Critical Care Transport Team Protocols 2019

Colleagues,

This edition of the protocols bears witness to continued evolution of our practice. Our patients remain small in number, high in acuity with a disproportionate number of life-years yet to live, and not infrequently, with youth on their side. Our protocols represent the parameters of our practice. They are derived from our quality assessment and performance improvement activities and where available, evidence from the literature. The Clinical Practice Committee (CPC) remains the arbiter of practice.

Progressive emphasis is now placed on the practice of critical care medicine, complementary to that of scene based resuscitation. The emphasis on critical care is substantiated by the volume of critically ill or injured patients transported from hospitals through-out the state to tertiary care centers within, and outside of Maine. By far, such inter-facility transports are the majority of missions which we undertake.

Some things do not change. Our patients remain some of the most fragile and vulnerable, and some of the smallest transported by any Maine EMS agency. The geography and meteorology of Maine present unique challenges. The exigencies of transport in our state frequently result in prolonged intervals during which our providers must aggressively intervene to manage patients whose continued stability depends on astute clinical acumen, and adroit technical interventions.

Also unchanged is the expectation that our delivery of care is competent, compassionate, creative and credible. We remain an organization which expects that all members of the chain of survival are sophisticated. We are dedicated to creating an intellectual environment of life-long learning which befits an academic and collegial perspective. We are an organization which eschews heroism in favor of routinely excellent performance by all team members in an intellectual and emotional environment which is anti-hierarchal, anti-authoritarian and anti-elitist.

Though "geography is destiny" and determinative of the affairs of state, our challenge is to reduce its influence on the fate of an individual patient. The diagnostic and therapeutic interventions described in these protocols and applied by our teams, represent the most intense and direct practice of medicine in this effort. They have been created with great thoughtfulness, and with due regard for the risks attendant to medical practice in an austere, if not adverse, environment. Our patients are commended into our care, in trust by their loved ones and the clinicians and field providers who have administered to them before us. May we always prove worthy.

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Medical Director, LifeFlight of Maine

1. GENERAL CONSIDERATIONS

1.1 General Considerations

1.1.1 Goal:

- To maintain the most clinically adept team for critical, high risk or problem prone patients who must be transferred after careful consideration of the risks and benefits.

1.1.2 Objectives:

- Optimize pre-departure interventions to diminish the potential for enroute deterioration.
- Respond aggressively to enroute deterioration with interventions guided by the protocols, and communication with On Line Medical Direction (O.L.M.D.) if necessary.
- Seek to achieve application of tertiary care perspective and technology to integrate the care of the patient from the referring source into that of the receiving facility.

1.1.3 Policy:

- The Critical Care Transport Team, under the guidance of designated O.L.M.D. will follow the outlined protocols and procedures to meet the needs of the patient, their family and the referring staff. These guidelines apply to both the paramedic and nurse disciplines of the LifeFlight of Maine Critical Care Transport Team.

1.1.4 At the referring hospital:

- Introduce yourself and the team members.
- Unless the patient is in extremis, one crew member may initiate care while the other retrieves report. Remember, the referring hospital may have hours or days of experience with this patient.
- Review X-rays, EKG's, lab information and perform a physical exam with emphasis on the pertinent systems. Collect the pertinent information for the care of the patient during transport and hand-off
- Proceed with stabilization utilizing standing protocols. If the management of the patient is beyond the scope of these protocols, or if you have reason to believe these protocols do not apply, call OLMD for consultation and guidance.
- Work with referring staff as much as possible. To the extent possible, explain what you're doing and why.
- Before leaving the referring hospital, have the patient and family visit if possible.
- Explain the patient's condition and probable course. It is important to have a clear set of expectations for families and providers.

1.1.5 The transport team should give a complete report to the receiving unit and leave documentation of the care provided during the transport. Feedback information must be given as well.

1.1.6 Some medications discussed in these protocols may be obtained from the referring hospital.

1.1.7 All medications listed in these protocols are to be considered IV/IO unless otherwise stated.

1.1.8 Note: This protocol manual will not suffice as a tutorial or substitute for training, education, experience and a commitment by providers to lifelong learning.

1.2 Routine Standard of Care

1.2.1 Universal precautions

1.2.2 Vital sign monitoring commensurate with clinical manifestation of the patient and, at a minimum, every 30 minutes

1.2.3 As patient acuity dictates, interventions include

- Cardiac Monitor
- Pulse Oximetry
- Nasal Capnography
- Serial BP monitoring
- Serial 12 Lead Electrocardiography
- Analgesia and sedation appropriate to the patient's condition
- Appropriate airway management
- Appropriate respiratory assistance
- Oxygen therapy via Nasal Cannula, NRB, or other device as appropriate for the patient condition
- Appropriate ventilator management, when applicable
- Reliable intravenous access for medication and fluid administration
- Appropriate fluid therapy and bleeding control
- Gastric decompression as indicated for patient condition
- Identify or obtain a thorough history and physical exam
- Identify or obtain diagnostic information necessary to support a working diagnosis and the treatment plan that follows
- Aseptic technique for all invasive procedures
- Unless specified, all medications are to be administered via peripheral IV or IO
- Continuous waveform capnography for ALL intubated patients
- Continuous waveform monitoring if the patient has a PA/Arterial Catheter or ICP monitor
- Documented blood glucose in patients with altered mental status

1.2.4 Provide complete verbal report to receiving staff

- Assure referring assessment, diagnostics, and treatments have been included in transfer of care

1.2.5 Paper handoff form, documenting care provided by LOM crew, is REQUIRED

1.2.6 NOTE: Ketamine should not be used as procedural sedation. Unless being administered for RSI, contact with LOM medical direction MUST be made if intended to be used on a patient without a Supraglottic or endotracheal airway in place.

2. AIRWAY / RESPIRATORY

2.1 Airway Management

2.1.1 Indications:

- Any patient who presents with an obstructed airway, apnea, or compromised spontaneous oxygenation and ventilation

2.1.2 Objectives:

- To achieve secure, adequate, protected, and stable exchange of gases, oxygenation and ventilation, of the patient during the entire transfer operation.

2.1.3 Clinical Management:

- Maintain cervical spine precautions in all patients suspected of spinal trauma.
- Administer Fi02 appropriate for patient's condition.
- Clinical Indications and Required Equipment:
    - Respiratory Distress and hypoxia
        - Nasal Cannula
        - Air Entrapment Mask (Venturi Mask)
        - Non-Rebreather Mask.
    - Obstructed Airway
        - Foreign body: Magill forceps (after Heimlich maneuver)
        - Vomitus: DuCanto suction device, if available
        - Blood/Saliva: DuCanto suction device, if available
        - Tongue: Oral airway and jaw thrust or chin lift
    - Severe facial/neck trauma:
        - Intubation, supraglottic airway device or surgical airway, when attempts at oral or nasal endotracheal intubation are unsuccessful (see protocol)
    - Apnea
        - Bag valve mask ventilation with oral airway: Initiate as temporizing maneuver
        - Oro-tracheal Intubation: Preferred under all circumstances.
        - Supraglottic Airway Device: For use when endotracheal intubation has failed.
        - Surgical airway: When endotracheal intubation is unsuccessful, after using all other methodologies and devices.
    - Ineffective oxygenation, but spontaneous ventilation
        - Rapid sequence induction (RSI).
        - Refer to CCTTP 2.3 Intubation; Pharmacologically Assisted or Rapid Sequence Intubation (RSI)
    - Anticipated clinical course
        - Deterioration – suspected or anticipated
        - Transport – safety to crew or patient
        - Impending compromise – i.e. inhalation injuries, angioedema

2.2 Oral and Nasal Intubation

2.2.1 Indications:

- The Critical Care Transport Team (LIFEFLIGHT) is directed to place a definitive airway in any patient who has little or no spontaneous ventilatory effort. If the patient has spontaneous ventilations, clenched jaw, or requires medications for placement of an endotracheal tube, LMA, or King Airway, Refer to CCTTP 2.3.

2.2.2 Relative Contraindications:

- Unable to oxygenate and ventilate with bag valve mask technique despite oral and nasal adjuncts.

2.2.3 Equipment Required:

- Appropriate personal protective equipment.
- Bougie.
- Endotracheal tubes of appropriate size for patient.
- CMAC and other appropriate laryngoscope handles (with functioning light bulbs).
- Various size and type of blades appropriate for patient.
- 10ml syringe.
- Tube securing device.
- End tidal CO2 waveform continuous monitoring device or (Emergency Backup: Easy Cap End-tidal colormetric device).
- Nasal Cannula with or without integrated End Tidal Capnography monitoring system.
- Bag Valve Mask with reservoir.
- Suction.
- Magill forceps.
- Stylet.
- Oxygen.
- Stethoscope.
- Alternative airway devices (including King LT/S-D and or appropriately sized Laryngeal Mask Airway).
- ECG monitor with pulse oximetry, NIBP monitor, and waveform capnography.

2.2.4 Clinical Management:

- Identify the need for placement of definitive airway.
- Assemble and prepare equipment (with back up devices) and achieve agreement with teammate on action sequence, including rescue maneuvers and contingencies.
- Prior to initiation of airway management, assess the patient's airway based upon co-morbidities, anatomy, and concurrent injuries. Determine the appropriate technique for airway placement and identify potential complications.
- If this is a pharmacologically assisted intubation, please Refer to CCTTP 2.3 for medication administration
- Check integrity of endotracheal tube balloon.
- Select appropriate size endotracheal tubes and blades (Preferred tube size is 8.0 mm (most adults, 7.5-8.0 mm).
- Insert stylet if desired. (Note: The end of the stylet should not go past the "Murphy's eye", approximately 1 cm from distal end of tube.)
- Apply appropriate personal protective equipment if not already completed.
- If the patient is not pre-oxygenated, an attempt should be made to pre-oxygenate with 100% oxygen via non-rebreather for 60 seconds prior to any intubation attempt or if possible, several (8) vital capacity breaths in order to facilitate nitrogen washout. These breaths should be ideally provided in a patient with spontaneous ventilations. In some cases, bag valve mask ventilations must also be done. Stop intubation

attempt if oxygen saturations are less than 10% of starting saturation. This should be accomplished with a non-rebreather mask to facilitate nitrogen wash out if the patient has spontaneous respirations.

- Place nasal cannula on patient for passive apneic oxygenation. Maintain oxygen therapy and if the patient is obtunded, liter flow can be increased up to 15 Liters per minute.
- Intubation:
    - Option 1: Oral Endotracheal Intubation (preferred)
        - Apply external laryngeal manipulation (ELM) at the request of the provider who is performing the intubation.
        - If unable to ventilate patient and maintain oxygen saturations > 94%, place an oropharyngeal or nasopharyngeal airway adjunct and perform 2 person, 4 handed ventilating technique.
        - Maintain in-line stabilization of all trauma patients. Use Head Elevated Laryngoscopy Position to achieve optimal visualization. Adjust accordingly to maintain anatomical alignment in trauma patients
        - Position the patient ideally (maintain c-spine immobilization where appropriate) at a comfortable height and in the "sniffing" position.
        - Remove any obstructing materials (i.e. front of cervical collar*, head immobilizers*, helmets) if appropriate. *If front of c-collar and/or head immobilization device is removed, manual inline c-spine stabilization MUST be maintained throughout procedure.
        - Remove foreign bodies and/or dentures from mouth if obstructing view.
        - Suction airway as needed.
        - While holding laryngoscope in left hand, insert blade into right side of mouth, sweeping tongue to the left.
        - Place the Mac blade (curved) in vallecula or the Miller blade (straight) under the epiglottis. With an upward motion, raise the epiglottis to visualize the vocal cords. NEVER use prying motion against the upper gums or teeth. LifeFlight of Maine utilizes the Storz CMAC intubation tool. This should be the first option used for ALL intubations.
        - While visualizing the vocal cords, pass the bougie or endotracheal tube through the cords approximately 0.5 cm beyond the cuff.
        - Adult female tube depth usually 21-22 cm.
        - Adult male tube depth usually 23-24cm.
        - Pediatric tube depth usually 3 x the size of the ETT appropriate for that size child.
        - If unable to visualize the cords consider maneuvers such as External Laryngeal Manipulation.
        - While securely holding the endotracheal tube, remove the laryngoscope and stylet.
        - Inflate the balloon with 5-10ml of air and remove the syringe.
        - Attach End Tidal CO_2 detection device (preferably waveform capnography). It is appropriate to use a quantitative monitoring device (Note: In cardiac arrest, lack of CO_2

production may make ETCO2 inaccurate, requiring the use of alternative devices or direct laryngoscopy, to adequately verify tube placement).
        - Ventilate patient with BVM at 100% O2.
    - Option 2. Nasal Endotracheal Intubation (Less preferable)
        - Refer to Maine EMS Protocol "Blue" Respiratory Section for details.
- Once the tube is placed, verification of tube placement will be accomplished using at least three of the following methods, one of which must be ETCO2 (a or b) or laryngoscopy by the second provider.
    - ETCCO2 Waveform Capnography
    - Colorimetric ETCO2 Device (i.e. EasyCap) if #1 is not available. This is far less preferable, but can be used in emergent situations.
    - Direct visualization.
    - Observation of chest rise and fall.
    - Auscultation of bilateral breath sounds.
    - Absence of epigastric sounds with respirations.
    - ETT condensation with exhalation.
    - **Confirmation of ETT placement is a dynamic process, requiring ongoing monitoring during transport**
    - While x-ray is a useful tool for confirmation of depth, it is not mandatory to evaluate placement
- Secure tube with appropriate ties and devices.
- The head of the bed should be elevated by 30 degrees and gastric decompression should be accomplished whenever possible to prevent gastric regurgitation.
- Observe for chest rise and fall and presence of ETCO2 waveform monitor. *Note: You must ventilate the patient for a minimum of 6 breaths before this device can been deemed accurate.)
- The standard is that ALL patients who are intubated have continuous end tidal capnography. It must be documented in the patient's record.
- Auscultate over the epigastrium first, then the lungs, if possible.
- If ETT placement is confirmed, continue to ventilate patient at an age/size appropriate rate and volume.
- Intubation attempts should be limited to avoid hypoxia. If possible, the patient's oxygen saturation should not be allowed to go below 94%.
- If ETT placement is unable to be confirmed, or there exists any doubt as to correct ETT placement, immediately remove ETT and oxygenate patient with a BVM and 100% oxygen. Return to Step 4.
- If right main stem intubation is suspected (decreased or absent left sided breath sounds), slightly pull back on the ETT (1-2cm) and recheck.
- When ETT position is confirmed, note cm marking at lip and secure the endotracheal tube with an ETT securing device.
- Consider placing a c-collar to prevent excessive head movement and subsequent ETT displacement
- If utilizing an Easy Cap for initial placement identification (emergent situation ONLY), switching to quantitative waveform ETCO2 monitoring should be done as soon as practical and should be maintained throughout transport. Continuous assessment of the waveform for morphology should be noted with

appropriate intervention as needed. ETCO2 must be numerically documented with vital signs, and a printed strip at relinquishment of care must be attached to chart.

- Throughout transport, the position of the endotracheal tube must be continually monitored. Reassessment must occur after every patient move.
- If intubation is unsuccessful after 2-3 attempts:
    - *Note: An intubation attempt is defined as laryngoscopy with the intent to place a tracheal device if a desirable view is achieved, prior to a drop in saturation or BVM intervention*
    - Consider placement of an alternative airway device (King LT/S-D airway or LMA), refer to appropriate protocol.
    - Consider maintaining a BLS airway for the duration of the transport.
- If intubation attempts are unsuccessful and BVM ventilation is ineffective:
    - Consider surgical cricothyroidotomy (adults). CCTTP 7.16
    - Consider needle cricothyroidotomy (peds). CCTTP 7.17
- Additional Notes:
    - Be sure that documentation includes:
    - Indication for procedure.
    - Vital signs (including pulse oximetry) before, during and after procedure including printed ETCO2 waveforms and values.
    - Medications, routes and doses.
    - ETT size and depth.
    - Verification of proper placement of ETT.
    - Pediatrics: Cuffed ETT in the pediatric population is the standard. However this should not be cause for changing an otherwise functioning uncuffed ET tube, which has been previously placed. Use a length based resuscitation tape or (age+16)/4 for pediatrics.

2.3 RSI Pharmacology and Procedure

2.3.1 Indications:

- It may be necessary on occasion to sedate and utilize neuromuscular blockade before or during transport to facilitate intubation of the patient with a compromised airway when standard methods have failed and would delay care. Indications for pharmacologically assisted intubation include:
- Failure to protect or maintain the airway (i.e. GCS < 9, prolonged seizure activity)
    - Can the patient phonate with a clear and unobstructed voice?
    - Can the patient swallow spontaneously and handle normal oropharyngeal secretions?
- Failure to oxygenate or ventilate (i.e. laryngospasms, ARDS, status asthmaticus)
- Anticipated clinical course
- Deterioration – suspected or anticipated clinical deterioration
- Transport - protection of patient and/or flight crew during transport due to combativeness or agitation
- Impending airway compromise – i.e. inhalation injuries, angioedema

2.3.2 Relative Contraindications:

- Inability to ventilate patient with pocket mask or bag valve mask techniques.

2.3.3 Equipment:

- Appropriate personal protective equipment.
- Endotracheal tubes of appropriate size for patient,
- Storz CMAC with appropriate blade sizes and assorted laryngoscope handles (with functioning batteries).
- Bougie
- Various sizes and types of blades appropriate for patient (with functioning bulb secured in blades).
- 10ml syringe.
- Nasal Cannula
- Tube securing device.
- End Tidal CO2 waveform probe and adapter,
- End Tidal CO2 cap (EasyCap) as back up ONLY
- Bag Valve Mask with reservoir and PEEP adaptor.
- Suction (functional with large rigid tip catheter).
- Magill forceps.
- Stylet.
- Oxygen. A nasal cannula and non-rebreather mask are required.
- Stethoscope.
- Alternative airway devices (Surgical Airway equipment, King LT/S-D appropriately sized for patient).
- ECG monitor, pulse oximeter and waveform capnography.

2.3.4 Pharmacologically Assisted Intubation (RSI) Summary

- 1. PREPARATION
    - Oxygen
    - Monitor oxygen saturations and provide 100% oxygen by non-rebreather mask for 3 minutes at a minimum (Nitrogen Wash-out).
    - Coach patient to take eight vital capacity breaths, if possible.
    - Place nasal cannula on patient in preparation for passive apneic oxygenation. Once the patient has been sedated adequately, the nasal cannula liter flow should be turned up to 15 Liters per minute (Apneic oxygenation).
    - If patient is obtunded or if the respiratory effort is inadequate, provide 100% via BVM.
    - Monitor vital signs (ECG, heart rate, blood pressure, pulse oximetry, and wave form capnography.
    - Position/Spine Stabilization/Airway Anatomy
        - Place patient in appropriate position (obese patients and neonates should be placed in sniffing position to facilitate airway placement.

        - Maintain spinal stabilization as indicated. One person should be responsible for maintain precautions during the procedure.
        - Assess the patient's airway and determine the most appropriate means of intubation and perceived difficulty.
        - Mnemonics may guide your decision-making process.
        - HEAVEN
        - POGO
        - MOANS
        - LEMONS
        - RODS
        - SHORT
    - IV Access/Meds
        - Ensure appropriate IV access. Preferably two sites.
        - Calculate ideal body weight and drug dosages.
        - Bougie on every attempt as this is the preferred device with which to achieve intubation
        - Equipment/Backup Options
        - Have back up devices (King Airway and other airway devices) at the bedside.
- 2. PREMEDICATION
    - Atropine can be used as a drying agent and to block bradycardia caused by laryngeal stimulation. It is also used in setting of a second dose of succinylcholine.
    - For all patients < 1 year of age and to be considered for patients < 5 years of age,
        - **Atropine** 0.02 mg/kg IV
        - Minimum dose: 0.1mg IV.
        - Maximum dose 0.5mg IV.
        - Onset: Immediate Peak at two to four minutes.
        - Duration variable.
    - There is little evidence demonstrating that **Fentanyl** is clinically beneficial and should NOT be administered as a neuroprotective premedication in RSI, empirically.
- 3. INDUCTION
    - If time allows for correction of hypotension (**SBP < 100 mmHg**) and/or predicted to be < 100 mmHg. Initiate plan to address peri-RSI hypotension
        - Insure adequate fluid resuscitation
        - REDUCE the dose of the induction agent
        - Consider initiation of bolus or infusion vasoactive medications as per CCTTP 4.13
    - During airway procedure, if anticipated or actual SBP < 100 mmHg, **Epinephrine 10mcg** every 2-5 minutes until airway patency is achieved and vasoactive infusion is prepared and initiated
    - **Etomidate** 0.3 mg/kg IV push.
        - Most commonly used sedative/ induction agent in RSI with widest range of applications.
        - Maximum dose: 40 mg single dose.
        - Onset: 15 to 45 seconds.
        - Duration: 3-12 min.
    - **Ketamine** 2 mg/kg IV OR 4 mg/kg IM to MAX 500mg
        - Ketamine is CONTRAindicated in patients < 3 months of age
        - Can be considered for hypotensive and/or bronchospastic patients. It can be also used for patients in imminent arrest due to its beta-adrenergic effects.
        - Maximum dose: 250mg IV or 500 mg IM single dose.
        - Onset: Less than 30 seconds.
        - Duration: 5-15 min.
- 4. PARALYSIS
    - **Succinylcholine**: 2 mg/kg IVP.

        - CAUTION: Repeat doses of Succinylcholine have potential to cause severe bradycardia, For repeat doses, consider pretreating with **Atropine** 0.02 mg/kg to MAX of 0.5mg
        - Onset: 30 to 60 seconds (maximum peak)
        - Duration: 4-12 min
        - Maximum dose: None
    - ABSOLUTE Contraindications to Succinylcholine:
        - Known or suspected hyperkalemia (K+ > 5.5).
        - History of malignant hyperthermia.
        - Burns >5 days until healed.
        - Crush injuries (muscle damage) >5 days until healed.
        - Spinal cord injury / Stroke >5 days – 6 months.
        - Neuromuscular disease, myopathy – indefinitely.
        - Intra-abdominal sepsis >5 days – resolution of infection.
    - **Rocuronium**: 0.6 to 1.2 mg/kg to MAX 150mg IV
        - Onset: 60 to 120 seconds (maximum peak).
        - Duration: Dose dependent, but typically 30-60 minutes.
    - **Vecuronium** (Third Line Agent): 0.1 mg/kg to MAX 10mg IV
        - Onset: 75 to 90 seconds (maximum peak)
        - Duration: 60-75 minutes
- 5. INTUBATION
    - Please refer to CCTTP 10 INTUBATION Tips for procedural details.
- 6. POST-INTUBATION
    - Add agents that are needed for ongoing management. If sedation and analgesia are not adequate, patients can awaken, but still be paralyzed.
    - If at any time following Airway Procedure, SBP < 100 mmHg, refer to CCTTP 4.13 for treatment options of post-intubation hypotension
    - See CCTTP 2.4 for adult patients and CCTTP 8.12 for pediatric patients.

2.3.5 Age, Approximate Size, and Airway

Age	Birth	6 mos	1 yr	2 yr	3 yr	4 yr	5 yr	6 yr	8 yr	10 yr	12 yr	14 yr	Adult
Average Weight (kg)	3.5	7	10	12	14	16	18	20	25	30	40	50	70
ETT Size	3-3.5	3.5-4	4	4.5	4.5	5	5	5.5	6	6.5	7	7.5	8
Insertion Depth (cm)	9	11	12	13	14	14	15	15	16	17	18	20	22

2.4 Post-Intubation Sedation, Pain Control & Paralysis

2.4.1 Indications:

- To optimize the post-intubation treatment of critically ill patients in terms of adequate analgesia, on-going paralysis and appropriate sedation. To differentiate the intubated patient from the non-intubated patient as regards aggressive pain control and sedation.

2.4.2 Pearls, Pitfall and Considerations:

- Intubated patients require aggressive pain and anxiety management.
- Enhanced consideration must be given to vital signs and non-verbal communication to adequately assess pain, anxiety, and seizure activity in the intubated and paralyzed patient.
- Some analgesic and/or sedative agents may cause or exacerbate hypotension.
- Non-depolarizing agents should be used if ongoing paralysis is necessary after intubation.
- Remember that patients can awaken but still be paralyzed. To avoid this possibility, ongoing sedation and analgesia should be done on an empiric dosing schedule.
- Consider the effects of post-intubation sedation. Anticipate hypotension and insure treatment prior to the medication effects occur. Refer to CCTTP 4.13

2.4.3 Analgesia (Choose one or a combination of the following depending on patient needs):

- **Fentanyl Bolus**: 0.5 to 2 mcg/kg IV Bolus PRN.
  - Minimum dose: none.
  - Maximum dose 150mcg IV.
  - Onset: 1-3 min Peak: 3-20 min.
  - Duration: 15-30 min.
- **Fentanyl Infusion**: 0.25 – 2.5 mcg/kg/hr IV.
- **Morphine Bolus**: 0.05 – 0.1 mg/kg IV prn. Titrate to adequate pain control.
  - Minimum dose: none.
  - Maximum dose 8mg
  - Onset: 1-3 min Peak: 3-20 min.
  - Duration: 15-30 min
- **Morphine Infusion:** 0.01-0.1 mg/kg/hr IV
  - Maximum dose: 10 mg/hr
- **Ketamine Bolus/Infusion**: See below

2.4.4 Sedation (Choose one or a combination of the following depending on patient needs):

- **Midazolam Bolus**: 0.01 – 0.1 mg/kg IV every 5 minutes
  - Minimum dose: none.
  - Maximum dose: 5 mg IV
  - Onset: 1-3 min Peak: 3-20 min.
  - Duration: 15-30 min.
- **Midazolam Infusion**: 0.04-0.2 mg/kg/hr
- **Lorazepam Bolus**: 0.01 – 0.05 mg/kg IV every 15 minutes
  - Minimum dose: none.
  - Maximum dose 4 mg IV in single dose bolus
  - Onset: 5-20 min Peak: 3-20 min.
  - Duration: 15-30 min.
- **Lorazepam Infusion**: 0.01-0.1mg/kg/hr
- **Propofol Bolus:** 0.1 to 1 mg/kg IV
  - Minimum dose: none.
  - Maximum dose: none
  - Onset: 1-3 min Peak: 3-20 min
  - Duration: 15-30 min
- **Propofol Infusion:** 5 – 200 mcg/kg/min

- Titrate in increments of 10 – 25 mcg/kg/min if MAP > 65
- Usual Maintenance is 50 – 80 mcg/kg/min in transport

- **Ketamine Bolus:** 1 mg/kg IV
  - CONTRAindicated in patients < 3 months of age
  - In patients with physiologic stress leading to concern for catecholamine depletion, consider lower dose (0.25-0.5 mg/kg)
    - For hypotensive and/or bronchospastic patients (this is a second tier agent).
    - May repeat 0.25-0.5 mg/kg prn or use infusion
  - **Ketamine** also possesses potent analgesic properties, there is no need for concurrent opioid administration
  - Minimum dose: none.
  - Maximum dose: 250mg IV
  - Onset: 1-3 min Peak: 3-20 min
  - Duration: 15-30 min
- **Ketamine Infusion**: 0.5-2 mg/kg/hr (second line agent currently).

