =** (Age / 4) + 4
- **ETT Depth =** 3 x ETT Size (Endotracheal)
- **Weight in kg (> 1 year) =** (Age (years) x 2) + 8
- **Systolic BP minimum =** 70 + (Age (years) x 2)

MEDICATION FORMULAS

- **Mcg/kg/min (micrograms/kilogram/minute) =** [16.7 x drug concentration (mg/mL) x infusion rate (mL/hr)] x weight (kg)
- **Infusion rate (mL/hr) =** [desired mcg/kg/min x weight (kg) x 60] / drug concentration (mcg/mL)

HEMODYNAMIC FORMULAS

- **MAP (Mean Arterial Pressure) =** [(2 x DBP) + SBP] / 3
- **Pulse Pressure =** SBP – DBP
- **Cerebral Perfusion Pressure (CPP) =** MAP – ICP
  - **Ideal CPP =** 60-70

COMMON CONVERSIONS

- **Lbs. =** kg x 2.2
- **Kg =** lbs. x 0.45
- **Fahrenheit =** (Celsius x 1.8) + 32
- **Celsius =** (Fahrenheit – 32) x 5/9
- **1 tsp. =** 5 mL
- **1 tbsp. =** 15 mL
- **1 oz. =** 30 mL
- **1 g =** 1,000 mg
- **1 mg =** 1,000 mcg
- **1 g =** 10,000 mcg