2.4.5 Paralysis

- If patient's minute ventilation is above the ventilator settings, prior to medication, correct ventilator settings as needed and appropriate
- If staff feel that they are not able to manage the patient's effectively without the use of muscle relaxants (i.e. paralytics) medical direction supports the use of these medications. It is imperative to have a detailed neurological exam recorded.
- Long Acting: Use when sedative agents alone are insufficient for safe transport.
  - **Rocuronium**: 0.6 to 1.2 mg/kg q 30 min. prn. Onset: 1-2 min. Duration: dose dependent.
    - Minimum dose: none.
    - Maximum dose 150mg IV.
    - Onset: 1-3 min Peak: 3-20 min.
    - Duration: 15-30 min.
  - **Vecuronium**: 0.1 mg/kg IV/IO prn.
    - Minimum dose: none.
    - Maximum dose 10mg IV.
    - Onset: 60 to 75 seconds.
    - Peak: 3-20 min.
    - Duration: 15-30 min.

2.5 Acute Bronchospasm

2.5.1 Indications:

- Acute bronchospasm occurs in a variety of disease processes. These include chronic disease states including chronic obstructive pulmonary disorder (COPD), emphysema, bronchitis, and congestive heart failure. Other reversible disorders include asthma. It is important for the provider to illicit a thorough history and precipitating factors. Determining a patient's usual status of disease will enable the provider to assess the current presentation and allow for an appropriate level of treatment.

2.5.2 Pearls, Pitfalls and Considerations:

- Indications for aggressive treatment include evidence of hypercarbia, hypoxia, fatigue (to include nebulizer and other adjunctive therapies). Controlled hypercarbia is preferable to inducing barotrauma in these patients. All that wheezes is not asthma.

2.5.3 Clinical Management:

- Assess and maintain an adequate airway. Additionally, assess the patient's respiratory and circulatory status. Watch for increasing ventilatory fatigue, which will culminate in hypoventilation and the need for intubation and ventilatory support.
- Position of comfort (usually most comfortable sitting upright).
- If the patient has spontaneous respirations, administer supplemental oxygen 6-15 L/minute via NC or NRB to maintain oxygen saturations of greater than 93%. If the patient has severe respiratory distress, consider high flow oxygen. Prepare for advanced airway management.
- Monitor cardiac rhythm, oxygen saturation, end tidal carbon dioxide and hemodynamic status.
- Establish IV and maintain KVO rate.
- Duo-Neb (**Albuterol** 2.5mg/**Ipatropium** 0.5mg) mixed in nebulizer and given over 5-15 min. (flow rate 6-8 LPM air/oxygen). After two doses of Duo-Neb, administer continuous albuterol nebulizers PRN. Do not use atrovent in patients with known peanut allergies.
- If not otherwise given, administer **Methylprednisolone Sodium Succinate** (Solu-Medrol) 2mg/kg to MAX dose 125mg IV.
- Consider the administration of **Magnesium Sulfate** 25-75 mg/kg to MAX dose of 2g IV over 30 minutes in patients with known history of asthma. Monitor for cardiorespiratory depression.
- If above ineffective, administer **Epinephrine** 1:1000 0.3mg IM, q 5-10 minutes in patients with life threatening respiratory distress or refractory shock. Use with caution in patients with cardiovascular disease or over age 55.
    - PEDIATRIC dosing (< 30 kg) **Epinephrine:** 1:1000 0.01 mg/kg IM q 5-10 minutes X 2 doses (MAX dose 0.3mg)
    - After two doses of epinephrine IM, initiate **Epinephrine Infusion:** 0.05 mcg/kg/min to max dose of 0.5 mcg/kg/min
- If the patient's respiratory status continues to deteriorate, consider trial of Bi-Pap at initial settings of 10/5 with a Fi02 of 100%. Titrate accordingly.
- If the patient's mental status continues to wane, prepare for emergent intubation. Induction medication of choice is **ketamine** for asthma.
- Reassess respiratory status and associated vital signs.
    - In intubated patients, for **Albuterol**, use Metered Dose Inhaler (MDI.) Install a spacer in the ventilator circuit and extend it fully. If an HME filter is being used, remove it prior to the administration of the MDI. Insert the MDI at the top of the spacer and depress medication just

prior to the inspiratory phase. Allow the patient to take several breaths and subsequently repeat. Collapse the spacer after treatment to minimize dead space.

2.5.4 SPECIAL CASES: Partial Airway Obstructions

- Croup
  - Assess the adequacy of the airway, breathing and circulation, intervene as appropriate.
  - Provide ventilatory support as needed. If there is concern for the patient to maintain a patent airway, consider endotracheal intubation by most experienced provider (including anesthesiology in operating room environment)
  - Monitor and record vital signs including RR, SPO2, HR, ECG and BP.
  - Administer high flow, high concentration oxygen.
  - **Dexamethasone** (Discuss with sending clinician)
    - 0.6 mg/kg PO/IV MAX 10mg
  - Prepare the nebulizer with **racemic epinephrine** (0.05 ml/kg of a 2.25% solution to a max single dose of 0.5 ml. May not exceed every 1 to 2 hours as needed for severe stridor.
  - Connect the nebulizer to an oxygen source at 6 liters per minute.
  - Reassess and monitor for desired effect and side effects.
- Epiglottitis or Undifferentiated Stridor.
  - Assess the adequacy of the airway, breathing and circulation, intervene as appropriate.
  - Provide ventilatory support as needed. If there is concern for the patient to maintain a patent airway, consider endotracheal intubation by most experienced provider (anesthesiology in operating room environment) especially in adult or pediatric patients presenting with signs and symptoms of upper airway compromise
  - Monitor and record vital signs including RR, SPO2, HR, ECG and BP.
  - Administer high flow, high concentration oxygen.
  - If there is concern for an infectious etiology of the airway obstruction (epiglottitis, retropharyngeal abscess, etc), the patient should have appropriate antibiotic coverage prior to transfer.
  - Contact On-line medical control including receiving physician or LOM medical director for additional options of further interventions as necessary.
  - Reassess and monitor patient during course of patient care for any changes signs and symptoms.

2.6 Cardiogenic Pulmonary Edema

2.6.1 Indications:

- Any patient with signs and symptoms of acute pulmonary edema.

2.6.2 Pearls, Pitfalls and Considerations:

- Clinical evaluation should be primarily to assess for perfusion adequacy. In the initial evaluation, assess airway, breathing and circulation. Obtain history from providers and patient if possible. Obtain lab values, EKG, and echocardiogram reports.
- If the patient has undergone recent hemodynamic monitoring, record the following: CO, PA, PCWP, CVP, and SVR.

2.6.3 Clinical Management:

- Assess respiratory and circulatory status with special attention to respiratory fatigue, worsening dyspnea, and alterations in mental status.
- Precipitating factors should be identified and corrected if possible. These include:
    - Dysrhythmias.
    - Alterations in blood pressure including hyper- and hypotension.
    - On-going cardiac ischemia.
- Establish and maintain adequate airway and ventilation status.
- Initiate oxygen therapy to maintain oxygen saturations of greater than 93%.
- Place patient in position of comfort.
- Consider trial of BiPap Ventilation. Refer to CCTTP 7.9
- If patient in respiratory failure, consider intubation. See protocol.
- Confirm placement of adjunct airway.
- With confirmed diagnosis of congestive heart failure (based upon history, clinical exam, chest x-ray, and laboratory evaluation), medication administration can include:
- If MAP below 60, refer to CCTTP 4.13.
- If MAP above 60:
    - **NTG** 0.4mg SL once per minute for continuous CVP/SVR reduction if symptoms are severe, **NTG** sprays to be used as bridge to initiation of NTG infusion 50 -200 mcg/min.
    - **Furosemide** 20-80mg IV. Titrate administration based upon prior exposure to medication and hemodynamics.
    - Prior to transport, consider inserting an indwelling urinary catheter to monitor urine output (If available at the sending facility and procedure does not unnecessarily delay transport).

2.7 Acute Pulmonary Embolism

2.7.1 Indications:

- Any patient with signs and symptoms of a pulmonary embolism (PE).
- Staff must be able to recognize patients with history commiserate with PE provide safe and efficacious care and transport to the appropriate destination.

2.7.2 Pearls, Pitfalls, and Considerations:

- Patients with PE can present with a wide variety of signs and symptoms. These can include everything from dyspnea and chest pain to profound hypotension and refractory shock.

2.7.3 Clinical Management:

- Assess patient's airway, breathing and circulation.
- Assess patient's oxygenation and hemodynamic status.
- Provide supplemental oxygen as needed to maintain oxygen saturations greater than 93% in patients with spontaneous respirations.
- In patients with acute respiratory distress consider endotracheal intubation (Refer to CCTTP 2.3)
- In patients with refractory hypotension, refer to CCTTP 4.13
- In patients with suspected or confirmed pulmonary embolus, anticoagulation therapy should be considered
- Consider involving LOM medical director to assist in this decision
    - Consider facilitating transport to embolectomy capable facility)
    - Administration of heparin can occur if no ABSOLUTE contraindications are present. These include:
        - Recent surgery
        - Hemorrhagic CVA
        - Active bleeding (Other than menstruation or epistaxis)
        - Aortic Dissection
        - Intracranial or Spinal cord tumors
    - **Heparin**
        - Bolus of 80 units/kg,
        - Followed by a continuous infusion of 18 units/kg/hr.
    - For persistent hypotension despite management with the preceding measures, initiation of thrombolytic therapy (per sending physician) may be considered prior to departing the referring facility.

2.7.4 If a thrombolytic is given to a patient with pulmonary embolism, refer to CCTTP 4.15

3. CARDIAC

3.1 Acute Coronary Syndromes

3.1.1 Indications:

- Patient presenting with signs and symptoms compatible with acute myocardial ischemia. This can encompass patients who have anginal symptoms to those patients experiencing STEMI or Non- ST Elevation Myocardial Infarctions.

3.1.2 Pearls, Pitfalls, and Special Considerations:

- Identify patient as candidate for primary percutaneous coronary intervention or **thrombolytic therapy**.
- Inclusion Criteria:
  - 12 hours or less from onset of symptoms
  - ECG showing new LBBB or ST Elevation >1mm in 2 consecutive leads.
  - Other STEMI equivalents or ACS syndromes that have been identified by involved providers.
  - Ongoing chest pain
- Exclusion Criteria (Absolute):
  - Active or recent internal bleeding (<10 days)
  - History of stroke < 6 months or any Hemmorrhagic stroke
  - Intracranial or Interspinous surgery / trauma within past 2 months
  - Recent trauma or surgery at a non-compressible site < 10 days
  - Suspected Aortic Dissection or Pericarditis
  - Known allergy to specific thrombolytic agent
- Exclusion Criteria (Relative):
  - Known Bleeding disorders
  - Pregnancy
  - Severe Uncontrolled Hypertension (SBP>200 or DBP>120)
  - CPR > 10 minutes
  - Current Coumadin therapy with INR>2
  - Hemorrhagic Ophthalmic conditions
  - Ischemic stroke > 6 months
  - Recent puncture or procedure to non-compressible blood vessel
  - Significant trauma or major surgery >2 weeks <2 months.
  - DNR/DNI
  - Known contrast Allergy
- Prior to transport, distinguish location of myocardial infarction. Anticipate added fluid requirements and bradydysrhythmias for proximal RCA lesions (including Inferior Wall Myocardial infarctions).
- Beta Blockers should be used with caution in ACS patients. It should only be used in patients who are having cardiac symptoms and are truly hyperdynamic with elevated blood pressure and heart rate. The administration of a beta-blocker would be after the discussion with the receiving physician.
- NTG administration is NOT contraindicated, but judicious clinical use is advised
- Deferring treatment and diagnostic procedures for transport, with the intent of shortening the time interval spent at the scene or sending facility, may be the best practice for these patients.

3.1.3 Clinical Management:

- Assess and manage airway, breathing and circulation
- Initiate cardiac monitoring, pulse oximetry and serial vital signs.
- Obtain or review a 12 Lead EKG and interpret the findings. Assess for dysrhythmias and treat per appropriate Protocol. Complete Right sided EKG if indicated.
- Establish IV access (consider 2 sites) and infuse at a maintenance rate if blood pressure is stable, bolus fluids if hypotensive (SBP <90mmhg).
- Consider utilizing ultrasound to assess global cardiac function and estimate stroke volume and cardiac output as applicable

- Consider placing defibrillation pads prior to transport. External pacer on standby if indicated.
- Position patient on semi fowler's position, unless hypotensive.
- Treat arrhythmias per Advanced Cardiac Life Support (ACLS) guidelines.
- Treatment sequence, (continue sequence if already initiated by referring facility):
- **NTG** 0.4mg, spray 1 SL q 3-5 min X3 for chest pain as tolerated by BP.
    - Check BP after each dose, maintain SBP>100mmHg.
    - Use with caution in the presence of a Right Sided MI.
    - If the patient has received a dose of Viagra within the past 24 hours or a dose of Cialis or Levitra within the past72 hours, NTG is contraindicated.
- **Aspirin** 81-324 mg PO unless contraindicated by a true allergy.
    - Dosage goal for full 324mg daily.
- If pain is not relieved consider **NTG Infusion** via IV
    - Initiate at 20 mcg/minute. Max 200 mcg/min. Titrate NTG in increments of 5 mcg/min increments q 3-5 minutes for relief of pain.
- If pain still not relieved, treat pain per CCTTP 6.7
- **Heparin** IV Bolus– 60 units/kg IV
    - MAX dose 4000 units
- **Heparin infusion** of 12u/kg/hr for protracted transports of over 1 hour
    - MAX dose 1000 units/hr

3.1.4 Special Considerations

- Continuous infusions of medications, including NTG and Heparin, can be held during transition from bedside to transport vehicle to expedite scene time. Use clinical judgement as necessary
- There is NO indication to routinely complete ECG at the bedside, unless there is a change in patient's clinical status (ie. Change in pain, hemodynamic changes, or dysrhythmias) that may change treatment or destination unit

3.2 ACS / STEMI Catheterization Lab Activation Checklist

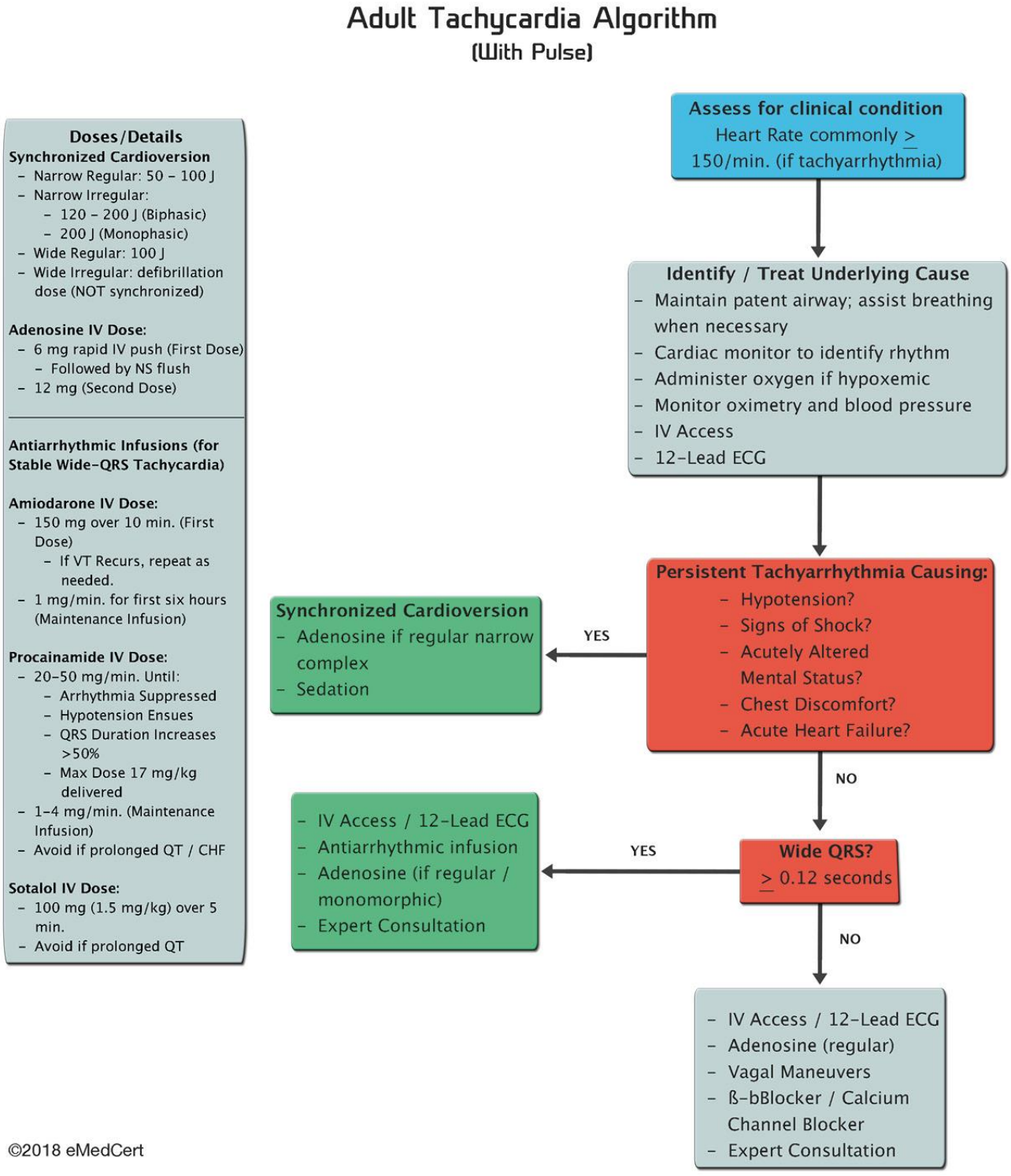
3.2.1 The following information should be communicated via **MEDCOMM. 1 (888) 421-4228**

- Satellite Phone utilization may be required

Patient information	Name
	DOB
	Weight
Medical History	Current Pain / Discomfort Level
	Duration of Symptoms
	Contrast Allergy?
	Code Status?
Clinical Findings	Evidence of concurrent CVA or GIH?
	Hemodynamics / Airway Status
	Location of MI on ECG
Treatment	IV Access
	Treatment provided

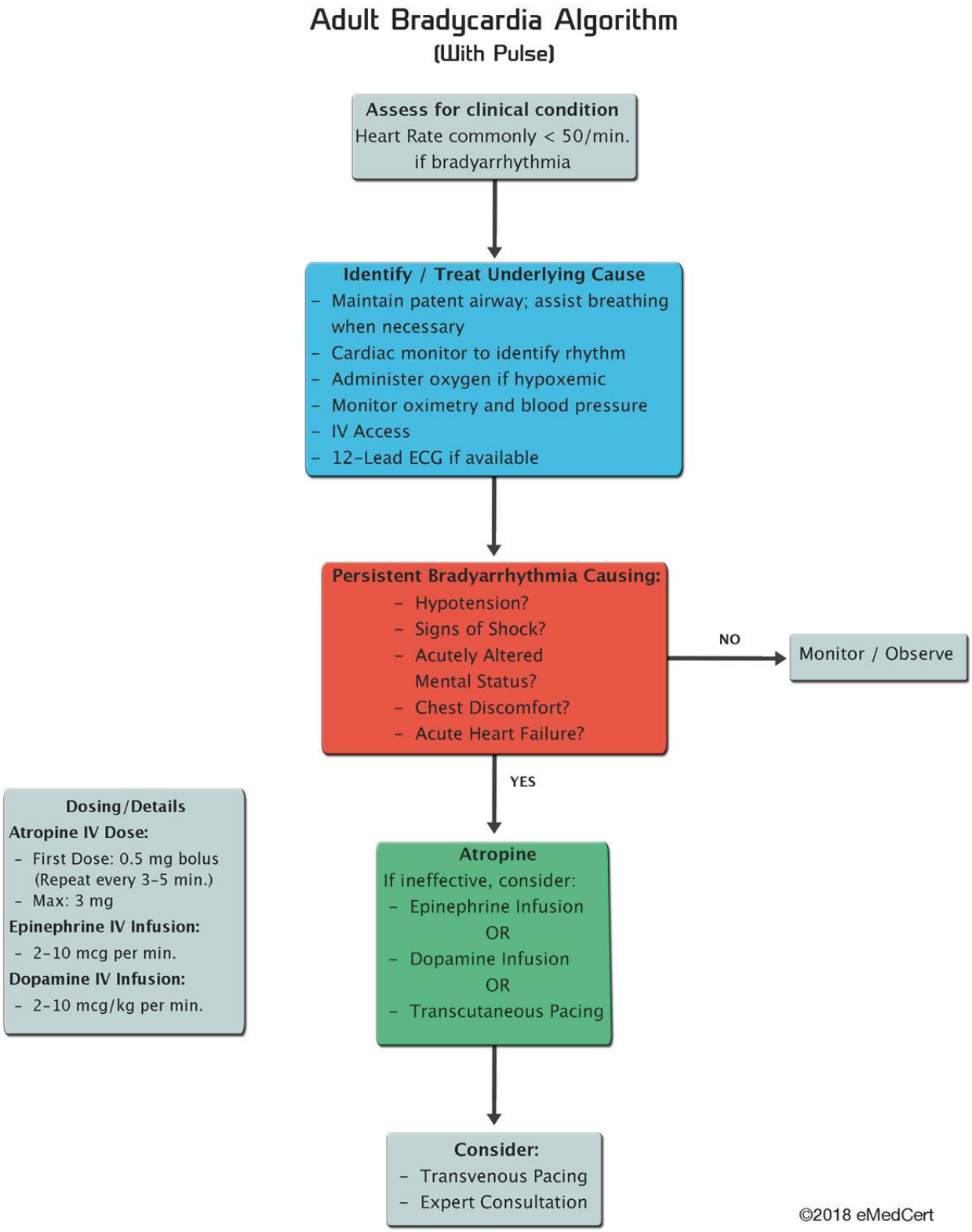
3.3 Cardiac Dysrhythmias – Tachycardia

3.3.1 Refer to ACLS



3.4 Cardiac Dysrhythmias – Bradycardia

3.4.1 Refer to ACLS



3.5 Cardiac Arrest

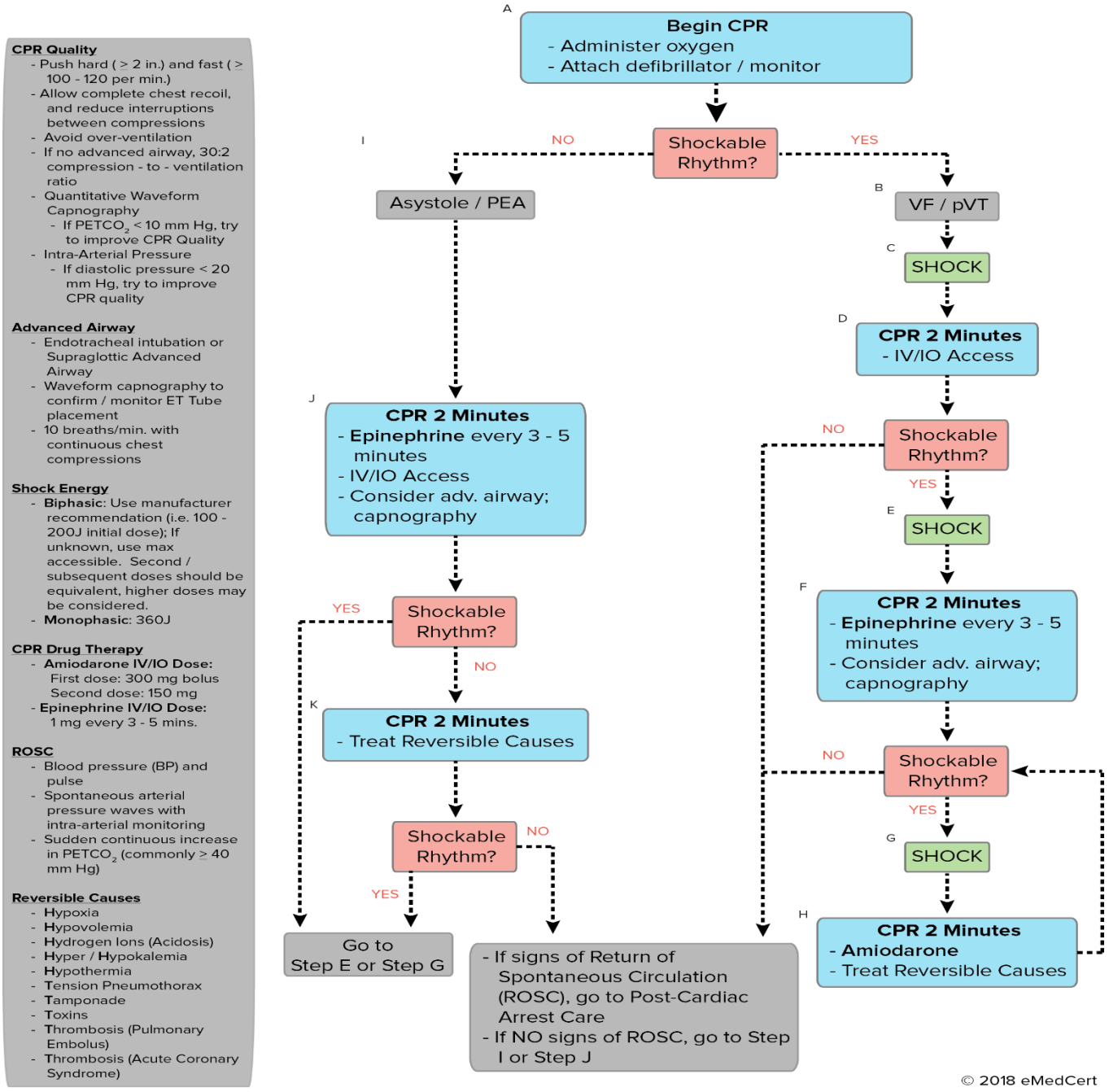
3.5.1 Refer to ACLS

3.5.2 With ROSC and compromised neurological function, consider Neuroprotective Therapeutic Hypothermia, FRP 3.6

3.5.3 Termination of Resuscitation

- Refer to MaineEMS Protocol in Cardiac (RED), Termination of Resuscitation
- If arrest is suspected to be ONLY traumatic in nature, refer to CCTTP 5.10

Adult Cardiac Arrest Algorithm



Termination of Resuscitation

Resuscitation should be **withheld** under the following circumstances:

- When it is found that the patient has a DNR order or other actionable medical order (i.e. POLST/MOLST, etc.) form
- Scene Safety: the physical environment is not safe for the provider(s)
- When irreversible signs of death, such as dependent lividity, pupils fixed and dilated, palpable hypothermia (not from exposure) and no audible heart sounds are noted in patient with unknown downtime or downtime > 20 minutes in a witnessed arrest without bystander CPR

Resuscitation may be **terminated**:

- When the patient regains pulse/respirations
- When the rescuers are physically exhausted or when equally or more highly trained healthcare personnel take over
- In the absence of ALS, when the same Maine EMS licensed crew member has determined the absence of vital signs for 20 minutes, in spite of BLS, except in the case of hypothermia, see **Yellow 8**
- When it is found that the patient has a DNR order or other actionable medical order (i.e. POLST/MOLST, etc.) form
- When the following time frames have been met for ALS providers alone:
  - Persistent asystole x 20 minutes
  - Slow and/or wide complex PEA x 20 minutes
  - Fast/narrow PEA x 45 minutes
  - VF/Pulseless VT x 60 minutes
- If ALS providers arrive on scene of a patient managed by BLS providers, consider TOR if:
  - After a total (BLS + ALS) resuscitation time of 20 minutes, the AED has ***never*** advised shock AND the first rhythm noted by ALS providers is asystole or slow/wide PEA
  - If patient is found in fast/narrow PEA does not achieve ROSC after 45 minutes of ALS + BLS care
  - If the patient is found in VF/Pulseless VT does not achieve ROSC after 60 minutes of ALS+BLS care
  - In the case of fast/narrow PEA and VF/Pulseless VT, the ALS provider must complete the ALS algorithm as dictated in these protocols prior to consideration of TOR, regardless of time frame

*Survival and functional neurologic outcomes are unlikely if ROSC is not obtained by EMS. It is dangerous to crew, pedestrians and other motorists to attempt to resuscitate a patient during ambulance transport. If circumstances do not allow TOR for safety or other reasons, notify OLMC.

If Resuscitative Efforts are terminated:

1. Focus attention on the family or bystanders. Explain the rationale for termination
2. Consider accessing support for family: other family, friends, or social support such as clergy
3. If termination of resuscitation occurs, one must consider management of patient's remains. No one option is correct for all circumstances and factors on scene will likely dictate the best option. Refer to **Grey 4**. If questions remain regarding disposition of the patient's remains, contact OLMC

3.6 Atrial Fibrillation and Atrial Flutter

3.6.1 Indications:

- Successful treatment of the rapid heart rate by stabilizing the abnormal heart rhythm through therapeutic interventions.

3.6.2 Pearls and Pitfalls:

- Obtain a 12 lead EKG to confirm the presence of Atrial fibrillation or Atrial flutter and document ventricular rate.
- Obtain past medical history (A-fib/flutter, Wolff-Parkinson-White Syndrome, COPD, CHF).
- The rapid heart rate is considered symptomatic with accompanied by chest pain, dyspnea, diaphoresis, nausea and vomiting, or unstable vital signs.
- Consider underlying cause of atrial dysrhythmias prior to rate control (i.e. sepsis or trauma)

3.6.3 Clinical Management:

- Manage airway, breathing, and circulation.
- Administer supplemental oxygen to maintain SpO2 > 95%.
- Begin cardiac, pulse oximetry and blood pressure monitoring. Consider hands-free multi-function pads to patient's chest. May proceed directly to cardioversion if patient becomes unstable.
- Establish IV access of 0.9 % NS or LR at KVO rate.
- **If patient is symptomatic, with stable hemodynamics (SBP > 110,)**
    - Choose **ONE** of the following:
    - **Diltiazem**
        - Add **Diltiazem** 125mg (25mL) to 100mL NS
        - 0.25 mg/kg (MAX of 20mg) IV/IO push over 2 minutes.
        - If not effective in 15 minutes, a second dose of 0.35 mg/kg (MAX of 25mg) IV may be given.
        - If still NOT effective, begin **Diltiazem infusion** at 5 – 15 mg/hour.

      -OR-
    - **Metoprolol** 5 mg IV/IO push over 2 minutes.
        - May repeat x 2 every 5 minutes to a total of 15 mg. Obtain an optimal heart rate of 50-60 BPM.
        - Note: Avoid with patients in CHF, heart block, valvular failure, cocaine use, HR < 50, or systolic BP < 90mmHg.

      -OR-
    - **Amiodarone**
        - Mix 150 mg in 50mL NS and administer IV over 10 minutes
        - If conversion successful, initiate **Amiodarone Infusion**
        - Mix for concentration of 1.8 mg/mL (90mg/50mL, 180mg/100mL, etc.) and initiate infusion at 1 mg/min, with inline 0.2 micron filter, noting exact time and report total dose to receiving facility staff
- **If patient is unstable** (systolic BP < 90 mmHg, altered LOC, severe chest pain, pulmonary edema):
    - Perform synchronized cardioversion at 75J, 120J, 150J, 200J, or monophasic equivalent.
    - Consider sedation or analgesia per CCTTP 6.7 or 6.8

3.7 Targeted Temperature Management

3.7.1 Indications:

- Increased brain temperature contributes to ischemic brain damage in patients post cardiac arrest.
- Studies have shown that lowering brain temperature, even by a few degrees decreases ischemic damage.
- TTM protocols have contributed to improved neurological outcomes. There is new data demonstrating improved outcomes with early initiation of targeted temperature management, but there is no evidence that improved outcomes occur with out of hospital initiation.

3.7.2 Patient Inclusion Criteria:

- Age 18+ (less than 18, Consult Ped's Intensivist)
- Cardiac arrest from any malignant arrhythmia & ROSC.
- Cannot follow commands/Comatose.
- Intubated with mechanical ventilation required
- SBP can be maintained at 90mmHg or greater, spontaneously or with fluids, vasopressors, and/or inotropes.
- Less than 6 hours since ROSC and less than or equal to one hour of resuscitation time.
- Less than 15 minutes from collapse to CPR. (if time unknown, err on starting therapeutic hypothermia)

3.7.3 Patient Exclusion Criteria:

- Continuing significant cardiac arrhythmia or hemodynamic instability.
- Evidence of sepsis.
- Active severe bleeding
- Coma unrelated to arrest. (i.e. drug overdose)
- Recent major surgery or trauma
- DNR or any condition precluding treatment in the opinion of the transferring physician or flight crew.
- Pregnancy is NOT an exclusion criterion.

3.7.4 Clinical Management:

- There is no evidence to support utilization of TTM in out of hospital cardiac arrest
- The overriding goal of out of hospital transport of cardiac arrest patients is to **avoid temperatures in excess of 37 degrees Celcius**
- Discuss with accepting providers and institution about the initiation of therapeutic cooling.
- Evaluate and record neurologic status prior to initiation of sedatives and paralytics if possible.
- However, if a provider is unavailable, initiate cooling as early as possible. Temp goal is 33-36°C.
- Sedate and paralyze the patient as per CCTTP 2.3. Suppress shivering with neuromuscular blockade.
- In consultation with receiving physician, consider rapid IV infusion of ice cold (4°C). LR. Administer 30 ml/kg IVx1 dose over a period of 30 minutes immediately after neuromuscular blocking agent administered. Maximum of 2 liters LR during transport, which will be initiated by sending institution.
- Apply ice packs to patient's neck, axilla, and inguinal area after patient is sedated and paralyzed and iced LR is administered IV.
- If patient shivering increase sedative and/or analgesia dose prior to increasing paralytic.
- Monitor temperature via esophageal, rectal, or foley temperature probe –as time and mission allow.
- Consider turning on aircraft AC to assist with cooling enroute.
- Report to receiving tertiary care center.

4. MEDICAL

4.1 Anaphylaxis and Allergic Reactions

4.1.1 Indications:

- Symptoms ranging from urticaria, flushing, itching, and facial edema to respiratory distress, laryngoedema, hypotension, and irreversible shock occurring in a patient who, within the previous few hours, was exposed to a precipitating medication, insect bite, or food.
- Attempt to identify cause of reaction (consider blood products, medications or latex) and prevent or eliminate further exposure.
- Be prepared for recurrence of allergic signs and symptoms despite initial interventions.

4.1.2 Pearls, Pitfalls and Considerations:

- Early, rather than late airway intervention may be required if swelling is rapid.

4.1.3 Clinical Management:

- Identify etiology of antigen exposure.
- Assess and maintain adequate airway, breathing, and circulation.
- Provide supplemental oxygen to maintain oxygen saturations greater than 93%. Proceed to advanced airway management and intubation if there is potential for airway obstruction or the patient has severe dyspnea.
- If there is concern for progression of the allergic reaction, consider establishing intravenous access with two large bore needles (18 gauge or larger) with 0.9% Normal Saline at initial KVO rate.
- Mild Reaction:
    - **Diphenhydramine** (Benadryl) 50mg IV/IM
    - Consider **Epinephrine** 1:1000
        - 0.3mg IM q 15 minutes for three doses PRN.
        - In patients with risk of cardiovascular disease, note that there is risk for cardiovascular sequela with the use of epinephrine.
    - Solumedrol (**Methylprednisolone**) 125mg IV/IM q8 hrs
    - Consider **Albuterol** Nebulizer
        - (Premix of 2.5 mg in 3ml of NS), repeat as tolerated.
        - Staff may consider continuous nebulizer of **Albuterol** (7.5 mg/9 ml) inhaled for severe bronchospasm. Refer to CCTTP 2.5.
    - Consider **Famotidine** - 20mg IV.
- Moderate to Severe Reaction:
    - In addition to the above medications, continue to monitor for worsening upper airway edema, and bronchospasm.
    - If there is evidence for worsening respiratory distress or respiratory failure, consider Rapid Sequence Intubation
    - CCTTP 2.3. Intubation: Pharmacologically assisted or Rapid Sequence Intubation
- If the patient develops worsening hypotension, provide intravenous fluid resuscitation with crystalloids to maintain SBP > 90 mmHg systolic.
- If the patient remains hypotensive despite a total of 2000ml of intravenous fluid, refer to Refractory Shock Protocol (CCTTP 4.13).
    - Monitor for signs of pulmonary edema and fluid overload.
    - Consider **Epinephrine** Infusion
        - Start at 0.05 mcg/kg/min. Titrate by 0.02 -0.05 mcg/kg/min as indicated.
        - Dose range: Up to 0.5 mcg/kg/min. There is no true maximum dose, but consider additional agent if the patient is unresponsive to higher doses.
    - In cases of refractory shock due to severe anaphylaxis, epinephrine infusion is the vasopressor of choice. Doses noted in refractory shock protocol (CCTTP 4.13).

4.2 Diabetic Emergencies

4.2.1 Indications:

- This protocol addresses patients with complications from diabetes mellitus including those patient experiencing hypoglycemia, hyperglycemia, or diabetic ketoacidosis is indicated.

4.2.2 Pearls, Pitfalls, and Considerations:

- DKA represents a state of disordered metabolism in which the level of hyperglycemia may not fully describe or comport with the other metabolic changes such as potassium depletion or ketoacidosis.
- Repletion of potassium, fluids, and correction of the acidotic state must proceed deliberately and with due regard for the time interval in which this patient has been experiencing this condition.
- Overly aggressive administration of insulin, fluids, potassium, and sodium bicarbonate will produce untoward outcomes.
- Hyperglycemia from other etiologies other than that of DKA should be ruled out before applying this protocol.

4.2.3 Hypoglycemia

- Determine serum glucose level with point of care device (Istat or Accu-check Fingerstick).
- Obtain IV access with large bore IV (18 gauge or greater)
- Initiate Intravenous fluids with 0.9% Normal Saline initially at TKO rate.
- Maintain appropriate hemodynamic status blood pressure with fluid resuscitation as indicated.
- Treatment of known diabetic with decreased LOC or patient with altered mental status with hypoglycemia:
- If measured glucose level is low (FSBG < 80 MG/DL):
    - **Dextrose 50%** 25g, Repeat if needed.
- If suspected or known ETOH abuse, consider administration:
    - **Thiamine** 100mg IV over 5 minutes (Prior to **Dextrose 50%**)
- If unable to start IV, administer:
    - **Glucagon** 1mg IM.

4.2.4 Hyperglycemia

- If measured glucose level is high or diabetic ketoacidosis is suspected:
- It is imperative to review lab values (if already obtained and document for chart and receiving facility):
    - CBC
    - CMP, Mg, and Phos
    - Serum B-Hydroxybutyrate (Serum ketones)
    - Venous blood gas
    - UA
    - **Calculate anion gap = (NA-(Cl+CO2))**
- If labs are unavailable, complete VBG and BMP on ISTAT.
- If following criteria are met, proceed to 4.2.6 DKA protocol
    - Analyze data
        - Identify if whole blood glucose is greater than 200mg/dl
        - Venous pH < 7.3.
        - Bicarbonate (HCO3) < 15 mmol/L
        - UA demonstrates ketones
        - Anion gap greater than 12.
- If labs are unobtainable, do not initiate insulin therapy. Consult medical control for additional options.

4.2.5 Hyperglycemia Therapy

- If above criteria are not met for DKA or all data has not been obtained as outlined above, discuss with OLMC necessity of therapy.
- 0.9% Normal Saline at maintenance therapy can be initiated. In discussion with OLMC, rate can be adjusted based upon diagnosis and hemodynamic stability.

4.2.6 Diabetic Ketoacidosis (DKA) (Adult Patients).

- Meets all criteria as outlined above.
- Patient to remain NPO
- Stop insulin pump, or other exogenous insulin source
- Intravenous Fluids
    - 0.9% Normal Saline (NS)
        - 1000ml/h x 1h, then 500ml/h x 2h then
    - After initial infusion of 0.9% NS, fluid should be changed to 0.45% NS
        - 500ml/hr for 2hrs
        - Then, maintain maintenance at 200ml/hr
    - IVF should be changed to **D5W 0.45% NS** at 200ml/hr when Serum Glucose < 250mg/dL
    - IF the patient has a history of heart failure or an alternative diagnosis where fluid overload is a concern, consult OLMC or receiving physician.
- **Do NOT bolus Insulin**
- Initiate **Insulin infusion** and adjust rate based upon table below.
    - Regular **insulin** (100units /100ml 0.9% NS) infusion at 0.1unit/kg/hr (typically between 6-10 units per hr).
    - Adjust per DKA Protocol as outline in Table below.
- If K < 3.3mEq/L MUST initiate potassium replacement CONCURRENTLY with insulin (see below)

Current WBG	Change in WBG from previous value	Action
250mg/dl and above	Increased by 50mg/dl or more	Verify **insulin** infusion is running at prescribed rate and contact prescriber.
250mg/dl and above	Increased by 1-49mg/dl or Decreased by any amount	No change
Below 250mg/dl	Decreased by 100mg/dl or more	Change IV fluid to **D5W/0.45NS** and Decrease **insulin** infusion rate by 50% (1/2) and recheck WBG in 30min. Notify prescriber if WBG still decreasing
Below 250mg/dl	Decreased by 1-99mg/dl or Increased by any amount	Change IV fluid to **D5W/0.45NS** and No change in **Insulin** drip rate
Below 200mg/dl	Decreased by 60mg/dl or more over the previous TWO hours	Change IV fluid to **D5W/0.45NS** and Decrease **Insulin** infusion rate by 50% (1/2) and call prescriber for changes to insulin rate/IV fluids
Below 200mg/dl	Decreased by 1-59mg/dl over the previous TWO hours Or Increased by any amount	Change IV fluid to **D5/0.45NS** and No change in **Insulin** drip rate
Below 100mg/dl	N/A	Decrease **Insulin** infusion rate by 50% (1/2) and change IV fluid to **D10 / 0.45NS** at current rate. Call prescriber to re-evaluate **insulin/IV** fluids.

- Do NOT stop **Insulin** infusion UNTIL all 3 criteria met:
  - Anion gap is < 12
  - Serum CO2 (Bicarbonate) is greater than or equal to 20
  - Long acting insulin has been administered.
- **Potassium** replacement for patients in Diabetic Ketoacidosis (DKA).
  - Patients experiencing hypokalemia without concurrent diagnosis of DKA, refer to CCTTP 4.8
  - Infuse potassium replacement CONCURRENTLY with insulin.

Serum Potassium	Treatment
K+ > 5	Add **Insulin**
K+ between 4 and 5	Infuse **KCl** at 10mEq/h IV x 2h
K+ between 3 and 4	Infuse **KCl** at 10mEq/h IV x 3h
K+ < 3.0	Infuse **KCl** at 10mEq/h IV x 4h

- **Sodium Bicarbonate** 8.4%:
  - Generally not needed and remains controversial.
  - Consider contacting receiving physician for any of the following for direction
    - pH is < 7.1
    - HC03 < 5
    - K+ > 6.5
    - ECG changes
    - Decreased MAP refractory to fluid administration and vasopressor use.
    - **Consideration of IV bolus dosing will be completed under advisement from on-line medical control or receiving clinician.**
- Contact receiving clinician for any of the following
  - Euglycemia is achieved
  - Anion Gap < 12
  - Potassium has normalized

4.3 GI Bleed

4.3.1 Indications:

- Patients who present with the loss of blood in either the upper or lower tract.
- Patient may present with mild anemia to severe hypovolemic shock.

4.3.2 Pearls, Pitfalls, and Considerations:

- "Coffee ground" emesis or hematemesis suggest a proximal lesion and hematochezia or melena suggest a distal lesion.
- History of medication, alcohol use, and anticoagulants should be elicited.
- Octreotide has been shown to be an effective bridge to endoscopy in patients suffering from upper GI bleeding (variceal or otherwise). Octreotide is also appropriate in patients suffering from GI hemorrhage of unknown origin.

4.3.3 Clinical Management:

- Assess and monitor airway, breathing and circulation.
- If patient has adequate spontaneous respirations, administer supplemental oxygen to maintain saturation greater than 93%.
- Monitor cardiac functions (EKG, BP, P, and RR) and O2 saturations
- Establish TWO large bore IV's of 0.9% Normal Saline.
- Treat for hypovolemic shock as appropriate.
    - Use permissive hypotension strategy.
    - Maintain MAP of 60-65.
    - If patient has continued hypotension, refer to CCTTP 4.13
- Consider taking additional O negative blood and Liquid Plasma from EMMC or CMMC prior to launching, if patient has sustained major blood loss.
- Identify a completed INR, type and screen, and hematocrit prior to transport. If these values have not been completed, consider obtaining I-Stat INR, hemoglobin/ hematocrit and ABG with lactate with every patient.
- If patient has supratherapeutic INR, consider discussion of anticoagulation reversal with accepting physician including **Liquid Plasma** or **Prothrombin Complex Concentrate** (CCTTP 7.3)
- NG tubes are NOT contraindicated in patients vomiting bright red blood or with confirmed esophageal/gastric varices that have recently bled. Avoid over vigorous suction to avoid mucosal irritation
- Consider initiation of somatostatin analogues in patients with uncontrolled Upper GI hemorrhage or those patients that the source of gastrointestinal bleeding cannot be identified.
    - **Octreotide**
        - I.V. bolus: 50 mcg in 100ml over 20 minutes
        - After bolus, initiate continuous I.V. infusion of 25-50 mcg/hour (specifically indicated in end stage liver disease with esophageal varices, but should be used for all significant bleeds)
- Consider Blood Product administration per CCTTP 7.1
- Consider Proton Pump Inhibitor (PPI) administration for undifferentiated gastrointestinal bleeding:
    - **Pantoprazole** 80 mg IV bolus q 12 hours
- If balloon tamponade (i.e. Blakemore tube) is necessary, endotracheal intubation should be completed prior to its placement to prevent airway obstruction during transport. Discuss this option with providers directly involved in patient care.
- In cases of severe bleeding from esophageal varices
    - Consider the use of **Vasopressin**:
        - 0.2 to 0.4 units per minute (Note this dose is higher than the refractory shock dose)

4.4 Ischemic and Hemorrhagic CVA, TIA, and Non-Traumatic SAH

4.4.1 Indications:

- To identify those patients with intracranial abnormalities including hemorrhage and ischemic. Once identified, management should be tailored to blood pressure management and rapid transport to the appropriate receiving center.

4.4.2 Pearls, Pitfalls, and Considerations:

- Initial evaluation should include the differentiation between stroke and associated mimics (hypoglycemia, seizures, etc).
- Subsequent management of intracranial pathology is tailored to the diagnosis. Emergent transport to the most appropriate facility should be completed efficiently and swiftly.
- In the setting of ischemic stroke without reperfusion and subarachnoid hemorrhage, consideration for neurosurgical consultation is required.

4.4.3 Clinical Management:

- Assess airway, breathing, and circulation. Maintain adequate airway and ventilation
- If the patient has spontaneous respirations, provide supplemental oxygen to maintain oxygen saturations greater than 93%.
- Determine fingerstick blood glucose. If fingerstick blood glucose less than 80 mg/dl
    - **Dextrose** 50% 25g IV
    - If IV unobtainable, consider
    - **Glucagon** 1mg IM.
- Obtain I.V. access with two peripheral I.V.'s of 0.9% Normal Saline at a TKO rate.
- Obtain vital signs and place patient on monitor including pulse oximetry and end tidal carbon dioxide as indicated. Complete a neurologic exam including appropriate stroke score (NIHSS or Cincinnati).
- Determine exact time of onset of signs and symptoms, if possible.
- If the patient has significant alteration in mental status and cannot adequately protect the airway, consider advanced airway management with rapid sequence intubation (CCTTP 2.3)
    - With airway placement, avoid hypotension (SBP of less than or equal to 90mmHg) and hypoxia (PaO2 of less than 60). Refer to CCTTP 2.3
- Elevate head of bed 30 degrees. Minimize noxious stimuli and treat pain aggressively.
- IV fluids:
    - 0.9% Normal Saline at a TKO rate.
- If intracranial bleeding is suspected, consider obtaining INR value.
- If the INR is elevated greater than 2.0, contact receiving center staff for option:
    - **Liquid Plasma, Fresh Frozen Plasma, or Prothrombin Complex Concentrate**; refer to CCTTP 7.3 or 7.4
    - **Vitamin K (phytonadione)** 5-10MG IV mixed in 50-100ml of 0.9% Normal Saline over 30 minutes.
- Identify nearest appropriate facility and contact stroke team personnel with early activation if possible.
- **For Scene transports, ONLY manage hypertension if SBP > 220, or DBP > 105 mmHg**
    - **Transport the patient to the nearest hospital with confirmed and available CT imaging. Always provide advanced notification.**
    - Use appropriate antihypertensive to an SBP of 180
- For inter-facility transports with a confirmed diagnosis of stroke by CT or MRI imaging, maintain following parameters:
    - **Ischemic CVA (Both Lytic eligible and ineligible): SBP < 180 and DBP < 105 mmHg.**
    - **Intraparenchymal Hemorrhagic CVA SBP < 160 and DBP < 100 mmHg**
    - **Spontaneous Non-Traumatic SAH SBP < 140 and DBP < 90 mmHg**
- If the patient is hypertensive, refer to CCTTP 4.14.
    - Initial choice of antihypertensive medications includes short-acting Nicardipine as first line agent.

    - **The use of nitroprusside in the setting of intracerebral bleeding or ischemia is contraindicated**.
    - Do not drop SBP more than 25% from patient's baseline
- If the patient is hypotensive with a MAP < 65mmHg with associated mental status changes, refer to CCTTP 4.13
- There is currently a debate in the use of prophylactic anti-epileptics drugs (AED's) in the setting of spontaneous ischemic strokes, TIA's, or intracerebral bleeding except in the setting of SAH. Please consult the accepting attending for option of Levetiracetam (Keppra) or other
- If seizures occur, refer to CCTTP 4.12.
- If the patient received tissue plasminogen activator (tPA), document time of bolus and time of infusion, physician ordering, and any noted complications.
- Consider placing arterial line for continuous monitoring of blood pressure.
- If patient has intracranial pressure monitor in place, maintain CPP between 70-100 mmHg (with minimum of 60mmHg).
- If needed administer sedation per CCTTP 2.4. In the intubated patient, short acting agents such as propofol are ideal.
- In the setting of SAH, consider Nimodipine 60 mg PO or per Gastric Tube can be administered if available from the sending facility if the patient is not receiving IV Nicardipine.
- Consider other medications for treatment of specific target organ failure; (May require dialogue with the sending/ accepting physician or OLMC)
- If clinical severe neurological deterioration is occurring with signs and symptoms including altered mental status, obtundation, unequal pupils, and Cushing's Triad (hypertension, bradycardia, and irregular respirations), consideration of medications to manage increasing intracranial pressure should be considered.
    - Unless specified by receiving physician
    - **Hypertonic 3% NS** (Preferred choice for all patients)
        - 5 mL/kg to **MAXimum of 250mL** over 15 minutes
    - **Mannitol** (For SBP > 90 and requested by referring physician)
        - 1 g/kg over 15 minutes
        - Observe closely for hypotension in patients receiving Mannitol

4.5 Abdominal Aortic Aneurysm

4.5.1 Indications:

- An aortic aneurysm can develop anywhere in the ascending, descending, arch or thoracic-abdominal area of the aorta. Aortic aneurysms are commonly located below the renal arteries.

4.5.2 Pearls, Pitfalls, and Considerations:

- A distending abdomen, absence of distal pulses, mottled and/or cyanotic distal extremities, accompanies severe hypotension from a ruptured aneurysm.
- The patient may have a history of severe abdominal pain, but may not have ruptured.
- Many patients with leaking aneurysms may need to remain mildly hypotensive to survive this complicated disease process during transport to a definitive-care facility.
- Aortic dissection may present as an acute stroke or AMI.
- Many patients with leaking aneurysms may need to remain mildly hypotensive to survive this complicated disease process during transport to a definitive-care facility.
  A permissive hypotensive strategy should be utilized in the resuscitation of these patients. Titrate BP to a systolic of 80 to 90 and/or a MAP of 60.

4.5.3 Clinical Management:

- Rapidly assess and obtain history to include known trauma, infection, congenital condition, hypertension, atherosclerosis, known aneurysm, and onset of pain.
  - Assessment is to include primary and secondary surveys, blood pressure in both arms, and distal pulses in all four extremities.
  - Avoid aggressive abdominal examinations.
- Syncope and back pain are key findings.
- Assess airway, breathing, and circulation. Maintain adequate airway and ventilation. If the patient has any alteration in mental status or level of consciousness, consider advanced airway placement per CCTTP 2.3
- Consider utilizing ultrasound to assess great vessels
- If the patient has spontaneous respirations, provide supplemental oxygen to maintain oxygen saturations greater than 93%.
- Obtain two large bore peripheral I.V.'s.
- Monitor patient's hemodynamic status including continuous pulse oximetry, heart rate, and respiratory status.
- Alert the receiving hospital for imminent surgery.
- Titrate fluids to keep systolic blood pressure to approximately 90 mmHg systolic or a blood pressure that maintains cerebral perfusion.
  - Consider need for colloids and resuscitate with PRBCs or Liquid Plasma
  - Consider placement of arterial line
- Consider obtaining INR.
- If the patient demonstrates evidence of hypovolemic shock, refer to CCTTP 4.13.
- Initial resuscitation should focus on fluid and blood administration with goal blood pressure as noted above,
- If providing Packed Red Blood Cells, refer to CCTTP 7.1
  - If the patient remains hypotensive despite fluid and blood administration, refer to CCTTP 4.13.
- If the patient is anticoagulated and/ or has an INR > 1.4, consider emergent anticoagulation reversal in consultation with accepting physician. Refer to CCTTP 7.3 or 7.4
- Provide appropriate pain and anxiolysis per CCTTP 6.7 and 6.8
- If the patient is Hypertensive
  - Consider aggressive analgesia and anxiolysis prior to progressing to antihypertensives
  - Priority should be focused on systolic blood pressure control over that of the HR
  - Use **Nicardipine** to achieve target SBP 90 – 100
  - If hypertension persists, contact receiving clinician for other options. Refer to CCTTP 4.14

4.5.4 Overall Management and Communication with receiving physician:

- A ruptured abdominal aortic aneurysm is a time sensitive diagnosis requiring immediate operative repair. The flight team is to ensure that scene times are minimized. Provide effective communication to ensure receiving facility is aware of diagnosis. Determination for the need for direct admission to the O.R. must be made and communicated with Medical Control as soon as possible.

4.6 Aortic Dissection

4.6.1 Indications:

- Aortic dissection begins with the formation of a tear in the aortic intima that directly exposes an underlying medial layer to the driving force (pulse pressure) of the intraluminal blood.
- There are two types of aortic dissections.
    - Stanford type A
        - Involves the ascending aorta and/or aortic arch, and possibly the descending aorta.
        - The tear can originate in the ascending aorta, the aortic arch, or, more rarely, in the descending aorta.
        - It includes DeBakey types I and II. It requires emergent surgical repair,
    - The Stanford type B
        - Involves the descending aorta or the arch (distal to the left subclavian artery), without involvement of the ascending aorta.
        - It includes DeBakey type III. It is typically managed medically until complications arise.

4.6.2 Pearls, Pitfalls, and Considerations:

- Achieve maximal control of luminal flow with initial heart rate control and then subsequent BP management.

4.6.3 Clinical Management:

- Rapidly assess and obtain history to include known trauma, infection, congenital condition, hypertension, atherosclerosis, and onset of pain.
    - Assessment is to include primary and secondary surveys, blood pressure in both upper extremities, and distal pulses must be assessed in all 4 extremities.
- Place at least two large bore IV lines. If unable to obtain IV access, consider the placement of an Intraosseus line or having a provider place a central line.
- Place patient on monitor and have patient on continuous heart, respiratory, pulse oximetry, and end tidal CO2 monitoring.
- Provide appropriate pain and anxiolysis per CCTTP 6.7 and 6.8
- Obtain all laboratory and Imaging reports from sending facility. EKG's should be completed on all dissections as well. Prior to transport, attempt to view chest x-ray. Note size of mediastinum and evaluate for apical capping.
- Identify or consider obtaining INR
    - If > 1.4, contact receiving clinician for options of Liquid Plasma and Vitamin K (Refer to CCTTP 7.3)
- Blood pressures should be completed every 5 minutes during transport.
- Consider placement of arterial line to monitor blood pressure continuously.
- Consider utilizing ultrasound to assess great vessels and determine presence of pericardial effusion
- Assess for new heart murmurs.

4.6.4 Blood pressure management:

- Hypotensive patient
    - Titrate fluids to keep systolic BP at 90 systolic, or that which maintains cerebral perfusion
    - Consider **Liquid Plasma or PRBCs**, refer to CCTTP 7.1
    - Consider vasopressors if hypotension has not responded to fluids and colloids
    - If HR > 70 AND SBP < 90, contact receiving clinician for rate control options
- Hypertensive patient
    - Consider aggressive analgesia and anxiolysis prior to progressing to antihypertensives
    - Use **Esmolol** to achieve HR 50 – 70 beats per minute
    - If the patient's BP remains elevated, consider **Nicardipine** (or other agent) to achieve target SBP 90 – 100 mmHg
    - Refer to CCTTP 4.14

4.6.5 Patients with concurrent myocardial infarction confirmed by EKG analysis.

- Complete EKG
- Initiate appropriate blood pressure management based upon noted vital signs. If patient is hypotensive, refer to CCTTP 4.13.
- If patient is hypertensive, refer to antihypertensive therapy protocol.
- Avoid thrombolytics, aspirin or heparin.
- Consult immediately with receiving physician team and transport to appropriate destination.

4.7 Sepsis

4.7.1 Indications:

- To identify those patients with septic shock.
- The Surviving Sepsis campaign of 2012 has focused on early aggressive therapy to combat the sequelae associated with severe septic shock in a rapid manner.
- Once identified, blood cultures and appropriate antibiotic therapy and resuscitation MUST occur within 60 minutes of presentation.

4.7.2 Pearls, Pitfalls, and Considerations:

- Once identified, septic shock must be treated with aggressive crystalloid infusion to maintain urine output of greater than 0.5ml/kg/hr, a lactate less than 2.0 and a CVP of 12-15. Blood cultures and antibiotic therapy MUST occur prior to transport.

4.7.3 Clinical Management:

- Assess airway, breathing, and circulation. Maintain adequate airway and ventilation. If the patient has any alteration in mental status, consider advanced airway placement per CCTTP 2.3.
- Given the debate of the use of Etomidate in the setting of sepsis due to adrenal suppression, **Ketamine** should be considered as a first line induction agent in the setting of rapid sequence intubation.
- If the patient has spontaneous respirations, provide supplemental oxygen to maintain oxygen saturations greater than 93%.
- Obtain at least two large bore peripheral I.V.'s. If I.V. access not possible, proceed to I/O or request sending providers to place central line catheter.
- Place patient on cardiac monitor.
- Continue to monitor patient's hemodynamic status including continuous pulse oximetry, heart rate, and respiratory status.
- Obtain core temperature (rectally if possible).
- If central venous access is available, monitor Central Venous Pressure (CVP).
- Prior to departure from sending facility.
    - Obtain blood cultures prior to the administration of antibiotics.
    - Ensure that the administration of broad-spectrum antibiotics has occurred prior to transfer.
- Obtain ISTAT lactate.
- Fluid bolus of 30ml/kg of 0.9% Saline or Lactated Ringers) for hypotension and/or a lactate greater than or equal to 2.0 mmol/L.
    - There is a small subset of patients who may require additional fluid boluses prior to vasopressor administration.
    - Clinical judgment must be utilized including the use of ultrasound (RUSH exam), urine output and other markers of resuscitation.
- If the patient's hemodynamic status does not improve with crystalloid infusion or the patient's lactate remains greater than 4, refer to CCTTP 4.13
    - Vasopressor therapy initially to target a mean arterial pressure (MAP) of 65 mm Hg, refer to CCTTP 4.13
        - **Norepinephrine** is the vasopressor of choice.
        - **Epinephrine** can be substituted to or potentially used as an additional agent is needed to maintain adequate blood pressure
        - **Vasopressin** 0.03 units/minute can be added to **norepinephrine** (NE) with intent of either raising MAP or decreasing norepinephrine use (**Vasopressin** is a fixed medication and is typically not titrated). It should not be used as a single agent.
    - **Dopamine** should only be used as an alternative vasopressor agent to **norepinephrine** only in highly selected patients (i.e. patients with low risk of tachyarrhythmias and absolute or relative bradycardia).
    - **Phenylephrine** is not recommended in the treatment of septic shock
- Cardiac output is known to be high and blood pressure persistently compromised

    - As salvage therapy when combined inotrope/vasopressor drugs and low dose vasopressin have failed to achieve MAP target a trial of **dobutamine** infusion can be administered or added to vasopressor (if in use) in the presence of:
        - Myocardial dysfunction as suggested by elevated cardiac filling pressures and low cardiac output
        - Ongoing signs of hypoperfusion, despite achieving adequate intravascular volume and adequate MAP.
- If using vasopressor therapy, it is recommended that arterial line be placed as soon as feasibly possible.
- If the patient remains hypotensive despite aggressive fluid resuscitation and vasopressor use, consider the administration of **hydrocortisone** (Solu-cortef) 100mg IV (from sending hospital).
- If the patient is noted to have a hemoglobin of less than or equal to 7.0, initiate packed red blood cell infusion refer to CCTTP 7.1 for target levels of 7.0 to 9.0g/dL.
- Monitor blood glucose q 1-2 hours,
    - If glucose greater than 180mg/dl, refer to CCTTP 4.2. for aggressive control of hyperglycemia
- Contact receiving physician for option of **Sodium Bicarbonate** if pH is less than 7.1. There is very limited current indication for its use.

4.8 Hypokalemia

4.8.1 Indications:

- Any patient for whom electrolyte replacement therapy has been initiated by the referring institution.

4.8.2 Potassium Administration Procedure:

- There is limited efficacy of oral potassium in the setting of critical illness.
- Verify that the patient meets criteria for urine output and serum creatinine level.
- Generally the patient's urine output should be more than 20ml/hr for at least 2-hours before using this protocol.
- The patient's serum creatinine level should be < 2.0 before using this protocol, unless otherwise ordered by the physician.
- If a serum K+ is less than 3.5, infuse KCL in concentrations no greater than
    - 20mEq/50ml D5W (or NS if indicated) for central lines and
    - 10mEq/100ml D5W (or NS if indicated) for peripheral lines according to the following scale per hour.
- NEVER ADMINISTER KCL IV PUSH: It could cause BRADYCARDIA, VENTRICULAR FIBRILLATION and ARREST.

4.8.3 FOR CENTRAL LINES:

SERUM K+	**KCL DOSE**	**TOTAL**
< 2.5	20mEq KCL q1hr x 5	100mEq
2.6 – 3.0	20mEq KCL q1hr x 4	80mEq
3.1 – 3.5	20mEq KCL q1hr x 3	60mEq

4.8.4 FOR PERIPHERAL LINES:

SERUM K+	**KCL DOSE**	**TOTAL**
< 2.5	10mEq KCL q1hr x 10	100mEq
2.6- 3.0	10mEq KCL q1hr x 8	80mEq
3.1 – 3.5	10mEq KCL q1hr x 6	60mEq

4.9 Hyperkalemia

4.9.1 Indications:

- To emergently treat hyperkalemia which can be due to:
  - decreased or impaired potassium excretion i.e. acute or chronic renal failure;
  - addition of potassium into extracellular space i.e. meds, rhabdomyolysis and hemolysis;
  - transmembrane shifts i.e. acidosis and medication effects;
  - or factitious hyperkalemia i.e. improper blood collection or lab error.
- Mortality from hyperkalemia can be as high as 67% if severe hyperkalemia is not treated rapidly.

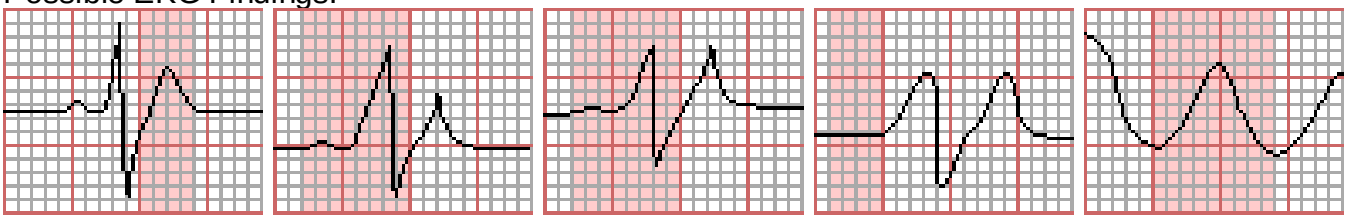
4.9.2 Pearls, Pitfalls & Considerations:

- The presence of typical EKG changes or any rapid rise in serum potassium indicates that hyperkalemia is potentially life threatening and warrants immediate treatment.
- Succinylcholine should be avoided in patients exhibiting a serum potassium above 5.5
- Substitute Magnesium sulfate in place of calcium in the presence of digoxin-toxic cardiac arrhythmias; see below.

4.9.3 Hyperkalemia is defined as a potassium level greater than 5.5 mEq/L. Ranges are as follows:

- 5.5 – 6.0 mEq/L – mild condition
- 6.1 – 7.0 mEq/L – moderate condition
- 7.1 mEq/L and greater – severe condition

Possible EKG Findings:



Hyperkalemia

- Early — peaked T waves
- Late — Intraventricular Block (T wave may no longer be present)
- Other changes such as flat or absent P waves; ST-T changes less consistent

4.9.4 Clinical Management:

- Confirm any potassium level > 5.5 prior to treatment unless patient is hemodynamically unstable.
- If IFT transport, request sending facility to confirm prior to LOM arrival; otherwise use I-Stat device.
- Monitor serum potassium by I-STAT every 20-30 minutes after starting treatment for hyperkalemia.
- Perform continuous EKG monitoring with vital signs documented every five minutes or appropriate interval.
- If the hyperkalemia is severe (potassium >7.0 mEq/L) or the patient is symptomatic, begin treatment before investigation of the underlying cause.
- Avoid **Calcium** if digoxin toxicity is suspected. **Magnesium Sulfate** (2gm over 5 min) may be used alternatively, in the face of digoxin-toxic cardiac arrhythmias.
- Individualize treatment to the patient; i.e. if the hyperkalemia is not severe, the patient may only need furosemide to enhance elimination.

Therapy	Dose	Onset of Effect	Duration of Effect
Calcium Gluconate	1 gram over 10 minutes. IV (peds- 100mg/kg over 2 min)	1-3 minutes	30-60 minutes
Sodium Bicarbonate	1 meq/kg IV bolus (peds-1-2 mEq/kg/dose). Max dose is 100 meq IV.	5-10 minutes	1-2 hours
Insulin plus Dextrose. Use 1 unit of insulin to 2.5 g glucose ratio.	Regular insulin 10 U IV (peds-0.1 IU/kg) plus 25g of dextrose in 50ml IV bolus (peds 0.5-1 g/kg)	30 minutes	4-6 hours Monitor for predictive K+ drop. May defer D50 if glucose > 250
Nebulized **albuterol**	10-20 mg nebulized over 15 minutes (peds-2.5 mg if < 25 kg; 5.0 mg if > 25 kg)	15 minutes`	15-90 minutes
Furosemide ONLY with physician consult	40-80 mg IV bolus (peds-1 mg/kg)	With onset of diuresis	Until diuretic effect ends

4.9.5 Treatment:

- Mild (5.5-6.0)
  - Cardiac monitor and repeat K+ enroute
  - If patient is HYPERVOLEMIC, hypertensive, and has normal renal function contact receiving physician or medical director for option of **Furosemide.**
- Moderate (6.0-7.0) without EKG changes:
  - The above treatments (dosages noted above) &
  - Administer **Insulin** & **Dextrose** IV (may defer Dextrose if glucose > 250)
- Severe (>7.0) or Moderate (6.0-7.0) with EKG changes:
  - The above treatments (dosages noted above) &
  - Administer Nebulized **Albuterol** 10-20mg over an hour
  - Administer **Sodium Bicarbonate**
  - Administer **Calcium Gluconate**.
    - If there is a central line (not I/O), 1 gram (an amp) of **Calcium Chloride** (CaCl) can be given alternatively.
- Special situations:
  - Acute Renal Failure:
    - Arrange for dialysis.
    - Patients with chronic renal failure on dialysis tolerate higher than normal potassium levels.
    - Communicate with receiving facility to expedite process.
  - Hold kayexalate.
    - There is limited data on its efficacy

4.10 Magnesium Derangements

4.10.1 Indications:

- Any patient for whom electrolyte replacement therapy has been initiated by the referring institution.

4.10.2 MAGNESIUM ADMINISTRATION PROCEDURE:

- The patient's urine output should be >20ml/hr for at least 2 hours before using this protocol, unless otherwise ordered by the physician.
- Cardiac monitoring is required during administration of IV magnesium to digitalized patients due to the risk of heart block.
- IV magnesium mixture is not to be concentrated more than 1 gm/100ml.
- Administer the Magnesium at a rate no greater than 500mg/hr in digitalized patients, due to the risk of heart block.
- Hypotension can occur from rapid administration. During administration of IV Magnesium, monitor BP at least q 15 min. for the duration of the infusion.
- Magnesium sulfate is available in varying strengths for parenteral administration. Solutions should be carefully checked to verify that correct dosage is being administered.
- To make a 10% solution from a 50% solution:
    - Take 4ml 50% Magnesium and dilute with 16ml D5 or NS.
    - This results in 2gms Magnesium/20ml (or 100mg/ml)
- Serum magnesium repletion.
    - Magnesium should not be administered intravenously at rates greater than 125mg/min; except when administering for pre-eclampsia or for prevention of pre-term labor.
    - Magnesium is contraindicated in patients with myocardial infarction or heart block, as it may slow cardiac conduction.
- Because of the CNS effects of magnesium, there may be interactions between magnesium and barbiturates, narcotics, hypnotics, or systemic anesthetics.
- Treatment of hypomagnesemia depends on the degree of deficiency and the clinical effects. Oral replacement is appropriate for mild symptoms, while IV replacement is indicated for severe clinical effects.
- Most patients with symptomatic hypomagnesemia and normal renal function, with an estimated deficit of 1-2 mEg/kg should receive 1 mEq/kg of magnesium sulfate for the first 24 hours as a continuous IV infusion.
- If cardiac dysrhythmias or seizures are present, infuse 2g magnesium sulfate IV push over 2 minutes.

4.11 Hypocalcemia

4.11.1 Indications:

- Any symptomatic patient presenting with an iCal value below 1.0.
- Normal iCal is 1.19 to 1.29
- Be watchful for neurologic changes (Tetany, Chvostek's sign, etc)
- Patients with elevated K+ (CCTTP 4.9)
- Symptomatic magnesium overdose (Contact O.L.M.D.)

4.11.2 Pearls, Pitfalls, and Considerations:

- Monitoring of iCal levels are of increased importance in patients receiving blood transfusions due to the Citric Acid preservative used in banked blood binding to calcium.
- Low calcium levels can exacerbate bleeding.

4.11.3 Clinical Management:

- In patients receiving large amounts of banked blood products, venous or arterial Ionized calcium levels will be monitored.
- Consider using I-Stat.
- If indicated, administer **Calcium Gluconate** 1 gram IV over 10 minutes.
- Monitor for dysrhythmias and hypotension.
- Draw and analyze iCal q 30 minutes.

4.12 Seizure Management

4.12.1 Indications:

- Any patient with seizure activity or reported seizures prior to LIFEFLIGHT arrival.

4.12.2 Pearls, Pitfalls and Considerations:

- In many cases, patients with refractory seizures lose airway reflexes after the administration of benzodiazepines and other anti-epileptics. Consider RSI if patient requires high doses of these medications. The use of paralytics can mask ongoing seizure activity.

4.12.3 Clinical Management:

- Establish and maintain adequate airway, oxygenation, and ventilation.
- Initiate or maintain IV of NS at TKO.
- Obtain blood glucose level and treat appropriately.
    - If fingerstick blood glucose is less than 80mg/dl,
        - Treat with either 25 grams of **Dextrose 50%** or 1 gram of intramuscular **Glucagon**.
    - Consider **Thiamine** 100 mg IV if suspicion of ETOH abuse.
- If the patient is actively seizing, consider the use of ONE type of benzodiazepine.
    - **Lorazepam**: 0.15 mg/kg to MAX 2 mg IV push.
        - Repeat twice as needed. Monitor for respiratory depression.
    - **Midazolam** 0.1 mg/kg to MAX 5mg IV push or intramuscular (IM).
        - Repeat twice as needed. Monitor for respiratory depression.
    - If patient is unable to protect the airway, refer to CCTTP 2.3.
- If seizures cannot be controlled administer:
    - **Fosphenytoin** - 20mg PE/kg IV not to exceed 150 mg PE/min.
        - MAX dose 1500 mg PE/kg IV
        - Monitor for cardiac dysrhythmias and associated hypotension
    - **Phenytoin** – 20 mg /kg IV. Infusion rate should be 25mg/min.
        - MAX dose 1500 mg IV
    - Monitor for cardiac dysrhythmias and associated hypotension
    - Consider use of **Keppra** for treatment and/ or patient has allergy to fosphenytoin or continues to have seizures, administer:
    - **Keppra** 20 mg/kg IV over 15 minutes
        - MAX of 1g
        - Note: There has been noted literature in the use of Keppra in the setting of Subarachnoid Hemorrhage (traumatic and spontaneous). Consult accepting physician or OLMC for option of this medication.
    - If intubated and BP allows, consider **Propofol**
        - Bolus 0.1 – 1 mg/kg
        - If MAP > 65, infusion with MAX dose 200 mcg/kg/min
- The administration of **Phenobarbital** or **Propofol** infusions have been shown to effectively suppress seizure activity.
- Consult OLMC or Receiving physician for the administration.
    - If staff is directed to administer these medications, endotracheal intubation is usually mandated.
    - Refer to CCTTP 2.3 and 2.4 for aggressive management of seizures post intubation, especially if long acting neuromuscular blockade is utilized.
- Once seizures are terminated, examine patient for trauma and treat accordingly;
    - In particular, examine for shoulder dislocation (usually posterior), and intra-oral injury.
- Avoid systolic blood pressures less than 90mmHg and PaO2 less than 60.
- If the blood pressure remains below 90 mmHg, consider aggressive fluid resuscitation of 30ml/kg or subsequent vasopressor therapy use. (Refer to CCTTP 4.13)
- Transfer to tertiary capable of managing status epilepticus.

4.13 Refractory Shock and Hypotension

4.13.1 Indications:

- The LOM Provider will institute measures necessary for the stabilization and maintenance of ventilation and circulation in patients exhibiting signs and symptoms of shock.

4.13.2 Pearls, Pitfalls and Considerations:

- Swan-Ganz catheter is very useful in treating shock. Document that the balloon wedges and the position of the catheter. Always transduce the PA pressure to ensure proper catheter position.
- **Vasopressin** and **Epinephrine** can cause constriction of coronary vasculature which may lead to cardiac ischemia.
    - **Vasopressin** may be the only vasopressor that works reliably with a pH below 7.15. Phenylephrine raises SVR/Afterload without any beta stimulus which may contribute to left ventricular workload.
- A vasopressor/inotrope strategy that has been initiated prior to LOM arrival, which is proving effective and is physiologically appropriate, may be continued or modified at the discretion of the LOM team.

4.13.3 Clinical Management:

- Consider placing a radial or femoral arterial line as soon as practicable. Femoral line placement may be less difficult in the hypotensive patient. Titrate vasopressors and inotropes to MAP of 65.
- Assess airway, breathing, and circulation.
    - Administer high flow oxygen and begin continuous hemodynamic monitoring with cardiac monitor, non-invasive blood pressure monitoring, oxygen and end-tidal CO2 monitoring.
    - Establish two large bore IV's. In the setting of an interfacility flight, if the patient has a central line, establish if the line is in the appropriate location and is patent.
- If possible, determine Shock etiology.
- Ascertain patient's hydration status
    - PCWP below 6.0
    - Urine Output
    - CVP of 8
    - Respirophasic pulse pressure variation via arterial line
    - Consider RUSH ultrasound exam for IVC collapse.
- If the patient is not hydrated adequately, consider aggressive, but appropriate, fluid rehydration

4.13.4 Shock and other altered hemodynamic States

- If **Phenylephrine** is infusing at the sending facility and hemodynamics are stable, it may be continued by the crew. Usual dosing is 10-180 mcg/min and normal mixing is 80 mcg/mL

4.13.5 Distributive Shock (septic, neurogenic, anaphylactic; SVR below 800)

- Initiate Rapid Fluid Administration up to 30ml/kg. Monitor for respiratory distress.
- Treat with appropriate protocol that addresses specific etiology of shock in conjunction with this protocol.
- Therapies can include the following:
    - If transient hypotension is suspected, or a bridge to definitive therapy or infusion is required, consider push-dose **Epinephrine** described below in CCTTP 4.13.9
    - **Norepinephrine**
        - Start at 0.05 mcg/kg/min. Titrate by 0.02 mcg/min as indicated
        - Dose range: 0.05-0.6 mcg/kg/min.
        - There is no true maximum dose, but consider additional agent at the once titration has reached 0.3 mcg/kg/min
    - If not effective, add **Vasopressin** 0.03 units/min
        - It is important to note that typically vasopressin is held at a fixed rate (i.e. 0.03 units per minute as is not titrated).
    - If above not effective consider **Epinephrine Infusion**
        - 0.05mcg/kg/min titrated for effect to MAX dose of 0.5mcg/kg/min

4.13.6 Cardiogenic Shock: (CO below 3.5/CI below 2.0)

- Treat any rate/arrhythmia issue with appropriate LOM protocol.
- If known volume issue or in case of RVMI, aggressively fluid hydrate patient.
- Therapies can include:
    - If transient hypotension is suspected, or a bridge to definitive therapy or infusion is required, consider push-dose **Epinephrine** described below in CCTTP 4.13.9
    - If unresolved, initiated **Norepinephrine** infusion
        - Start at 0.05 mcg/kg/min. Titrate by 0.02 mcg/min as indicated
        - Dose range: 0.05-0.6 mcg/kg/min.
        - There is no true maximum dose, but consider additional agent at the once titration has reached 0.3 mcg/kg/min
        - If unresolved, add **DOBUTamine** 5-20 mcg/kg/min to further increase CO/CI without reducing filling time and increasing tachycardia.
    - If no response to any of the above, add **Epinephrine** Infusion
        - 0.05 mcg/kg/min titrated for effect to MAX dose of 0.5 mcg/kg/min
    - **DOPAmine** 2-20mcg/kg/min IV is the last adjunctive therapy that should be used for both chronotropy and inotropy.

4.13.7 Hypovolemic Shock

- Stop Bleeding. Utilize direct pressure and deploy tourniquet as needed.
- It is reasonable to defer crystalloids and initiate colloids if obvious or suspected blood loss exists.
- Initiate judicious fluid challenge with 0.9% NS up to 30ml/kg. Target MAP of 60-65 and SBP of 80-90 mmHg.
    - Refer to CCTTP 7.1 for blood product administration considerations
    - If clinically indicated, consider **TXA**, refer to CCTTP 7.2
- If no response to above and treatments in CCTTP 5.10 are being completed simultaneously,
    - If transient hypotension is suspected, or a bridge to definitive therapy or infusion is required, consider push-dose **Epinephrine** described below in CCTTP 4.13.9
    - Initiate **Norepinephrine** Infusion
        - Start at 0.05 mcg/kg/min. Titrate by 0.02 mcg/min as indicated
        - Dose range: 0.05-0.5 mcg/kg/min.
        - There is no true maximum dose, but consider additional agent at the once titration has reached 0.3 mcg/kg/min

4.13.8 Shock of indeterminate etiology. (hypotensive without a clear etiology)

- Rapid Administration of isotonic fluid at 30ml/kg.
- Vasopressor therapy can include:
    - If transient hypotension is suspected, or a bridge to definitive therapy or infusion is required, consider push-dose **Epinephrine** described below in CCTTP 4.13.9
    - **Norepinephrine** Infusion
        - Start at 0.05 mcg/kg/min. Titrate by 0.02 mcg/min as indicated
        - Dose range: 0.05-0.5 mcg/kg/min.
        - There is no true maximum dose, but consider additional agent if the patient is unresponsive to higher doses.
- If above therapy contra-indicated or unsuccessful and etiology of shock remains undetermined, add or substitute
    - **Vasopressin** 0.01 to 0.04 u/min IV (Typically, vasopressin is held at a steady dose at 0.03 units per minute)

4.13.9 Transient hypotension "Push-dose **Epinephrine**"

- Utilize pre-filled syringe, if available, or see mixing guide below
- Adults: **Epinephrine** 5-10 mcg (0.5-1 mL of 10 mcg/mL concentration) every 2-5 minutes to SBP target. Ideally limit use to up to 2 administrations while concurrent titratable vasopressor is prepared.

- Pediatrics **(≥10kg only)**: **Epinephrine** 5-10mcg (1 mL of 10 mcg/mL concentration) every 2-5 minutes to SBP target. Ideally limit use to up to 2 administrations while concurrent titratable vasopressor is prepared.
- Administration notes and Mixing Guide
    - As with other pressors, IV administration is preferred through a large-bore vein (central, if possible) or IO.
    - "Push-dose **Epinephrine**" mixing guide
        - Utilizing 10mL Saline syringe, eject 1ml (total of 9mL of saline remaining in syringe).
        - Utilizing the saline syringe, with 9mL remaining, and a three-way stopcock, withdraw 1mL of the 0.1mg/mL (1:10,000 – "Cardiac") epinephrine into the (total of 10mL of volume in syringe).
        - This will make a solution of 0.01 mg/mL (10 mcg/mL) in the syringe. The syringe should be labeled prior to utilization.
        - Preparation of the syringe should only be performed after patient contact and recognition of need. Once prepared, the syringe may only be utilized for that one patient and may not be saved.

4.14 Hypertensive Emergencies

4.14.1 Indications:

- The LOM Provider will institute measures necessary for the stabilization and maintenance of ventilation and circulation in patients exhibiting signs and symptoms of hypertensive crisis.

4.14.2 Pearls, Pitfalls and Considerations:

- A hypertensive emergency occurs as a result of either an acute or chronic elevation in blood pressure resulting in significant end organ dysfunction.
- Critical systems affected include central, cardiac, and renal.
- It is imperative that the provider illicit a complete history including history of the current complaint, past medical history, and suspected or confirmed current diagnosis.

4.14.3 Clinical Management:

- Assess and monitor airway, breathing and circulation.
- If patient has adequate spontaneous respirations, administer supplemental oxygen to maintain saturation greater than 93%.
- Monitor cardiac functions (EKG, BP, P, and RR) and O2 saturations
- Establish TWO large bore IV's of 0.9% Normal Saline.
- Titrate medications below to targets outlined in individual protocols for Non-Traumatic CVA, Aortic Dissection or Aneurysm

4.14.4 Refer to CCTTP 4.4, 4.5, 4.6

4.14.5 Medications Commonly used and encountered include (in alphabetical order):

- If HR > 60 and preferentially for Aortic Dissection
  - **Esmolol** (Brevibloc) Premixed 2500mg/250mL (10,000mcg/mL)
    - Loading dose 1 mg/kg to MAX of 80mg over 30 seconds
    - Initiate infusion at 150 mcg/kg/min
    - Titrate by 50 mcg/kg/min to desired HR of 60 – 70 and a MAX of 300 mcg/kg/min
    - If HR drops below 60, reduce **Esmolol** infusion
    - If Hypertension persists, add additional antihypertensive (**Nicardipine** infusion as below)
    - Use extreme caution in asthmatics, diabetics, impaired renal function, or patient's with a history of hypotension and CAD.
    - May cause arrhythmia, angina, MI, or death if stopped abruptly. May cause hypoglycemia and mask the symptoms.
- If HR ≤ 60 and preferentially for Aortic Aneurysm and CVA's
  - **Nicardipine** (Cardene) Mix 25mg/250mL
    - Initiate infusion 2.5 mg/hr
    - Consider increasing infusion at 5 – 10 minute intervals
    - Increase infusion by 2.5 mg/hr
    - MAX dose 15 mg/hr
    - ONCE desired BP achieved, consider incremental dose reduction to lowest rate possible while still achieving desired SBP parameters, typically, this can be achieved at 3mg/hr.
- If hypertension persists, contact receiving clinician for other options
- Others you may encounter
  - Clevidipine
    - No loading dose
    - Initial infusion at 1-2mg/hr. Titrate 1-2mg/hr q 5-10mins for therapeutic effect
    - Typical dosing is 4-6mg/hr.
    - Max dose 16mg/hr.
    - May be given through peripheral line.
  - Hydralazine:
    - 10-20 mg slow IV push
    - May be given through peripheral line.

- Labetalol
  - 10mg slow IV push
  - May repeat 10-20 mg IV q10 minutes up to 200 mg until adequate BP is reached.
  - May be given through peripheral line.
- Nitroprusside
  - Start infusion at 0.5mcg/kg/min.
  - The infusion can be increased by 0.5 mcg/kg/min every 5 minutes until desired BP is reached or max dose of 10 mcg/kg/min.
  - Do NOT use in the setting of intracranial pathology

4.15 Thrombolytic Therapy Monitoring

4.15.1 **** Note: these guidelines are obtained directly from the American Heart Association/American Stroke Association (AHA/ASA) and the manufacturer.

4.15.2 Activase (alteplase or tPA).

- General Indications for therapy: Ischemic Cerebral Vascular Accident
- **Part 1 During tPA therapy infusion**:
  - Perform neurologic assessment
    - The use of a stroke rating scale, preferably the NIHSS, is recommended.
    - Repeat every 15 minutes during the 1-hour infusion to monitor for neurologic deterioration.
  - Check for major and/or minor bleeding
    - All body secretions should be monitored for occult blood.
    - Major bleeding: intracranial, retroperitoneal, gastrointestinal, or genitourinary hemorrhages.
    - Minor bleeding: gums, venipuncture sites, hematuria, hemoptysis, skin hematomas, or ecchymosis.
    - Arterial and venous punctures should be minimized and checked frequently.
  - Monitor blood pressure every 15 minutes during the 1-hour infusion.
    - Blood pressure should be monitored frequently and controlled during and after tPA administration (systolic blood pressure ≤180 mm Hg and diastolic blood pressure ≤110 mm Hg)
    - Administer antihypertensive medications to maintain blood pressure at or below these levels as described in CCTTP 4.14.
  - Maintain patient's head at 30 degrees
  - Maintain NPO (Nothing by Mouth) during transfer.
  - **Discontinue infusion** and notify receiving facility if the patient develops severe headache, acute hypertension, nausea, or vomiting; or has a worsening neurologic examination.
  - Monitor for signs of orolingual angioedema.
    - If angioedema is noted, promptly institute appropriate therapy.
    - Refer to CCTTP 4.1 Anaphylaxis and Allergic Reactions.
    - Consider discontinuing tPA infusion with consultation with receiving service.
- **Part 2 Post tPA therapy**
  - Continue to monitor for neurologic deterioration
    - Complete neurological exam every 15 minutes for the first hour after the infusion is stopped.
    - Then complete exam every 30 minutes for the next 6 hours
    - If the patient is still in the care of the transporting team, a neurological exam should be completed hourly from the eighth post-infusion hour until 24 hours after the infusion is stopped.
  - Continue to check for major and/or minor bleeding.
  - Continue to monitor and control blood pressure.
    - Every 15 minutes for the first hour after the infusion is stopped.
  - Continue to monitor for signs of orolingual angioedema.

4.15.3 **Tenecteplase (TNK) Therapy**

- Indications for therapy: ST Elevation Myocardial Infarction (STEMI)
- Massive Pulmonary Embolism with hemodynamic instability
    - Post fibrinolysis re-assessment and monitoring
        - Vital signs: Completed every 15 minutes for the first hours and then every 30 minutes for the next four hours thereafter.
        - A concurrent Neurological assessment hourly should be completed at the same time frame as hemodynamic monitoring.
        - Continuous cardiac monitoring until transfer is completed at the acute care hospital as reperfusion arrhythmias may occur
        - Defibrillator and treatments should be immediately available. Transcutaneous pads should be in place at all times.
        - Repeat a 12 lead EKG at 60 and 90 minutes post TNK administration to assess reperfusion. If the patient reports worsening pain, palpitations or resolution, a 12 lead EKG should be immediately completed.
        - Patient should be on bed rest
        - Avoid IM injections or unnecessary disturbance of the patient (e.g. automatic blood pressure cuff)

5. TRAUMA

5.1 Abdominal and Pelvic Trauma

5.1.1 Indications:

- Blunt or penetrating injury to the abdomen and fracture to the pelvis. The major immediate complications are hypovolemia and shock.

5.1.2 Clinical Management:

- Complete primary assessment and manage airway, breathing and circulation.
- If indicated, maintain standard spinal precautions.
- Control any sources of bleeding identified during this assessment.
- Titrate oxygen accordingly to maintain oxygen saturations greater than 93%. If the patient is intubated, do not wean Fi02 unless recent arterial blood gas has been completed.
- Monitor and treat for hemorrhagic shock as appropriate.
- Use permissive hypotension strategy as indicated.
- Establish TWO large bore peripheral IV's of isotonic crystalloid solution to maintain MAP's of 65 or greater.
    - If patient is being transported from a community facility obtain and administer blood products if available as determined by patient condition.
    - If the patient has had adequate crystalloid volume resuscitation, consider utilizing packed red blood cells and Liquid Plasma as outlined in CCTTP 7.1
    - If the patient has been receiving colloids from a sending facility, it reasonable to discuss the use of fresh frozen plasma with sending and receiving providers PROVIDED that it does not delay transport to the receiving facility.
- Monitor closely for any changes in mental status, vital signs and/or impending profound shock.
    - Early detection of signs of hemorrhagic shock and appropriate fluid administration can prevent or reduce the degree of shock.
    - Keep in mind that intravenous volume administration may result in increased bleeding from intra-abdominal sources.
    - If the source of bleeding is from a non-compressible site, judicious use of fluids may be wise.
- Provide appropriate analgesia and or sedation as indicated. Refer to CCTTP 6.7 or 6.8
- If the patient is intubated, refer to CCTTP 2.4 Post-intubation sedation, pain control and paralysis
- Assess for varying degrees of abdominal pain during a rapid but all-inclusive abdominal examination.
    - Note Kehr's, Cullen's or Grey Turner's sign.
- Spleen and liver injuries may lead to exsanguination immediately following the injury and therefore specific treatment should focus on hemodynamic status.
    - IV fluids and/or blood products along with rapid transport should be considered
- Any trauma resulting in hematoma formation to the male or female genitalia should be treated with ice, cold packs, and pressure dressings.
    - Avoid placement of foley catheter in setting of severe perineal swelling or blood at the meatus.
- When lacerations are present on male genitalia place wet saline dressings to area, if bleeding of the penis or scrotum is present, pressure dressings should be applied.
- Vaginal bleeding should be observed, and a pressure dressing should be applied to the perineum when bleeding is profuse, and from a compressible source.

5.1.3 Fluid replacement requirements:

- Adults in hemorrhagic shock, judicious use of crystalloid to a MAX of 30 mL/kg
- Examine the abdomen for obvious wounds.
- Stabilize any impaled or penetrating object.
- If the object cannot be stabilized appropriately, alternate form of transport must be utilized.
- If there is evidence of eviscerated abdominal contents, examine closely to ensure lack of torsion.
    - Reduce torsion if noted.

- Apply saline impregnated gauze directly to the site and dry dressing thereafter
- Consider occult intra-abdominal hemorrhage as part of differential diagnoses, especially in the presence of sustained tachycardia in the trauma patient.
  - E-FAST ultrasound is an appropriate diagnostic if available.
- Assess for signs of exsanguination such as decreased LOC, pale, cool, clammy, diaphoretic skin, pale mucous membranes, delayed or absent capillary refill, distended rigid abdomen, shortness of breath and/or tachypnea, tachycardia and hypotension, unobtainable BP, BP that does not respond to fluid administration, and c/o of abdominal pain.
- Consider NG tube. Patients being transferred from sending facilities who have suspected intestinal injury, gastric distention, or potential for aspiration should have an NG tube. In particular, patients with diaphragmatic rupture, GI tract injuries, and pregnancy should have an NG tube inserted prior to or in transport.
- Consider foley catheter if no blood observed at urethral meatus. Do not force if insertion is difficult.

5.1.4 Pelvic - Inspect perineum and buttock area, including anus for trauma.

- Use CCTTP 7.15 Hemostatic Gauze as indicated for hemorrhage control.
- If unstable pelvic fracture is suspected, apply pelvic binder (commercial device or sheet wraps). Refer to CCTTP 7.7
  - Identify appropriate position of pelvic binder over trochanteric heads.
  - Avoid repeated assessments by manual compression of an unstable pelvis.
- Any large open fractures, administer **Cefazolin**
  - < 40kg Contact receiving clinician
  - 40 – 80kg 1g
  - ≥ 80 kg 2g
- If the patient is an interfacility transport assess or obtain readings on abdominal films, Chest Radiograph for signs of free air or intra-abdominal bleeding. Assess for pelvic fractures on films and during complete examination.
- Frequent and continuous monitoring of vital signs for developing signs of increasing shock and/or exsanguination.

5.2 Burns – Major

5.2.1 Indications:

- Any patient with chemical, electrical, or thermal burns. Chemical decontamination MUST occur prior to transport.

5.2.2 Caution/Special Considerations:

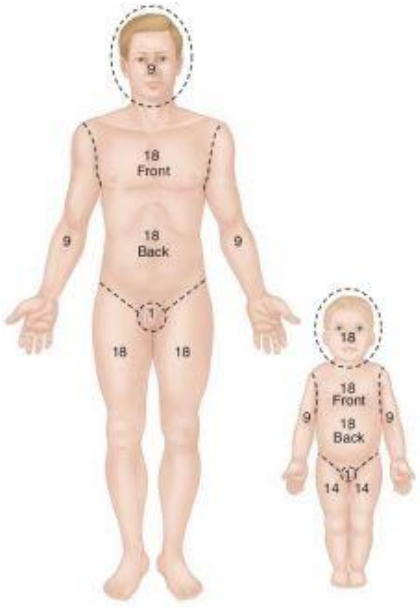
- For scene flights with patients who have sustained second or third degree burns greater than 50% body surface area and who are hemodynamically stable, consult OLMD for possible direct transport to Boston Hospitals. Maine Medical Center should also be consulted prior to diversion to Boston.

5.2.3 Clinical Management:

- Stop the burning process and remove all clothing. Thoroughly rinse chemicals off with water, with the exception of powdered chemicals which should be brushed off.
- Conduct primary assessment and ensure adequate ABCs.
    - Any life threatening problems identified will be immediately treated.
- Thorough assessment of respiratory status of patients with facial, neck and chest burns.
    - Early intubation is often indicated for:
        - Severe burns of the face and/or neck.
        - History of confinement in burning environment.
        - Carbon deposits in the oropharynx or nares in conjunction with hoarseness, stridor or some other tangible evidence of suspicion for airway injury
        - Facial and neck edema, such injuries require prompt intubation or possible cricothyrotomy.
        - If intubation is required it must be performed early on in the course of care because it may prove to be impossible with the onset of edema after the initiation of fluid replacement.
    - If the patient is intubated, refer to CCTTP 2.4
    - If patient has adequate spontaneous respirations, administer supplemental oxygen to maintain SpO2 > 95%. Consider providing 100% via NRB due to concerns of CO poisoning.
    - If bronchospasm is present, consider the administration of Albuterol. Refer to CCTTP 2.5
- Assess for mechanism of injury; include any potential trauma and circumstances surrounding the burn injury.
    - If the potential for significant non-burn related traumatic injury exists, the patient should be transported to the closest appropriate trauma center.
    - Treat for signs and symptoms of concurrent significant blood loss and impending hypovolemic shock.
- Consider placement of Foley catheter for continued monitoring of urine output.
- Assess for area and degree of pain.
- Assess for circumferential burn injury and distal pulses, motor and sensation to the injury.
    - Calculate % TBSA burned of superficial, partial, and full thickness burns.
    - In estimating scattered burns, a fairly accurate approximation can be made utilizing the patient's palm to represent 1% of the total BSA and visualizing palm over the burn area. (Refer to 5.2.4 for Rule of 9's).
- Obtain or estimate weight.
- Establish a minimum of 2 large bore IV's (Use 0.9% Normal Saline), preferably outside burned area. Avoid over-hydration.
- Treat pain and anxiety per CCTTP 6.7.
    - Burn injured patients frequently require large doses of pain medications.
- Thermal burns:
    - Fluid resuscitation as needed for other acute trauma
    - Burn fluid (based on Parkland formula) ml per hour = (**Lactated Ringers is preferred, if available**) 0.9% Normal Saline at

        - MAX of 4 ml/kg X %BSA
        - Administer ½ of Parkland calculated fluid in the 1st 8 hrs, then administer the remaining ½ over the next 16 hrs
    - Maintenance fluids:
        - For pediatric patients, maintenance fluids with dextrose (D5 NS) must be calculated and administered in addition to Parkland fluids
    - In the absence of significant non-burn related trauma, transport to burn center if:
        - >20% partial thickness burn in pts 10-50 years old.
        - >10 % partial thickness burn in pts >50 years old or <10 years old.
        - >5% full thickness burn in patients of any age.
        - Burns of hands, face, genitalia, feet, or joints.
    - Inhalation injury.
    - Chemical or electrical burns.
    - Circumferential burns of an extremity.
    - Burns on patients with pre-existing medical illnesses.
    - Burn injury that requires long-term rehabilitative support, and special social/emotional support.
- Electrical burns:
    - Initiate crystalloid infusion at 500ml/hour to achieve urine output of 75-100ml/hour, titrate to maintain urine output of 75-100ml/hour.
    - Patient is at risk for acute renal failure with these burns (With concurrent rhabdomyolysis). Contact receiving clinician for option of **Sodium Bicarbonate** bolus
    - Electrical burn patients should be monitored for life threatening dysrhythmias.
    - Full spinal immobilization should be considered if indicated.
    - Check for entrance and exit wounds.
- Be aware of mechanism of injury. Toxic products of combustion may induce non-cardiogenic pulmonary edema.
- If circumstances indicate closed space exposure, carbon monoxide poisoning may coexist with other trauma and burns.
    - High flow O2 should be provided.
    - If patient is unconscious, intubation and administration of 100% Fi O2 should be initiated.
        - Refer to CCTTP 2.3. CO level should be obtained, if possible.
    - Refer to CCTTP 6.9 if there is suspicion for concurrent cyanide toxicity in the patient who may exhibit concurrent neurologic, respiratory or cardiovascular compromise including cardiac arrest.
- Assess and treat the burn itself.
    - If burns are not dressed, cover with clean dry sheet.
    - Cover facial burns with dry sterile dressing. Avoid moist dressings.
    - Eye (corneal burns) - irrigate with 500-1000ml NS
    - Note: There is currently no role for Antibiotic treatment in the acutely burned patient

5.2.4 Rule of Nine's



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(%)	Head	Chest	Abdomen	Back	Genitals	R Arm	L Arm	R Leg	L Leg
Adult	9	9	9	18	1	9	9	18	18
Child	18	9	9	18	1	9	9	14	14

5.3 Chest Trauma

5.3.1 Indications:

- Any patient exhibiting signs and symptoms of blunt or penetrating trauma.

5.3.2 Clinical Management:

- Perform primary assessment and identify critical injuries to the respiratory and circulatory systems. If airway compromise is identified, refer to CCTTP 2.3.
- Oxygen as indicated by patient condition. Administer supplemental oxygen to maintain SpO2 >95%
- Identify and stabilize any penetrating objects to the chest.
- Control hemorrhage by direct pressure and/or Hemostatic Gauze. Refer to CCTTP 7.15
- Treat for shock as appropriate.
    - Use permissive hypotension strategy. Maintain MAP of 60-65.
    - Establish TWO large bore peripheral I.V.'s of isotonic crystalloid solution.
- If the team is completing an interfacility transport, assess initial chest radiograph for signs of hemothorax or pneumothorax as well as patient assessment and respiratory status.
- If chest tube is in place with either chest drainage unit or Heimlich valve, confirm position and function of system before departure. When feasible, maintain active suction to the closed system.
- Monitor hemodynamic status including heart rate, blood pressure, oxygen saturations and end tidal carbon dioxide.
- Consider NG tube.
- Observation of clinical signs of an open pneumothorax require immediate placement of a sterile occlusive dressing, large enough to overlap the wound edges, that is taped securely on three sides.
    - If signs of a tension pneumothorax develop, release occlusive dressing before performing needle thoracostomy or chest tube insertion. Refer to CCTTP 7.8, 7.9, 7.10 as required.
- If a closed pneumothorax is diagnosed, chest tube placement should be strongly considered prior to flight to avoid an increase in size of the pneumothorax at altitude.
    - Refer to CCTTP 7.8, 7.9, 7.10 as required.
    - The risk of this delay must be considered in relation to the risk of deterioration of the patient when brought to altitude.
- Identify central line position if the line is placed in subclavian or internal jugular positions.
- Provide appropriate analgesia and/or sedation. Refer to CCTTP 6.7 or 6.8
- If trauma is a penetrating wound to the chest, consider administration of antibiotics.
- If a chest tube is inserted prior to transfer, one can consider administration of **Cefazolin** for antibiotic prophylaxis.
    - < 40kg — Contact receiving clinician
    - 40 – 80kg — 1g
    - ≥ 80 kg — 2g
- For known or suspected great vessel traumatic injury (Aorta, vena cava, and pulmonary artery), provide adequate pain and management.
    - Recognize that the effects of intubation and positive pressure ventilation can increase intrathoracic pressure.

5.3.3 Thoracic Crush injury syndrome

- In the setting of crush syndrome of the thorax (traumatic asphyxiation), staff must be able to identify injuries to the critical systems and be prepared to address these injuries immediately.
    - Airway management must be addressed with high flow oxygenation to maintain oxygen saturations greater than 95%.
    - A thorough respiratory assessment must ensue as described above. Lung decompression may be indicated if there is evidence of hemo- or pneumothorax.
    - If the patient is in cardiac arrest, please refer to CCTTP 5.10 Acute Resuscitation Multisystem Unstable Adult Trauma Patient" for further interventions.

- In patients with crush syndromes to the thorax, provide intravenous fluids of 0.9% Normal Saline. Repeat 0.9% Normal Saline.
- If there is concern for acute decompensation secondary to metabolic acidosis (i.e. prolonged compression) after release, consider alkalinization:
    - PRIOR TO EXTRICATION: Consider contacting receiving clinician for option of **Sodium Bicarbonate** bolus and/or infusion
- If hyperkalemia is suspected (onset of PVC's, QRS > 0.12, or peaked T-waves) Refer to CCTTP 4.9

5.4 Extremity Trauma

5.4.1 Indications:

- Any patient exhibiting signs and symptoms of trauma to the extremities.

5.4.2 Clinical Management:

- Assess critical systems first including airway, breathing, and circulation prior to addressing extremity trauma. Life threatening problems should be corrected immediately.
- Control external hemorrhage with direct pressure, elevation of extremity, and/or Hemostatic Gauze (CCTTP 7.15).
- If the provider is unable to control bleeding consider tourniquet proximal to site of injury.
- Assess extremity for pulse, circulation, sensation, and motor function of extremity.
- Identify significant swelling, discoloration, deformities or angulation / shortening of the extremity.
- Identify if there is superficial alterations in sensation (neurologic sequelae) or significant areas of pain out of proportion to the exam (compartment syndrome or deep muscle injury)
- Stabilize impaled objects.
- If there is an open fracture, apply moist sterile saline dressing to wound. Keep the wound as clean as possible. Antibiotics are not indicated for large lacerations without open fractures.
    - Open fractures: **Cefazolin**
        - < 40kg Contact receiving clinician
        - 40 – 80kg 1g
        - ≥ 80 kg 2g
    - Equivalent first generation cephalosporin is acceptable.

5.4.3 Fractures:

- Reduce and splint fractures, if possible, by clinician or staff before departure.
    - Do not reduce fractures if increased pain or resistance is encountered.
    - Assess tetanus immunization status in all trauma patients.

5.4.4 Amputation

- (Re-implantation may require resources available only at facilities in Boston. If patient otherwise stable, provide patient report to medical control and request direct flight to one of the aforementioned facilities.)
    - Complete amputation
        - Wrap part in saline soaked gauze, place in water-tight zip lock bag, place bag in cold water filled container; save for possible reimplantation (Ensure that the part is NOT in water directly).
        - Wrap stump in sterile saline moistened dressing and pressure dressings.
        - DO NOT SOAK AMPUTATED PART DIRECTLY IN WATER.
    - Partial amputation:
        - Place in anatomical position and splint.
        - Wrap in bulky sterile saline moistened dressing and keep moist
        - Save any avulsed part
        - Treat pain per CCTTP 6.7
        - Pulse oximetry or doppler may be used to establish status of pulses.

5.4.5 Crush Syndromes – Extremity. Identify significant crush syndromes. These can include:

- One extremity crushed for >2 hours
- Two extremities crushed for >1 hour
- Treatment:
    - Start 2 large bore IV's, NS / LR at w/o rate x 1 L, then KVO.
    - Repeat NSS/LR 500 ml as needed to maintain systolic blood pressure > 90 mmHg.
    - Alkalinization (if patient meets the diagnostic criteria for crush syndrome), PRIOR TO EXTRICATION:
        - Contact receiving clinician for option of **Sodium Bicarbonate** bolus and/or infusion
    - If hyperkalemia suspected (onset of PVC's, QRS > 0.12, or peaked T-waves) Refer to CCTTP 4.9

5.5 Facial and Neck Trauma

5.5.1 Indications:

- Any patient exhibiting signs and symptoms of blunt or penetrating trauma to the face and neck.

5.5.2 Pearls, Pitfalls and Considerations:

- Be especially attentive to airway management principles, as these patients are at high risk of losing an initially adequate airway! Disrupted anatomy may prevent adequate ventilation by BVM.

5.5.3 Clinical Management:

- Conduct primary assessment, assure adequate ABC's. Any life-threatening injury should be treated immediately.
- Suspect concurrent cervical spine, head, and ocular trauma. Treat according to specific protocols. Maintain immobilization per clinical presentation.
- Control hemorrhage by means of direct pressure, packing or ligation before departure.
- Establish IV with two large bore intravenous lines and with 0.9% Normal Saline at TKO rate initially should be in place.
- Stabilize bone fragments or penetrating objects.
- Observe for CSF otorrhea or rhinorrhea.
- For uncontrolled scalp hemorrhage, refer to CCTTP 7.6 to staple the wound
    - If there is evidence of bleeding on face or neck, use direct pressure to control exsanguination.
    - Consider this use of Hemostatic Gauze application (CCTTP 7.15)
- Assess need for definitive airway placement with endotracheal intubation.
    - Patients with maxillofacial trauma can be difficult to manage with typical orotracheal intubation.
    - However, if an airway cannot be maintained with BLS maneuvers, refer to CCTTP 2.3.
    - The use of a paralytic in RSI intubation is indicated with caution in an unstable midface fracture due to distortion of the anatomy.
        - Concurrently, prepare for needle/surgical cricothyrotomy as needed.
        - Please refer to CCTTP 7.16 or 7.17
- Do not insert NG tube if severe facial injury or midface fracture, utilize OG tube for gastric decompression.
- Large lacerations alone are NOT an indication for antibiotics
- If facial trauma includes a gunshot wound and open fracture, continue antibiotics as initiated at referring institution. Consider **Cefazolin**
    - < 40kg Contact receiving clinician
    - 40 – 80kg 1g
    - ≥ 80 kg 2g
    - Or equivalent first generation cephalosporin.
- Treat pain and nausea per CCTTP 6.7
- Continually reassess airway for patency. Monitor for changes in hemodynamic and neurologic status.

5.6 Head Trauma

5.6.1 Indications:

- Any patient who has sustained a head injury who presents with an altered level of consciousness, or has a history of unconsciousness following injury.

5.6.2 Pearls, Pitfalls and Considerations:

- Consider early intubation because of the risk of deterioration during transport
- Maintain Cerebral Perfusion Pressure
    - Patients with multisystem trauma may initially appear hemodynamically stable only because of the catecholamine response associated with their pain
    - Use caution with initial analgesia, recognizing the increase in mortality associated with hypotension in TBI
    - The goal of BP management in the setting of head trauma is to manage as follows
        - Age 13 – 49 SBP > 110 mmHg
        - Age 50 – 69 SBP > 100 mmHg
        - Age ≥ 70 SBP > 110 mmHg
        - CPP 60 – 70 mmHg if ICP available
        - Avoid aggressive attempts to maintain CPP > 70 with fluids and vasoactive agents may be considered because of the risk of adult respiratory failure

5.6.3 Clinical Management:

- Conduct primary assessment, assure adequate ABC's. Any life-threatening injury should be treated immediately. If there is evidence of significant external blood loss, control bleeding. Refer to CCTTP 5.5
- If patient has adequate spontaneous respirations, administer supplemental oxygen to maintain SpO2 > 95%.
- Assess for Intracranial injury including
    - Evidence of altered mental status
        - GCS of less than 9
        - Evidence of Cushing's Triad
        - Other evidence of rising intracranial pressure.
    - If these signs and symptoms are present, consider performing a neuroprotective intubation. Refer to CCTTP 2.3
- Initiate and maintain full spinal immobilization as indicated Refer to CCTTP 5.9
    - Note and document if there is spontaneous movement of all extremities
- If mechanically ventilated
    - Maintain ETCO2 35-40 mmHg, until pCO2 is measured and then trend pCO2.
- Place patient in reverse trendelenburg, elevate head of bed 15 to 20 degrees. Maintain spinal precautions if indicated.
- Establish IV and infuse 0.9% Normal saline at maintenance rate unless hypoperfusion or other injuries dictate another rate.
    - Contact OLMD if greater than 2000ml of crystalloid has been infused to maintain perfusion.

5.6.4 For patients with evidence of herniation

- Unilateral pupillary dilation
- Rapidly decreasing LOC
- Decorticate/ decerebrate posturing
    - Increase the ventilator rate sufficient to decrease ETCO2 to at least 35 mmHg, correlating to a pCO2 of 35 as soon as possible
- With GCS < 8, profound coma or deterioration of consciousness and/or signs of increasing ICP.
    - **Hypertonic Saline** 3%
        - 5 mL/kg to **MAX dose of 250ml** hrough central or large peripheral line over 15 mins
        - ONLY for patients with signs of imminent herniation or progressive neurologic deterioration

OR
    - Infuse **Mannitol**
        - 0.25 to 1 gm/kg of 20% solution IV over 15 minutes
        - Use ONLY for patients with signs of imminent herniation or progressive neurologic deterioration with a MAP of 70
    - Note: Due to the logistic issues surrounding the use of Mannitol, it is the recommendation of the medical directors and the Clinical practice Committee that the **first line osmotic agent** for the treatment of increased intracranial pressure **should be hypertonic saline**.
- Treat associated problems:
    - Cervical spine precautions (CCTTP 5.9)
    - Treat seizures per protocol (CCTTP 4.12)
    - Dress open wounds as necessary per standard BLS management. If the wound requires stapling, refer to CCTTP 7.6. If bleeding continues, refer to CCTTP 7.15 for the use of Hemostatic gauze.
    - Sedate as necessary. Aggressively treat perceived pain. CCTTP 6.7
    - CCTTP 2.4 Post intubation: Sedation, pain control, and paralysis.
    - Intermediate-duration neuromuscular agents may be used after sedation for intubated patients that are resisting the ventilator or agitated and have signs of increasing ICP.
- Document neurological status.
- Obtain I-Stat INR value and arterial blood gas (ABG). Record and report to receiving staff.
- Consider Foley and orogastric tube in intubated patients.
- Consider placement of arterial line. Treat with crystalloids or colloids in the presence of shock state.
    - Maintain Systolic BP greater than 110 mmHg for optimal cerebral perfusion.
    - The arterial line should NOT cause any delay in transport to a definitive tertiary center.
    - Cerebral perfusion pressure is the mean arterial blood pressure minus the intracranial pressure (CPP = MAP-ICP).
    - Continually reassess for changes in hemodynamics and neurologic status.
- **If patient has an indwelling ICP monitor CPP 60-70 mmHg should be maintained.**

5.7 Near Drowning

5.7.1 Indications:

- Any patient involved in a near drowning incident.

5.7.2 Clinical Management:

- Conduct primary assessment for compromised airway, breathing and circulation. Simultaneously, maintain spinal precautions.
- If the patient has evidence of a compromised airway or is unable to protect the airway, proceed to CCTTP 2.3
- If the patient has spontaneous respirations, administer supplemental oxygen to maintain oxygen saturations of greater than 93%.
- If there is evidence of significant bronchospasm, proceed to CCTTP 2.5 Acute Bronchospasm
- Begin or maintain cardiopulmonary resuscitation immediately as indicated.
    - Proceed per CCTTP 3.4
- Establish two large bore IV's, with NS as TKO.
- Conduct FSBG.
    - If glucose is less than 80mg/dl, administer 25g IV of **Dextrose 50%** IV or 1mg of **Glucagon** IM.
- Check rectal temperature.
    - Treat per CCTTP 6.5 if rectal body temperature is compromised
    - Maintain warm environment and protect patient from further heat loss.
- If the patient becomes hypotensive, refer to CCTTP 4.13
- Consider NG tube.
- If pulmonary edema is present and it is felt to be secondary to near drowning:
    - Consider intubation. Refer to CCTTP 2.3
    - Oxygenation can be improved with the use of PEEP
- If O2 saturation cannot be maintained or improved, consider oxygenation strategies similar to CCTTP 2.6 Cardiogenic Pulmonary Edema.
- Consider Foley catheter at referring institution to monitor urine output.
- If the patient remains hypoxic, despite interventions, consider initiating a discussion for transfer arrangements to a facility capable of ECMO

5.8 Ocular Emergencies

5.8.1 Indications:

- Patient with injuries to the globe of the eye, including corneal damage, hemorrhage into the globe, penetrating injuries and rupture of the globe.

5.8.2 Clinical Management:

- Exam will include:
  - Assess anatomy:
  - Pupil size, shape, equality, hyphema or other traumatic injury.
  - Proptosis.
  - Bleeding or fluid emanating from the eye.
  - Extra-ocular movement.
  - Laceration of surrounding structures.
  - Checking visual acuity by finger counting.
  - Identify actual or potential injuries to eye and surrounding structures including
- Foreign body
  - Imbedded object
    - Surrounding facial trauma
    - Reassure and calm patient
    - Remove contact lenses as soon as possible.
    - If hyphema (blood in the anterior chamber of the eye, in front of the iris) exists and there are no contraIndications, transport with head of bed elevated to at least 45 degrees.
  - Penetrating injuries:
    - DO NOT put any pressure on the eye.
    - Immobilize any penetrating object(s) and secure with a bulky dressing.
    - Non-pressure shield both eyes to prevent movement of injured eye.
  - Non-penetrating injuries:
    - Blunt Trauma
    - Apply Rigid shield to affected eye (no patch).
    - Patch both eyes, if severe.
    - If there is significant proptosis with compromised visual acuity,
    - **Consult sending physician for emergent lateral canthotomy.**
  - Foreign Substance
    - Remove loose particulate matter with a cotton swab moistened with saline.
    - If chemical is involved, identify chemical for appropriate treatment
    - Irrigate with 1000ml NS per eye for at least 15-30 minutes.
    - If chemical is a base (caustic) and eye damage is evident, continue irrigation with NS until arrival at receiving facility
- If pain cannot be controlled adequately and there is no evidence of globe rupture
  - Consider **Tetracaine** 0.5 % solution 1 - 2 gtts for pain, or irrigation.
  - May repeat three times q 5 min.
- Treat pain per CCTTP 6.7

5.9 Spinal Injuries

5.9.1 Indications:

- Any patient with suspected or known spine injury.

5.9.2 Pearls, Pitfalls and Considerations:

- Removal of spinal immobilization for patient with "negative" spine injury, per protocol, may require specific communication and interactive skills for non-English speaking or pediatric patients.
- Cervical spinal cord injury patients have compromised respiratory function and may deteriorate enroute.
    - Consider pre-transport intubation.
- If a cervical collar has been applied, transport with collar in place.
- If a cervical collar is not in place, then patient must have met the MEMS Spine Injury Protocol requirements.
    - (Maine EMS Protocols as outlined, or been able to provide a reliable exam and had their "positive spine injury" ruled out with a full series of C-spine films/CT's, including flexion and extension films if they have spine pain/tenderness.
    - If uncertainty exists regarding C-spine status, apply/reapply collar for transport.)

5.9.3 Clinical Management:

- Complete primary assessment to evaluation for critical injuries affecting airway, breathing and circulation.
    - Simultaneously, protect spine (cervical, thoracic and lumbar regions) with appropriate immobilization if required based upon clinical presentation and mechanism of injury.
- Initiate oxygen therapy to maintain oxygen saturations greater than 93%.
- Note and document any gross neurologic deficits prior to immobilization.
- Document levels of sensory and motor function.
- Assess for soft tissue injury, swelling, bony crepitus, pain, deformity, muscle spasm.
- Assess movement, sensation, and strength of extremities
- Immobilize patient on backboard with straps and immobilize neck with cervical collar if indicated per Maine EMS State Spinal Immobilization protocol.
- Establish IV, NS at maintenance rate or as dictated by perfusion or associated injuries.
- Consider NG tube.
- Consider Foley catheter at referring institution if spinal cord injury is evident or there is known spinal column injury.
- If patient develops neurogenic shock, follow CCTTP 4.13
- Be alert for occult trauma to head, chest, abdomen, including pelvis.
    - Refer to CCTTP 5.10 for traumatic arrest

5.9.4 Interfacility Transfers:

- Refer to Maine EMS Protocols Green 6, 7, 8

PEARLS for Spine Management

Role of Backboards - While the MDPB is attempting to limit the use of backboards, pre-hospital and hospital providers should recognize there remain circumstances in which use of a backboard is appropriate. Backboards should be utilized to extricate patients from vehicles or other situations when they are unable to extricate themselves (critical patients, patients with lower extremity injuries, severe head injuries, etc.). In most instances, once on the EMS litter, the backboard is redundant and can be removed. However, in some settings, it may be appropriate for the backboard to remain. Those settings include, but are not limited to the following:

1) Cases in which the backboard is being utilized as an element of the splinting strategy (such as multiple long bone fractures)
2) Cases in which the patient is at risk for vomiting but unable to protect their own airway (such as intoxication, head injury, etc.) and may need to be turned to the side for airway protection during transport.
3) Cases in which the patient is unresponsive or agitated (i.e.: head injury)
4) Cases in which removal of the backboard would otherwise delay transport to definitive care in a critical patient.

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

- The use of a spine backboard can still be used as a transportation device at the discretion of the flight team.
- Treat pain and anxiety per CCTTP 6.7 and 6.8

5.10 Acute Resuscitation of the Unstable Adult Trauma Patient

5.10.1 Indications:

- To identify and prioritize goals of resuscitation of the unstable / peri-arrest trauma patient.
- Pearls and Pitfalls and Considerations:
- In many of the individual protocols in the trauma Section, attention has focused on individual areas of injury.
    - It is important to note that there is a small population who present with significant hemodynamic instability and high potential for high morbidity and mortality.
- As advanced providers, it is important to have a defined systematic approach to identify and prioritize areas of compromise in order to guide the resuscitation rather than specific diagnoses.
- These patients who are physically unstable are rapidly progressing to an arrest state if not treated appropriately.
- It is up to the providers to initiate rapid interventions to arrest this progression.
- This Protocol will attempt to outline key components of the resuscitation required to stop further decline.

5.10.2 Clinical Management:

- Note: Like many resuscitation techniques, LifeFlight continues to emphasize resuscitation strategies based upon well-defined guidelines of traditional techniques with incorporation of newer evidence based ideas and technology. This protocol will outline these below.
- Initiate primary assessment and identify critical injuries to the respiratory system.
    - Maintain oxygenation with supplemental oxygen to maintain saturations greater than 93%.
    - If airway compromise is identified, refer to CCTTP 2.3.
    - Consideration of the co-morbidities and concurrent injuries of the patient must be maintained.
    - Patients with potential intracranial pathology, suspected concurrent spinal trauma, and those with a contraindication to succinylcholine and other RSI medications must be identified and treated.
    - Prior to placement of a definitive airway, staff must consider those patients who may have distorted anatomy or will have a potentially difficult airway when placement is attempted.
        - Back up airway devices and needle/ surgical cricothyrotomy techniques may be required CCTTP 7.16 and 7.17
- Confirmation of definitive airway placement can occur with physical exam, capnograpy, imaging (chest x-ray) and thoracic ultrasonography (i.e. E-FAST).
- In the primary assessment, providers must observe for
    - External injuries such as open wounds, leaking air and chest wall deformity.
    - Additional, physical signs must be identified including:
    - crepitus, deformity and asymmetric respiratory motion.
    - Breath sounds must be auscultated in both the apical and lateral chest areas.
    - Lastly, the sonographic E-FAST can be useful as an imaging tool in the out-of hospital environment for identifying occult intrathoracic pathology.
        - If injuries are detected including
        - Tension pneumothoraces
        - Massive hemothoraces,
        - Cardiac tamponade
        - Flail chest
        - Each of these diagnoses must be addressed immediately CCTTP 5.3
- If a patient presents in cardiac arrest after blunt or intrathoracic penetrating trauma, consideration to needle and/ or finger thoracostomies should be considered if there is suspected evidence if injury. CCTTP 7.12, 7.13, and 7.14
- In addition to the noted respiratory compromise, intrathoracic trauma can lead to circulatory failure due to both hypovolemia and distributory shock due to impeded blood flow secondary to a tension pneumothorax,

- When patients have circulatory compromise, treatment should be initiated even if a specific source is not readily identified. Basic physical exam in conjunction with basic diagnostics if available should be used including (chest and pelvis radiographs and E-FAST ultrasound).
- If a patient has presented with circulatory collapse with noted cardiac arrest after blunt or penetrating chest trauma, staff should consider the use of ultrasound for the identification of cardiac tamponade.
    - If identified on ultrasound, staff may consider recommending an ultrasound guided pericardiocentesis to qualified individuals.
- In those patients who have been identified to have failure of tissue and cell oxygenation, resuscitation strategies remain controversial and no specific guideline exists.
    - Resuscitation efforts should focus on physiologic markers (urine output, mentation, etc) rather than specific vital signs.
    - Standard techniques focus on a MAXIMUM 1 to 2 liter infusion of IV Fluids with rapid progression to colloid blood products soon after to improve oxygen delivery to the appropriate tissues.
- Large bore intravenous lines or Central lines continue to be the mainstay for medication therapy or fluid infusion.
    - If central or peripheral access cannot be obtained, staff should consider the use of intraosseus access with the EZ I-O.
        - The humeral head is the preferred area of access.
- Bleeding control, both internal and external, must be part of the treatment of the initial assessment with the use of alignment of long bone fractures, the use of hemostatic gauze (CCTTP 7.15), stapler (CCTTP 7.6), and pelvic binder (CCTTP 7.7) in patients with open book pelvic trauma. The combination of these techniques with aggressive resuscitation measures may keep patients from progressing with further injury due to hypovolemia.
- With those patients with concurrent multisystem trauma with concurrent head injury, special care must be instated to minimize episodes of hypotension to avoid secondary injury.
    - Those patients with severe brain injuries, a single episode of hypotension doubles overall mortality of these patients.
    - Continued resuscitation efforts are the mainstay of treatment and maintaining a systolic blood pressure greater than 100-110 will concurrently maintain a cerebral perfusion pressure of 60-70 or more.

5.10.3 Note:

- It is essential to note that resuscitation techniques must focus on identifying if possible the injuries that are not only affecting the patient currently as well as additional potential injuries that may have a delayed effect.
    - Treatment must focus on arresting further bleeding and decompensation.
    - Out of Hospital Management of the Unstable Trauma Patient utilizes a variety of resuscitation techniques, but standard medical protocols (i.e. Advanced Cardiac Life Support) should only be utilized in identified patients rather than the standard of care.
    - The use of vasopressor therapy in trauma resuscitation should be reserved only for alpha agonists in the setting of neurogenic shock, otherwise, its use is very limited

6. MISCELLANEOUS

6.1 Alcohol Emergencies

6.1.1 Indications:

- Any patient experiencing some or all of the following symptoms resulting from cessation of habitual alcohol intake:
  - Malaise, tremulousness, sweating, agitation, elevated blood pressure, hallucinations, tachycardia, hyperthermia, cardiovascular collapse, and seizures.
  - Providers are reminded that both Delirium Tremens (DT's) which can cause altered mental status and withdrawal seizures can occur six to 24 hours after the last alcoholic drink.

6.1.2 Pearls, Pitfalls and Considerations:

- Trauma, communicable disease and alcoholism are frequently companions. Other significant co-morbidities may exist.
- If possible, determine when the patient last consumed alcohol and the quantity. Identify if the patient has had significant sequelae from alcohol use or withdrawal including seizures and delirium tremens in the past.
- If the patient has a seizure, refer to CCTTP 4.12, for detailed management. Any significant simple or complex partial seizure is NOT alcohol related. The patient requires further investigation of the etiology of the seizure (i.e. head CT).
- Determine if there are significant co-ingestants or other types of toxic alcohols consumed (i.e. Ethyl alcohol, ethylene glycol, methanol and others)
- If an alcohol level has been drawn, most patients will metabolize the alcohol based upon zero order kinetics at 25mg/dl/hr.

6.1.3 Clinical Management:

- Establish and maintain an adequate airway and ventilation. Assess for trauma concurrently.
- Monitor EKG, end-tidal CO2 and O2 saturations.
- If the patient has altered mentation, complete Fingerstick blood glucose.
  - If blood glucose level <80 mg/dl, administer 25g of **Dextrose 50%** or consider the use of **Glucagon** 1mg IM.
- Initiate IV access and provide 0.9% NS to achieve adequate hydration, unless patient has a history of congestive heart failure, renal failure, or is in pulmonary edema bolus with 500 ml NS and maintain at 200 ml/hr.
- Maintain NPO status during patient care.
- If the patient has a long history of alcohol use, consider the use of **Thiamine** 100mg IV or IM prior to providing dextrose if possible. Do not withhold dextrose if unavailable.
- Administration of **Lorazepam** for tremulousness with or without behavioral agitation and seizures.
  - Use caution in patients who are heavily intoxicated or have current head injuries.
  - **Lorazepam** 0.15 mg/kg to MAX of 2mg IV/IM as indicated. In cases of status epilepticus: May repeat at 15 minutes if the patient has persistent seizure activity:
- Most patients who experience alcohol withdrawal seizures, will not seize after the administration of appropriate doses of benzodiazepines. For seizures refer to CCTTP 4.12.
- If the patient becomes lethargic after benzodiazepine administration, consider airway protection – CCTTP 2.3.
- Restrain if needed to provide a safe transport for the patient and team.
  - If the patient is considered unsafe, consider transport by ground or, if appropriate, airway protection including rapid sequence intubation
- Toxic Alcohols
  - There are a number of toxic alcohols that require consideration in the intoxicated patient including:
  - Isopropyl Alcohol

    - Methanol
    - Ethylene Glycol
- In the setting of ethylene glycol and methanol ingestions, rapid transport is required to a center that can provide emergent dialysis
    - Consider **Fomepizole**, refer to referring or receiving physician for dosing
    - During transport contact the receiving physician or medical director for potential administration of **Sodium Bicarbonate** bolus or maintenance drip.
- Note: If there is a concern about a possible ingestion overdose, consider contacting the **Poison Control Center at 1-800-222-1222**

6.2 Behavioral Emergencies

6.2.1 Indications:

- Any patient who demonstrates restlessness, agitation, confusion or potentially violent behavior regardless of underlying diagnosis.
- The LOM CCT Provider will assess the patient and take appropriate measures to sedate and restrain the patient prior to and during transport to ensure a safe and secure environment.

6.2.2 Pearls, Pitfalls and Considerations:

- Remember that agitation may signal a physiologic deterioration of the patient and accompany hypoxia, hypoglycemia, cerebral edema, etc.
- If behavior compatible with safe flight cannot be achieved or predictably maintained, other transport modes MUST be considered.

6.2.3 Clinical Management:

- Assess mental, emotional, and physical status thoroughly prior to departure.
- Anticipate changes in attitude and behavior of patient.
- Maintain calm demeanor and environment; give explanations to patient as appropriate.
- Establish intravenous access. If there is potential for agitation. Make additional attempt to secure IV access (i.e. Cling, bandages, etc).
- Attend to concurrent medical or trauma needs as per protocol.
    - * (Remember - changes in behavior may have a physiologic or pharmacologic explanation).
- Medicate confused/combative patients as needed. See CCTTP 6.8
- Insure that patient is not carrying weapons or other items which may be used as such (e.g. ballpoint pens).
- If patient continues to demonstrate aggression or combativeness and is deemed a risk to flight safety and air transport is imperative, they should be sedated, paralyzed, and intubated refer to CCTTP 2.3

6.3 Frostbite

6.3.1 Indications:

- Any patient presenting with damage to the skin and underlying tissues as the result of exposure to low environmental temperatures.

6.3.2 Clinical Management:

- Remove the patient from further exposure to the cold. Remove cold and wet clothing if applicable.
- Handle the frostbitten part gently.
  - Protect it from further injury.
  - Avoid pressure or friction.
  - Do not break blisters.
  - Do not allow the patient to stand or walk on a frostbitten foot.
- Do not attempt to thaw frostbitten parts enroute.
  - Cover the injured part loosely with a dry, sterile sheet/dressing.
- Evaluate the patient's general condition for the signs or symptoms of hypothermia (CCTTP 6.5).
  - Must include rectal temperature with thermometer with suitable range.
- Keep the patient NPO, and establish IV.
- Treat pain per CCTTP 6.7
- **Note: Patients with severe frostbite to the trunk or extremities should be transferred to a burn center for treatment**

6.4 Hyperthermia/ Heat Stroke

6.4.1 Indications:

- Any patient with exposure to environmental heat or drugs that increase body temperature above normal with the resulting loss of body fluids and electrolytes.
- Heat Exhaustion can progress to Heat Stroke if not treated.
- Heat Stroke patients may perspire or they may present hot, dry, and with flushed skin.
- The differentiation between heat stroke and mild heat exhaustion is mental status changes in the former.

6.4.2 Clinical Management:

- Assess and manage airway, breathing, and circulation.
- Protect the patient from heat challenge, if core temp is above 105° F cool the patient by radical cooling.
- Place ice packs in axilla and groin and moisten exposed skin to facilitate evaporative cooling.
- Provide Oxygen appropriate for patient's condition.
- Discontinue Radical cooling if;
    - Shivering begins
    - CNS function returns to normal
- If there is concern for fluid depletion, dehydration, or hypovolemic shock, consider IV crystalloids to MAX of 30 mL/kg unless contraindicated
- Complete fingerstick blood glucose measurement.
    - If patient's glucose is less than 80mg/dl, administer **Dextrose 50%** 25g or **Glucagon** 1mg IM.
- Initiate hemodynamic monitoring including blood pressure, heart and respiratory rate, end tidal CO2 and O2 saturations.
- Consider Foley and NG tube if appropriate.
- Do not forget to inquire as to medication usage by the patient, if medications are used (e.g. phenothiazines)

6.5 Hypothermia

6.5.1 Indications:

- Any patient with low core body temperature (usually less than 35 degrees C or 95 degrees F) rectally, with or without accompanying signs and symptoms.

6.5.2 Clinical Management:

- Prevent further heat loss:
  - Insulate from cold
  - Protect from wind
  - Remove wet clothing
  - Cover with vapor barrier and blankets
  - Move to warm environment.
- Minimize extraneous stimuli and movement of patient. Do not rub or manipulate extremities.
- Establish and maintain airway and ventilation.
  - Assess breathing and circulation
  - Provide supplemental oxygen, preferably heated and humidified.
  - Initiate airway protection as indicated (CCTTP 2.3)
- Initiate hemodynamic monitoring (ECG, BP, end tidal CO2 and oxygen saturation).
- Initiate and maintain two IV's, with NS warmed if possible.
- Consider foley catheter.

6.5.3 Treatment:

- Mild to moderate hypothermia (32 to 35 degrees C):
  - Patient is cold but is not experiencing any severe adverse physiologic symptoms.
  - Encourage warm oral fluids if patient has clear level of consciousness.
  - IV therapy same as normothermic patient.
  - Continue to aggressively rewarm patient with blankets and other external heat sources. Be sure not to leave external heat sources unmonitored. Monitor for thermal burns aggressively.
- Severe hypothermia:
  - Life Sign Present: (pulse and respirations present, temperature less than or equal to 30C/86F depressed vital signs, altered level of consciousness, no shivering.)
    - Consider transport to center with bypass capability
  - Administer IV's 20ml/kg NS as bolus followed by 5ml/kg/hr continuous infusion.
  - Complete fingerstick blood glucose. If less than 80mg/dl, give 25g IV of **Dextrose 50%** or 1mg **Glucagon** IM in patients with no IV access.
  - Consider **Naloxone** 0.4 to 2.0 mg IV/IM in the patient with decreased level of consciousness.
  - Once patient's temperature is approximately 86 degrees F (31 C) all ACLS procedures and drugs should be utilized in the usual manner.
- Cardiac Arrest
  - Ascertain presence or absence of pulse or respirations for one minute.
  - If absent, start CPR.
  - CPR should not be initiated if core temperature is less than 60 degrees F. (15.5C) or if patient's chest wall is frozen making compression impossible.
  - Chest compression's should never be done if any clinical signs of life are present, even if a pulse is not palpable, and should be done only if functional cardiac activity is definitely absent (v-fib/asystole on monitor, or patient loses pulse)
  - Support ventilations with heated, humidified air or oxygen
  - Intubate per normothermic patients
  - See cardiac protocols for particular dysrhythmia, however defibrillation and anti-dysrhythmic medications should be withheld unless core temp is 86°F or greater.
  - If the patient is in ventricular fibrillation or ventricular tachycardia, repeat defibrillation as the core temperature rises.

- Termination of resuscitation efforts cannot be done until patient has a core temperature of 35° C (95° F) or greater.
- Contact on line medical control or medical director for mitigating circumstances.

6.6 Overdose of Medications / Other Substances

6.6.1 Indications:

- Any patient diagnosed or suspected of having an overdose of medications, drugs, or products. Ensure patient is not contaminated.

6.6.2 Pearls, Pitfalls and Considerations:

- Management principles include reducing exposure and absorption, enhancing elimination and treatment of signs and symptoms.
- Attempt to identify a syndrome for which a selected physiologic antagonist may be administered. It is beyond the capacity of these protocols to identify the treatment for each and every poisoning which may be encountered.
- Please contact online medical control for specific treatment instructions.
- Encourage sending or receiving institution to procure current treatment recommendations from Maine **Poison Control Center at 1-800-222-1222.**
- LifeFlight staff can also call the poison center with any concerns as well at any point of patient care.

6.6.3 Clinical Management:

- Ensure safety of providers prior to evaluation. All patients should be decontaminated prior to evaluation and treatment.
- Assess and manage airway, breathing and circulation.
- Restrain as needed
- Monitor hemodynamics including ECG, pulse, blood pressure, end tidal capnography and oxygen saturations.
- Obtain information on what was ingested and how long it has been since substance was initially ingested (if possible and safe, bring bottle or substance ingested).
- For all ingestions
    - Note pupil size, Reflexes, specific signs and symptoms with which the patient is presenting.
    - Obtain 12 lead EKG.
        - Note QTc interval
        - QRS interval
        - Other cardiac electrical abnormalities.
- If Tricyclic Antidepressant (TCA) is suspected with a widened QRS, contact receiving clinician for option of **Sodium Bicarbonate**
- Obtain Intravenous access. Fluids can be kept at a KVO rate unless there is associated hypotension. If patient noted to have persistent MAP's less than 65, refer to CCTTP 4.13.
- Perform a bedside glucose check and if glucose is < 80 mg/dL, administer 25 gm **Dextrose 50%** IV or unable to establish IV access, **Glucagon** 1mg IM.
- If the patient experiences seizures, refer to CCTTP 4.12. Seizure Management.
- If unknown or suspected narcotic overdose, consider **Naloxone** in 0.4mg increments up to 2 mg IVP.
- For all other known ingestions contact OLMD or Poison Control 1-800-222-1222 for guidance. Specific antidotes can be given under direct supervision or discussion with poison control and the sending/ receiving providers.
- Consider sedation of agitated or anxious patient. Refer to CCTTP 6.8

6.7 ANALGESIA in the patient without an advanced airway

6.7.1 Indications:

- Any patient with pain due to injury or illness.
- Pain is a subjective symptom in which the patient exhibits a feeling of distress and discomfort caused by stimulation of certain nerve endings related to their illness/injury.

6.7.2 Clinical Management:

- Manage pain aggressively
  - Titration over brief time periods is preferable to hourly, interval dosing as a means of achieving patient comfort
- Remain alert to complications and side effects
- Maintain adequate airway, breathing and circulation.
- Administer O2 as indicated to maintain oxygen saturations greater than 93%
- Monitor hemodynamics including pulse, blood pressure, respiratory rate, end tidal CO2 and oxygen saturation.
- Assess and document a patient's level of pain
  - Upon patient contact
  - At least every 10 minutes to coincide with the assessment and documentation of patient vital signs
  - After any intervention that is performed to relieve pain. Pain shall be documented in the patient chart where the numerical pain value is to be charted.
  - Assess patient for reports of pain using an objective scale
    - Numerical such as 1 to 10
    - Wong-Baker FACES scale as developmentally appropriate
    - In cases where a patient is unable to verbalize their pain, a pain assessment tool such as the Adult nonverbal pain scale should be used.

6.7.3 For pain unrelieved by other interventions

- **Fentanyl Bolus:**
  - Adult: 0.5 to 2 mcg/kg for MAX 150mcg IV PRN. Titrate to pain control, wakefulness, and airway protection
- **Fentanyl Infusion**:
  - 25 to 250 mcg/hr. Consider for longer interfacility transport of intubated patients.
- **Morphine Sulfate Bolus:**
  - Adult: 0.05 mg/kg to 0.1mg/kg IV to MAX 8mg prn pain. Titrate to pain control, wakefulness, and airway protection.
- **Morphine Sulfate Infusion:**
  - 0.5mg- 10 mg/hr. Titrate to effect.
- Have **Naloxone** 0.4 to 2.0 mg IV available to treat respiratory depression (RR <10/minute) or signs of narcotic overdose.
- If patient has been successfully medicated at referring hospital, continue medication enroute.
- Nausea
  - **Zofran** 4mg IV push. For persistent nausea/vomiting may repeat q 20-30 minutes prn up to 8 mg IV.
- Alternative therapy: **Ketamine Infusion**.
  - Contact LOM Medical Direction early for treatment options and subsequent analgesic dosing of Ketamine
  - Use with caution in patients with coronary artery disease, hypertension, tachycardia, psychosis, and elevated ICP.
  - Side Effects are not common with low dose ketamine infusions.
  - Adverse effects that have been reported, typically at higher doses include: hypertension, tachycardia, tremors, tonic-clonic movements, fasciculations, increased intracranial pressure,

hypersalivation, vomiting, increased skeletal tone, diplopia, nystagmus, increased intraocular pressure, increased airway resistance, and depression of cough reflex.

- Reassure patients (especially non-communicative patients) that they may experience a dream like feeling.
- Infuse through dedicated IV line (when possible) or via the most proximal port of a carrier solution.
- **Ondansetron** 0.1mg/kg, if NOT given within previous 30 minutes
  - MAX dose 4mg
- **Ketamine**
  - Mix desired dose in 10mL syringe and administer over 1 – 2 minutes
  - Rapid administration can cause nausea and apnea
  - Advise patient to mentally model a pleasant thought
  - BOLUS 0.2 mg/kg IV
  - MAX dose 25mg
- May also initiate **Ketamine Infusion** after bolus dose
  - INFUSION 0.05 – 0.2 mg/kg/hr
  - MAX dose 20 mg/hr
- Although dissociative doses are usually in excess of 0.5 mg/kg
  - If patient does not require airway management, but becomes agitated during emergence from effects, consider
  - **Versed** 0.01 mg/kg
  - MAX dose 1mg

6.8 Sedation For The Patient Without an Advanced Airway

6.8.1 Indications:

- Any non-intubated patient with anxiety or otherwise in need of sedation

6.8.2 Clinical Management:

- Manage sedation needs aggressively
- Titration over brief periods is preferable to hourly interval dosing as a means of reducing anxiety
- Remain alert to complications and side effects.
- Evaluate for any underlying medical cause that can be causing the anxiety, i.e. hypoxia, hypoglycemia, toxic ingestion, closed head injury, etc
- Identify changes in vital signs that may indicate that the patient is experiencing anxiety or agitation before significant sequelae occur.
- Monitor airway, breathing and circulation
- Administer O2 as indicated
- Monitor hemodynamics including EKG, pulse, blood pressure, end tidal CO2 and O2 saturation.
- Assess and treat pain (See CCTTP 6.7)

6.8.3 For anxiety or agitation unrelieved by other interventions, administer the following medications.

- For agitation causing acute deterioration or safety hazard administer:
    - **Midazolam**: 0.1 mg/kg to MAX 2mg IV every 5 minutes as needed.
    - **Lorazepam**: 0.15 mg/kg to MAX 2mg IV every 15 minutes as needed.
- For anxiety unrelieved by benzodiazepines, hemodynamic instability, or concerns for depressing respiratory drive with benzodiazepines
    - Contact medical control early for treatment options and subsequent sedative dosing of **Ketamine**
    - **Ketamine IM** 0.5 mg/kg to MAX 50mg
    - **Ketamine IV** 0.2 mg/kg to MAX 25mg
        - If possible, administer over 1-2 minutes, but it is noted this dose may be administered rapidly, potentially causing apnea and vomiting, be prepared to support and/or manage the airway
        - Although dissociative doses are usually in excess of 0.5 mg/kg, If patient does not require airway management, but becomes agitated during emergence from effects, consider
        - **Versed** 0.01 mg/kg to MAX 1mg
- If patient has been successfully sedated at referring hospital, continue medication enroute.

6.8.4 If patient is deemed a risk to flight safety and air transport is imperative, they should be sedated, paralyzed, and intubated. Refer to CCTTP 2.3

6.9 Patients with Suspected Cyanide Toxicity

6.9.1 Indications:

- To be given in patients with suspected cyanide exposure who exhibit neurologic, respiratory or cardiovascular compromise.
- This includes cardiac arrest. Administration should be immediately upon recognizing the need and should not await a confirmatory test

6.9.2 Clinical Management:

- Assess and manage airway, breathing and circulation.
- If patient has adequate spontaneous respirations, administer supplemental oxygen to maintain SpO2 > 95%. If necessary, secure an advanced airway via endotracheal intubation and ventilate with BVM or transport ventilator. Refer to CCTTP 2.3.
- Establish IV access of NS/LR @ a KVO rate. If patient displays signs of inadequate perfusion refer to CCTTP 4.13
- Use iSTAT to obtain Lactate and Bicarbonate level
- With a noted HPI, VS, record of interventions, and lab values, **CONTACT New England Poison Center at 1-800-222-1222**

6.9.3 If unconscious and in persistent shock despite adequate fluid resuscitation

- Simultaneously perform the following
    - Obtain Lactate and Bicarbonate level
    - With a noted HPI, VS, record of interventions, and lab values, **CONTACT New England Poison Center at 1-800-222-1222**
    - Mix Hydroxycobalamin in preparation for administration
- NOTE: EVEN in emergent situations, discuss case with Toxicologist on call prior to administration.
    - **Hydroxocobalamin**:
    - Adult: 5g mixed in total of 200ml normal saline infused over 15 minutes. If a favorable response is seen and a second dose becomes necessary, a second 5g dose may be considered.
    - Pediatric: 70mg/kg IV (max single dose 5g), may repeat once if needed.
- Given the potential for coexisting carbon monoxide toxicity in the smoke inhalation patient, consideration should be made for this diagnosis as well. Appropriate treatement and transport destination for possible need of hyperbaric oxygen can also be discussed with the Poison Center.
- Treat seizures per CCTTP 4.12

7. PROCEDURES

7.1 Packed Red Blood Cells and Liquid Plasma

7.1.1 Indications for PRBCs:

- Adult patients eligible for blood administration
  - History of obvious or suspected acute blood loss, who have had crystalloid fluid resuscitation with 2 liters of NS, and who demonstrate:
    - SBP less than 90mmHg
    - and/or
    - clinical signs of shock (alt. mental status, tachycardia, pallor, delayed capillary refill etc.)
- Pediatric patients eligible for blood administration
  - History of obvious or suspected acute blood loss, who have had crystalloid fluid resuscitation with 40 mL/kg of NS, and who demonstrate:
    - persistent signs of clinical shock
    - Altered mental status
    - Tachycardia
    - Pallor
    - Delayed capillary refill
  - Pediatric patients should receive blood transfusions of 10ml/kg, incrementally, as needed;
  - Maximum of 40 ml/kg should be transfused in this situation.

7.1.2 Indications for Liquid Plasma

- ≥ 16 years of age
- ≥ 50 kg in weight
  - TRAUMA with evidence of, or concern for, severe internal or external hemorrhage
    - AND presence of any one of the following
      - SBP ≤ 90
      - HR > 110
      - RR > 24
      - Cool, pale skin and capillary refill > 2 seconds
      - INR > 1.7
      - Base Excess < -6
      - Hemoglobin < 11 g/dL
      - Platelets < 200,000

Note: If a LifeFlight team is caring for a patient who has continued to demonstrate hemodynamic instability from a traumatic injury with significant hemorrhage, infusion of liquid plasma in a 1:1 ratio with PRBC's and co-administration of tranexamic acid (TXA) should be considered, if not contraindicated. In the setting of trauma, PRBC's should be administered first for oxygen carrying capacity. If the patient has already received PRBC's and the ratio is not 1:1, then first product should be Liquid Plasma

- Acute (Non-Traumatic) Medical Hemorrhage
  - Massive gastrointestinal hemorrhage
  - Great vessel disruption
  - Postpartum hemorrhage
  - Life threatening bleeding from any source with an elevated INR > 1.7
  - Anticipated emergent or urgent invasive/surgical procedures with concurrent life-threatening hemorrhage
  - Acute disseminated intravascular coagulation (DIC) with concurrent life-threatening hemorrhage
- Intracerebral Hemorrhage with INR > 1.7 (Traumatic AND/OR Non-Traumatic)
  - To include patients with Epidural or Subdural Hematoma, Subarachnoid or intraparenchymal hemorrhage

Note: Elevations in the INR can result from multiple causes including Coumadin therapy, congential factor deficiency, liver disease, and acute coagulopathy of trauma. Co-administration of Vitamin K or **Phytonadione** is indicated.

- Contraindications
  - Patient < 16 years of age OR < 50kg
  - Documented intolerance to plasma or its components
  - Congenital deficiency of IgA in the presence of anti-IgA bodies (This information is rarely identified prior to patient contact, thus it is imperative that providers monitor for signs of anaphylaxis with plasma transfusions)

7.1.3 Clinical Management:

- If available, one unit of Group A liquid plasma (LP), one unit of O negative blood, and one unit of O positive will be properly packed in a travel pack with ice for all LOM flights. A temperature indicator attached to the blood should be visible inside the cooler. Blood products must stay in travel pack with ice. If removed and not transfused, blood products will have to be discarded.
- Remove the blood products from the cooler and check the temperature indicator. Use only if proper temperature of 4-6 °C is maintained. Record temperature status, blood and LP unit # and the time the transfusion was initiated in the patient care record.
- **O Positive PRBC's - Female patients KNOWN to be 50 years of age and older and all male patients**
- **O Negative PRBC's - If age is uncertain or female patient less than 50**
- Consider placing blood products in a pressure bag for rapid administration.
- Initiate transfusion as per EMMC PCD 11.008 and CMMC "Administration of Blood Components".
- Return the completed transfusion documentation to the blood bank. Unused blood must be returned to the LOM blood bank refrigerator upon return to the base hospital.
- If a transfusion reaction is suspected, stop transfusion immediately and present suspect blood unit and tubing to receiving facility for testing. Refer to other appropriate protocols such as: anaphylaxis, pulmonary edema, shock.
- If a suspected transfusion reaction has occurred, notify base hospital blood bank as soon as possible upon completion of transport, and complete transfusion reaction (Blue) form for EMMC and Transfusion Reaction Protocol form for CMMC.

7.2 Tranexamic Acid (TXA)

7.2.1 Indications:

- Involved in Trauma (Blunt or Penetrating). History of Present Illness is documented in chart.
- Eligibility:
    - Age Greater than 18 years and the following:
    - Signs and symptoms consistent with severe hemorrhage (Internal or external bleeding)
        - Penetrating wounds to head, neck, torso and extremities proximal to the knee or elbow.
    - Chest wall instability or deformity (i.e. Flail chest)
    - Two or more proximal long-bone fractures
    - Crushed, degloved, mangled or pulseless extremity.
    - Amputation proximal to the wrist or ankle
    - Pelvic Fractures
    - Open or Depressed Skull fracture
    - Paralysis
    - Hemodynamic Instability In the setting of hemorrhagic shock:
        - Systolic Blood pressure less than 90 mmHg.
        - Tachypnea greater than 24 breaths per minute or bradypnea less than 10 breaths per minute.
        - Evidence of peripheral vasoconstriction including cool, pale skin and Delayed capillary refill of greater than two seconds.
    - Duration since the time of initial injury is less than 180 minutes (3 hours). Preferably less than 60 minutes since initial traumatic insult.
    - LifeFlight staff can consult with medical control for those patients who may benefit from this medication including impending hemodynamic instability that staff feels will require additional colloid transfusion

7.2.2 Cautions:

- Time elapsed from initial insult greater than 180 minutes or time elapsed since injury is unknown.
- Those patients who have clear contraindication for antibrinolytic therapy agents (i.e. thrombotic disease and disseminated intravascular coagulation, etc)
- Concurrent use of TXA and rFVIIa or PCCs in contra-indicated.
- Medical Control discretion as to the appropriateness of antifibrinolytic agents in this patient.

7.2.3 Clinical Management:

- Assess and manage airway, breathing, and circulation (ABC's) with simultaneous C-spine immobilization/stabilization. Treat life-threatening injuries as they are discovered as outlined in Trauma CCTTP 5.10
- If the patient remains hemodynamically unstable and staff suspect that the patient will continue to require aggressive colloid administration in the next 24 hours, administer tranexamic acid as described.
- **Tranexamic Acid** (Infusion over 10 minutes in a dedicated IV line, if possible)
    - < 60kg: 20mg/kg IV Bolus
    - 60-75kg: 1.5 gm IV Bolus
    - 75kg: 2 gm Bolus
- During initial report to the hospital and at the time of transition of care to hospital staff, please record time of injury, and time of TXA initiation

7.3 Management of Coagulopathy

7.3.1 Indications:

- Patients on anti-coagulant therapy with prolonged coagulation times with traumatic injuries or surgical emergencies anticipated to require immediate operative intervention.

7.3.2 Clinical Managements:

- Administer vitamin K, liquid plasma, fresh frozen plasma, Prothrombin Complex Concentrate (PCC) and cyroprecipitate according to the guidelines in the appendix on the following page.

7.3.3 Pearls, Pitfalls and Considerations:

- The use of intravenous vitamin K has become more main stream.
- The possibility of anaphylaxis has lessened in recent years, but can be still a rare event
- Oral and intravenous vitamin K are the preferred routes of administration over subcutaneous vitamin K because of the erratic absorption rate of subcutaneous vitamin K.
- Subcutaneous administration is no longer indicated.
- OLMD should be consulted before administering Prothrombin Complex Concentrate (K-Centra), Fresh Frozen Plasma, or Cryoprecipitate.
- Communication between sending facility and receiving facility is valuable due to the delay in thawing some blood products and their availability at some facilities.

Indications	Recommended Action
Serious or life threatening internal or extracorporeal hemorrhage and/or high probability of emergent surgical intervention with INR greater than 1.7 or PTT greater than 45 seconds.	If the patient has serious bleeding or rapid reversal is indicated for immediate surgical intervention: Discontinue use of anticoagulants, monitor the INR until it falls within the therapeutic range, administer **Liquid Plasma** and/or consult with OLMD for the use of **Fresh Frozen Plasma** and **PCC.**
Serious or life threatening internal or extracorporeal hemorrhage and/or high probability of emergent surgical intervention with INR greater than 1.7 or PTT greater than 45 seconds in patient population undergoing Coumadin therapy.	If the patient has serious bleeding or rapid reversal is indicated for immediate surgical intervention: Discontinue use of anticoagulants and monitor the INR until it falls within the therapeutic range. Administer **Liquid Plasma** and **Vitamin K** 10mg in 50 mL NS IV administered over a period of 20 minutes, and/or consult with OLMD for the use of **Fresh Frozen Plasma**
Serious or life threatening internal or extracorporeal hemorrhage and/or high probability of emergent surgical intervention with Fibrinogen less than 150mg/dl.	If the patient has serious bleeding or rapid reversal is indicated for immediate surgical intervention: Consider **Cryoprecipitate** (Consult with OLMD)
Serious or life threatening internal or extracorporeal hemorrhage and/or high probability of emergent surgical intervention with Platelet count less than 75,000/mm3	If the patient has serious bleeding or rapid reversal is indicated for immediate surgical intervention: Consider **Platelet** transfusion (Consult with OLMD)
Patient who has received a large amount of blood products and have an Ionized Calcium level below 1.0	Administer **Calcium Gluconate** 1 gram IV over 10 minutes.

7.4 Rapid Reversal of Coagulopathy in Non-Traumatic ICH

7.4.1 Indications:

- Patients with identified active intracerebral bleeding.
- Patients who are on vitamin K antagonist therapy (warfarin, coumadin, Jantoven).
- International Normalized Ratio (INR) greater than 2.0

7.4.2 Contraindications:

- Patients with a history of thromboembolic event (Deep vein thrombosis, pulmonary embolism or ischemic stroke) within the last three months.
- Urgent reversal for surgery in the absence of active major bleeding (i.e. this therapy is not indicated for the subacute or chronic bleed).
- Patients with hypersensitivity to K Centra or any of its components (factors, heparin, and albumin).
- Patients with disseminated intravascular coagulation (DIC).
- Patients with suspected or confirmed heparin- induced thrombocytopenia.
- Patients whose care is deemed futile.
- Coagulopathy secondary to liver disease.
- Currently NOT indicated for patients on thrombin inhibitors (i.e. Dabigatran) or Factor Xa inhibitors (rivaroxaban or Apixaban).

7.4.3 Clinical Management:

- Establish patent intravenous intravascular access with large bore IV.
- Confirm via CT scan the intracerebral hemorrhage.
- Consider INR by laboratory staff at sending facility.
- Identify both inclusion and exclusion criteria.
- Initiate **Vitamin K** (phytonadione) IV 5-10mg.
- Identify receiving physician and provide extensive history and physical findings.
- Obtain order from physician for administration of **K-Centra**.
- Document date, time, and name of the ordering physician.
- Clarify with provider that his or her name will be the name on the medical record for the administration of the therapy.
- Document time of administration, route, dose, and any complications.
- In hand off report to receiving staff, relay information in detail to accepting provider in person. IT IS NOT SUFFICIENT TO GIVE REPORT TO ACCEPTING ANCILLARY PERSONNEL.
- EMAIL and notify LifeFlight of Maine Medical Directors that this therapy was completed (even when there are no complications)

7.4.4 Dosing guidelines:

Drug	INR calculated	Dose
Prothrombin Complex Concentrate (K Centra)	INR greater than 2.0 and less than 4.0	25 units per kg IV once (Max Dose 2500 units)
Prothrombin Complex Concentrate (K Centra)	INR greater than 4.1 and less than 6.0	35 units per kg IV once (Max dose 3500 units)
Prothrombin Complex Concentrate (K Centra)	INR greater than 6.1	50 units per kg IV once (Max Dose 5000 units)

7.5 EZ-IO Intraosseous Vascular Access

7.5.1 Purpose:

- To establish criteria for the initiation of intraosseous infusion on critically ill or injured adult and pediatric patients.

7.5.2 Policy:

- This procedure is to be performed using the EZ-IO AD for patients weighing 40 kg and over, and the EZ-IO PD for patients weighing 3-39 kg.

7.5.3 Indications:

- Patients who meet the following criteria:
  - In need of vascular access for volume replacement, blood, or medication administration and who have either poor vein selection or failed access attempts (> 2 attempts or > 90 sec)
  - Decreased level of consciousness (GCS < 6 with no purposeful movement) due to medical or traumatic insult or injury
  - May be used on conscious patients, consider lidocaine anesthetic.

7.5.4 Contraindications:

- Fracture of the bone selected for IO infusion (consider alternate site)
- Excessive tissue at insertion site with the absence of anatomical landmarks (consider alternate site)
- Previous significant orthopedic procedures (IO within 24 hours, prosthesis- consider alternate tibia)
- Infection at the site selected for insertion (consider alternate site)
- Not intended for prophylactic use

7.5.5 Special Notes:

- All medications and blood or blood products that are administered via the IV route may be administered IO
- Device may be left in place for up to 24 hours

7.5.6 Equipment:

- EZ-IO® Driver
- EZ-IO AD® or EZ-IO PD® Needle Set
- Alcohol or Betadine Swab
- EZ-Connect® or Standard Extension Set
- 10 ml Syringe
- Normal Saline (or suitable sterile fluid)
- Pressure Bag or Infusion Pump
- Lidocaine (preservative free)
- EZ-IO® Yellow wristband

7.5.7 Clinical Management:

- Assemble and prepare all equipment, including bag of normal saline with tubing purged.
- Maintain standard precautions.
- Determine EZ-IO AD or EZ-IO PD Indications
- Evaluate for contraIndications
- Lifeflight of Maine approved insertion sites are
- Proximal humerus (adult only)
- Proximal tibia (adult and pediatric)
- Distal Femur (pediatric)
- Prepare the insertion site using aseptic technique
- Prepare the EZ-IO driver and appropriate needle set.
- Stabilize site and insert appropriate needle set.
- Remove EZ-IO driver from the needle set while stabilizing the catheter hub.
- Remove the stylet from the catheter, place stylet in shuttle or approved sharps container.

- Confirm placement, connect primed EZ connect
- Syringe flush the EZ-IO catheter with the appropriate amount of Normal Saline
- Check for infiltration.
- Adult
    - If time allows and not contraindicated, infuse 40mg **2% Lidocaine (without Epinephrine)** over 120 seconds to minimize pain during infusions
    - Allow medication to dwell in IO space for 60 seconds, if possible
    - Flush with 5 – 10mL Normal Saline
    - Slowly administer 20mg **2% Lidocaine (without Epinephrine)** over 60 seconds
- Infant / Child
    - If time allows and not contraindicated, infuse 2% **Lidocaine (without Epinephrine)** 0.5 mg/kg, MAX dose 40mg over 120 seconds
    - Allow medication to dwell in IO space for 60 seconds, if possible
    - Flush with 2 – 5mL Normal Saline
    - Slowly administer 2% **Lidocaine (without Epinephrine)** 0.25 mg/kg, MAX 20mg over 60 seconds
- Begin infusion utilizing pressure i.e. syringe bolus, pressure bag, or pump for continuous infusions where applicable
- Dress site, secure tubing, and apply wristband as directed.
- Monitor EZ IO site and patient condition
- Document procedure attempt, needle size, location, assessments including patency and how procedure / intervention were tolerated.

7.6 Scalp Wound Stapling for hemorrhage control

7.6.1 Indications:

- To assist in the control of bleeding from scalp wounds.

7.6.2 Contraindications:

- Staples can be applied over bones and viscera, however during application there must be a distance of not less than 6.5mm from the surface of the skin to the underlying bone, vessel, or viscera.
- The skin stapler is provided sterile and is intended for one time use only. Discard after use.
- The use of the skin stapler should not delay transport.

7.6.3 Clinical Management:

- Remove any dressings and inspect the wound.
- With gloved hand hold edges of laceration together.
- Place tip of stapler onto skin and squeeze lever. One staple at a time will penetrate the skin and hold the skin closed.
- If skull or brain tissue is visible, a saline soaked dressing may be applied over the wound first prior to stapling.
- During closure of the wound, a largely protruding piece of gauze should remain visible to alert the receiving facility as to the contaminated nature of the closure.

7.7 Pelvic Binder

7.7.1 Indications:

- The pelvic binder will be used to provide stabilization, aid in pain management, and attempt to lower the mortality rate when caring for patients that have possible pelvic fractures.

7.7.2 Clinical Management:

- Assess or abrasions and contusions around the pelvic area.
- Assess for superficial hematoma above the inguinal ligament, scrotum, and thigh.
- Assess limb length discrepancy and deformity.
- Assess pelvic stability by bimanual compression of the iliac wings ("rocking the pelvis.")
- Examine the external rectal, penile and vaginal areas for bleeding.
- Slide the binder under the supine patient, if a sheet had been placed as a binder, gently remove.
- Center binder over greater trochanters.
- Cut the free end of the binder to leave 6-8" gap
- Attach Velcro straps and plate to free end of binder.
- Tighten shoelace mechanism, close fastener.

7.7.3 Considerations:

- Binder should be snug, the provider should not be able to get more than 2 fingers between binder and patient
- The binder can be left in place for 24-48 hours
- The application of the binder should not delay transport

7.8 Mechanical Ventilation

7.8.1 INDICATIONS

- Ventilation of patient with an indwelling tracheal or supraglottic airway
- Special Considerations
  - All patients with an artificial airway in place must be accompanied with an appropriate sized Bag Valve and mask and a 10cc syringe during transport
  - Lung protective ventilator strategies should be used on all patients
  - Obstructive ventilator strategies (Permissive Hypercapnea and prolonged expiratory time) should be used on all patients with concern for, or presence of, autoPEEP. These patients may also have a substantially elevated serum bicarbonate level.
  - Continuous monitoring of waveform capnography is required
    - Notification of an LOM medical director is necessary if this cannot be achieved
    - The morphology of the waveform should be documented in the PCR
  - SIMV in the transport of acutely ill patients is rarely indicated
    - If used, assure adequate pressure support to reduce increased work of breathing for patient triggered breaths

7.8.2 CONTRAINDICATIONS

- None

7.8.3 PROCEDURE

- Trigger
  - Volume Control Ventilation is generally the standard breath type unless
    - Ventilation is suboptimal due to high PIP alarms
    - Poor oxygenation exists, despite appropriate alveolar recruitment with PEEP to 20
    - Flow requirements cannot be met with current compliance and inspiratory times
    - The patient is found ventilating well in PRVC or PCV and this modality can be safely continued during transport
  - Pressure Regulated Volume Control
    - Breaths are delivered in a decelerating inspiratory flow pattern to a target pressure, calculated from the previous breath, maximizing mean airway pressures when used in concert with PEEP
    - The target pressure is adjusted as patient's pulmonary compliance changes, based on the desired volume
    - The maximum allowed target pressure will be at least 5 cmH20 less than the set High Airway Pressure Alarm setting
    - Caution should be used in spontaneously breathing patients as variability in tidal volumes can be extreme
    - Caution should be used in obstructive lung disease patients as rapidly changing compliance can preclude adequate ventilation
- Lung Protection
  - Vt (Tidal Volume) should be 8mL/kg IBW (Ideal Body Weight)
    - Ideal Body Weight (calculated based on height measured in inches)
      1. MALE: 50 + 2.3 (Height – 60)
      2. FEMALE: 45.5 + 2.3 (Height – 60)
    - Reduce Vt until pPLAT (plateau pressure) < 30
    - Tidal volumes as low as 4mL/kg can be used if necessary
      1. CAUTION
         a. Consider increasing rate to maintain Ve (minute ventilation)
         b. Closely monitor I:E (Inspiratory Expiratory Ratio) and avoid inverse ratio ventilation

- Oxygenation
  - 100% FiO2 should be utilized until pO2 is identified or obtained and is > 90
  - PEEP should be 5 cmH20 on all patients
  - While strategies exist that address hypoxia with sequential increases in PEEP and FiO2, hyperoxia and free oxygen radicals have not been shown to be of concern in the acute resuscitative phase of an injury or illness
  - PEEP should be increased to 20 cmH20 to promote alveolar recruitment, prior to reflexively moving to pressure control ventilation
  - PEEP may also be increased to reduce FiO2 requirements in the long term setting
- Ventilation
  - Ventilatory RATE
    - Used to control minute ventilation to accommodate patient needs as they relate to pCO2 and respiratory acidosis
    - $\frac{Current\ Respiratory\ rate\ x\ pCO2}{Desired\ pCO2} = New\ Respiratory\ Rate$
- Flow and I:E ratio
    - Inspiratory time (i-Time)
    - Reducing the i-Time increases flow (VCALC)
    - Reducing the i-Time will increase the Peak Inspiratory Pressure
    - Be cognizant of I:E ratio and inadvertent inverse ratio ventilation

7.9 Non-Invasive Mechanical Ventilation (NPPV)

7.9.1 Special Considerations

- NPPV with a transport ventilation is NOT identical to Bi-Level positive airway pressure ventilation.
- Alterations in the ventilator settings in an attempt to mimic BiPAP are necessary
- Care should be taken to develop a rapport between the Revel ventilator and the patient when using NPPV

7.9.2 INDICATIONS

- Adult patients with respiratory compromise of sufficient severity to warrant ventilatory support where intubation is not desired or immediately necessary
- Respiratory distress with moderate to severe dyspnea, use of accessory muscles, and abdominal paradox

7.9.3 CONTRAINDICATIONS

- Apnea
- Recent surgery to face, upper airway, or upper GI tract
- Altered level of consciousness
- Emesis
- Absent or insufficient ability to protect the airway

7.9.4 PROCEDURE

- Mask Seal
  - Minimal air leaks will cause a "blower demand" alarm, significantly altering respiratory assistance from the ventilator
- Reduce IPAP by 2-4 from sending BiPAP
- Consider changing Rise Time and Flow Termination
  - Rise Time set to Profile 2
  - Flow Termination set to 40%
- Manage anxiety and alarms
- Connect to patient

7.10 Bronchodilator Administration For Ventilated Adult Patients

7.10.1 Objective:

- To enable the Critical Care Transport Team to administer bronchodilator therapy to intubated adult patients who are actively wheezing or exhibiting other signs of airflow restriction on exam.

7.10.2 Pearls, Pitfalls, and Considerations:

- Combivent is albuterol and atrovent (ipratropium bromide) mixed together as one medication.
- Atrovent is contraindicated for patients with allergies to soy lecithin or related food products such as soybeans or peanuts.
- High dose bronchodilator therapy may be necessary to reverse the bronchospasm associated with acute asthma.
- Consider appropriate steroid therapy to accompany the inhaled bronchodilators. See CCTTP 2.5

7.10.3 Clinical Management:

- Any multidose inhaler (MDI) must be "activated" prior to use.
- Shake well and do three priming sprays before administering the medication to the patient.
- The MDI adaptor should be placed on the inspiratory limb of the circuit (not the limb with the PEEP valve) between the corrugated tubing and the wye. The blue arrow on the MDI adaptor should be pointing to the patient.
- Whether using **combivent** or **albuterol**, either MDI should be administered as close as possible to the beginning of the inspiratory cycle.
- There should be a delay of approximately 30 seconds between puffs.
- The MDI canister should be removed from the ventilator tubing and shaken between puffs.
- Be sure the MDI adaptor cap is closed WHENEVER the MDI is not in place to prevent leaks from the ventilator circuit.
- Initial bronchodilator therapy should consist of combivent up to eight puffs. If the patient has already received anticholinergic therapy (usually atrovent), administer albuterol up to eight puffs. If necessary, administer follow-up bronchodilator therapy in twenty minutes.
- Consult OLMD prior to administration of either medication if patient's heart rate is greater than 150.
- Subsequent bronchodilator therapy should consist of albuterol up to eight puffs repeated as necessary at 20 minute intervals.
- Consult OLMD prior to administration if patient's heart rate increases by more than 20 beats per minute from pre-combivent baseline.

7.11 Transvenous/Epicardial (Temporary) Pacemaker

7.11.1 Indications:

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

7.11.2 Preparation:

- Explain the procedure to the patient.
- Assemble the necessary equipment / supplies

7.11.3 Insertion & Care:

- The pacing electrode insertion is done by a physician qualified in the procedure.
- The LOM provider may assist insertion as follows:
    - Monitor the patient's heart rhythm.
    - Prepare the external pacing generator:
    - Set the mA at 6 or as suggested by the sending physician
    - Set the rate at 10 bpm below the patient's intrinsic rate
    - Set the sensitivity fully clockwise (most sensitive)
    - Connect the proximal (+) and the distal (-) leads to the extension cable.
    - Tighten the connectors securely, but do not tape the connections.
    - Turn on the external generator and observe the EKG monitor for evidence of pacing and capture.
    - Determine the sensing threshold:
    - Turn the rate 10 bpm above the patient's intrinsic rate
    - Turn the sensitivity control counter clockwise slowly until the pacemaker begins to fire;
        - This is the threshold.
        - Set sensitivity at one half the threshold value.
    - Cover the insertion site with a sterile dressing.
    - Be sure the pacing electrode position is anchored securely with tape.
    - Secure the pacing generator and place the plastic cover over the pacemaker controls.
- Obtain portable CXR for electrode placement after insertion.
    - Note: This is a different indication than obtaining an x-ray after an airway is completed. Please evaluate for PTX or pneumopericardium

7.11.4 Considerations:

- Monitor the patient's heart rhythm closely during insertion
- Ventricular irritability is common as the electrode is positioned in the right ventricle
- When the "paceport" PA catheter is inserted, a continuous infusion regulated by an infusion pump must be connected to the orange port.
- This will maintain patency of the port in the event the Chandler probe needs to be repositioned.
- The pacing lumen will accommodate infusions up to 30ml/hr.
- Document depth of insertion of pacing catheter.
- The electrical safety precautions include the following:
    - All line powered equipment must be grounded (i.e., 3 pronged plugs).
    - Non-Sterile gloves are worn when handling the exposed electrode tips.
    - The pacing electrode tips should be individually insulated when not connected to the pacing generator.
- Failure to capture is usually due to electrode displacement or a high stimulation threshold in the electrode area. The LOM provider should:
    - Check and tighten all connections.
    - Increase the pacemaker output / mA.
    - Turn the patient to a left lateral recumbent position.

    - Consider contacting receiving cardiologist if effective capture is not regained after the above interventions.
    - Monitor the patient closely; manage according to ACLS guidelines as needed.
    - Prepare to reposition the transvenous pacing electrode if needed.
    - Place the external pacer on the patient and pace if needed for symptomatic bradycardic arrhythmia.
- Failure to pace without a spike present is usually caused by a broken or loose connection, electrode fracture, inhabitation of pacemaker output, battery or circuit failure. The LOM provider should:
    - Check and tighten all connections.
    - Check for any equipment that might cause electrical interference and remove if possible.
    - Replace the battery and/or pacing generator.
    - Place the external pacer on the patient and pace if needed for symptomatic bradycardic arrhythmia.
    - Monitor the patient closely, manage according to ACLS guidelines as needed.
- Failure to "sense" occurs when the pace maker does not sense an intrinsic beat. Competitive pacing spikes or complexes are seen on the EKG. With failure to sense, the under-sensing leads to over-pacing. The LOM provider should:
    - Check and tighten all connections.
    - Check the sensitivity setting; make it as sensitive as possible. (dial set fully clockwise @ 5 o'clock).
    - Place the patient in a position where adequate sensing was last observed. A left lateral recumbent position may help.
    - Increase the pacing rate to override the intrinsic rhythm if possible.
    - Turn the pacemaker off IF it is not needed, but do not disconnect from the electrode wires. Notify the physician of this immediately.
    - Monitor the patient closely if effective sensing is not regained after the above interventions.
- Over-sensing usually occurs because the pacemaker sensitivity is set too high.
    - It should be suspected when pauses are seen intermittently on the EKG or when the paced rate falls below that set on the pacemaker generator.
    - This pacemaker induced problem may be mistaken for electrode fracture or impending generator failure.
    - Oversensing leads to under-pacing.
    - The LOM provider should:
        - Decrease the sensitivity on the pacemaker (turn the dial counter clockwise).
        - Replace the pacemaker generator if the problem continues.
        - Consider transcutaneous pacing.

7.12 Needle Thoracostomy

7.12.1 Indications:

- Tension Pneumothorax

7.12.2 Equipment:

- Turkel Needle
- 10ml Syringe
- Scalpel
- Lidocaine and 5ml syringe with needle

7.12.3 Clinical Management:

- TURKEL:
  - Identify landmarks and cleanse site with Chlorhexadine or other suitable antimicrobial.
  - Make a small stabbing puncture over the 2nd rib with scalpel, consider lidocaine local anesthetic if available.
  - Introduce the Turkel device through the 2nd intercostal space using sufficient pressure to detect movement of the color indicator within the handle.
    - The indicator will change color to pink when the blunt cannula is in the retracted position within the needle shaft and the sharp bevel of the needle is exposed.
  - Advance the device to the desired depth
    - The indicator will change to green signaling the device has entered a "free cavity" and the sharp bevel of the needle is covered.
  - Failure of the device to return to green is indicative of the device either not being in a "free cavity" or failure of the safety mechanism resulting in an exposed sharp needle bevel and the needle should be removed.
  - The fenestrated catheter may be left in place once the needle has removed if it is determined that the catheter is indeed in the plural space.
  - Attach a syringe to the back of the needle and aspirate air and/or fluid to confirm placement.
  - The needle can be removed and the fenestrated catheter left in place and or used for drainage or to periodically aspirate air.
  - Once the needle is removed from the fenestrated catheter, a ball lock device will engage prohibiting reinsertion of the needle. Do not attempt to reinsert the needle into the catheter.
  - Secure the fenestrated catheter to the skin with tape and periodically open the distal valve to allow air to escape.
  - If a previously functioning catheter stops functioning, attempt to push sterile saline through the catheter to dislodge any clot that may have occluded the fenestrations or proximal openings
  - If patient is burned or excessively dirty about insertion site, consider **Cefazolin**
    - < 40kg Contact receiving clinician
    - 40 – 80kg 1g
    - ≥ 80 kg 2g
- COOK:
  - Identify landmarks and cleanse site with Clorhexadine or other suitable antimicrobial.
  - Introduce the Cook needle through the 5th intercostal space.
    - In cases of patients of large body habitus, the 2nd intercostal space on the mid-clavicular line may be used in situations where the 5th intercostal space proves unsuccessful.
  - Advance the device to the desired depth; attach a syringe to the back of the needle and aspirate air and/or fluid to confirm placement.
  - Attach pig tail or Heimlich valve to hub of device.
  - Monitor to ensure patency, repeat procedure as needed.
    - Proceed to Simple Thoracostomy (CCTTP 7.13) if indicated.

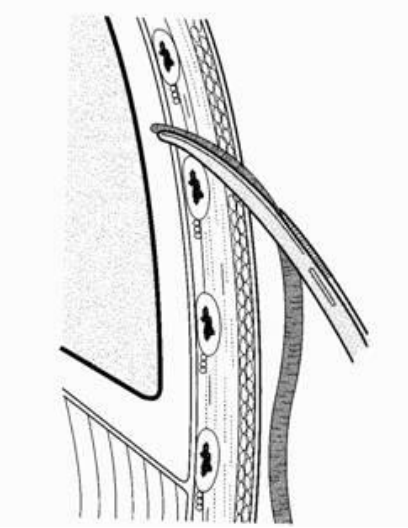
7.13 Simple Thoracostomy

7.13.1 Indications:

- This procedure should only be done in extremis, when there remains clinical signs of a tension pneumothorax despite at least 2 needle/turkel thoracostomies.
    - In obese patients, the 2nd intercostal space midclavicular line should be used.
- The patient must be intubated and on supportive ventilation. Consider local anesthesia with lidocaine.

7.13.2 Clinical Management:

- Prepare the axillary area on the symptomatic side with betadine and drape in the usual sterile fashion.
- The point of insertion occurs at a line drawn from the armpit (anterior axillary line) to the side (lateral) of the nipple in males, or to the side (about two inches) above the sternoxiphoid junction in females.
- Make a 3-4 cm incision through skin and subcutaneous tissues between the 4th and 5th ribs
    - Continue the incision through the intercostal muscles, right down to the pleura.
- Using a Kelly clamp go over the top of the chosen rib (see below) enter the pleura.
    - Enter the pleural space and spread the forceps widely.



- Insert gloved finger through your incision and into the thoracic cavity.
    - Make sure you are feeling lung (or empty space) and not liver or spleen.
- Cover the incision with a bulky, but loose dressing.
    - Reinforce or change as necessary, but do not allow dressing to become occlusive.
- Repeat steps above; if indicated.
- All patients receiving any thoracostomy procedure should have ample pain control and sedation as per protocol.

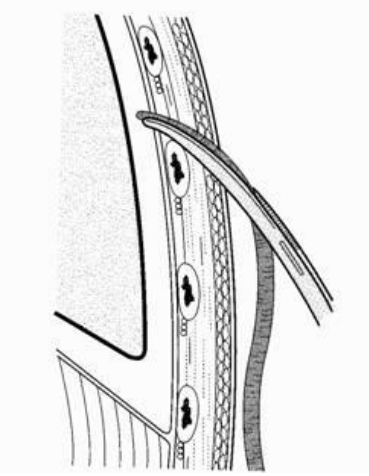
7.14 Tube Thoracostomy

7.14.1 Indications:

- This procedure should only be done in extremis, when there remains clinical signs of a tension pneumothorax despite at least 2 needle/turkel thoracostomies.
    - In obese patients, the 2nd intercostal space midclavicular line should be used
- The patient must be intubated and on supportive ventilation.

7.14.2 Clinical Management:

- Prepare the axillary area on the symptomatic side with betadine and drape in the usual sterile fashion.
- The point of insertion occurs at a line drawn from the armpit (anterior axillary line) to the side (lateral) of the nipple in males, or to the side (about two inches) above the sternoxiphoid junction in females.
- Make a 3-4 cm incision through skin and subcutaneous tissues between the 4th and 5th ribs
    - Continue the incision through the intercostal muscles, right down to the pleura.
- Using a Kelly clamp go over the top of the chosen rib (see below) enter the pleura.
    - Enter the pleural space and spread the forceps widely.



- Insert gloved finger through your incision and into the thoracic cavity.
    - Make sure you are feeling lung (or empty space) and not liver or spleen.
- Grasp end of chest tube (32-36 Fr in adults;18-24 in children) with the Kelly forceps and insert through the hole in the pleura into the thoracic cavity.
    - Remove Kelly and manually advance tube superiorly and posteriorly.
- Make sure that all fenestrations are within the chest.
- Clamp outer tube end with Kelly. Suture and tape tube in place.
- Attach end of tube to a Heimlich valve or a drainage system & connected to suction.
- Obtain post procedure CXR if time permits and services available

7.15 Radial Artery Cannulation

7.15.1 Indications:

- Consider Arterial cannulation when two or more of the following Indications exist
  - Continuous monitoring of blood pressure in patients with recent history of hypotension and/or patients for whom you are suspicious of continued hypotension during transport.
  - Patients receiving one or more vasoactive medications, particularly when they must be precisely maintained within a narrow range of blood pressure.
  - Continuous monitoring of blood pressure in patients for whom hypertensive episodes are of particular concern for contributing to morbidity or mortality.
  - Determination of blood pressure in high acuity patients when other conventional means are not available or assessment of perfusion is compromised.
  - Access site for continuous ABG and electrolyte analysis in high acuity patients over a protracted transport time.

7.15.2 Contraindications:

- Compromised circulation in the limb selected for cannulation.
- Evidence of infection in limb selected for cannulation.
- Time needed to perform procedure would unnecessarily delay patient transport in presence time sensitive injury or illness.
- Cannulation in limb with dialysis shunt.
- Patients under 40kg.
- Brachial, Pedal, and Ulnar cannulation.

7.15.3 Cautions:

- INR over 1.8 and/or PT over 37 seconds.
- Platelet Count under 20,000.
- Failed Allen's test (radial)
- More than 2 attempts at cannulation.

7.15.4 Equipment:

- 250 or large bag of 0.9% NS
- Transducer set
- Pressure bag
- IV Start pack
- Gloves & Eye protection.
- 20g. Arrow® Cath set with integrated wire.
- Wrist immobilization
- Lidocaine
- Stat-Lock® device.

7.15.5 Clinical Management:

- Select site to be cannulated with deference given to distal cannulation.
  - Consider utilizing ultrasound to identify site and guide during insertion
  - Choose a site with the strongest palpable pulse with preference to the left side of the patient.
  - Radial:
    - Perform Allen's test in selected limb to determine collateral flow
    - Consider utilizing ultrasound to verify ulnar artery blood flow via pulse-wave or color doppler
  - Femoral:
    - See CCTTP 7.16
- Prepare equipment including setup and zeroing of pressure transducer line.
- If radial site is selected, consider immobilization wrist in slight extension with towel roll or commercial immobilization device.

- Consider local anesthetic injection of lidocaine.
- Prep cannulation site with Clorhexadine® or other suitable antimicrobial agent.
- Using aseptic technique, insert the catheter at a 45 degree angle.
- Upon receiving blood return into the catheter, lower the angle of the catheter and slide the guide wire into the artery.
    - Stop if resistance is felt.
    - Reposition catheter and begin again if indicated.
- If artery is punctured but not cannulated, direct pressure must be held on site for 120 seconds.
- No more than two attempts at cannulation should be made at the sending facility.
- Once wire is inserted into vessel, carefully slide catheter over the wire into the vessel.
- Hold firm pressure over distal end of catheter in order to occlude blood flow out of catheter and remove/dispose of guide-wire assembly.
- Attach pressure transducer line to hub of catheter and watch for favorable waveform.
    - Accidental undetected disconnection of pressure line from hub of catheter is a potentially fatal complication.
    - If waveform not visualized, check connections, stop cocks, attempt to flush transducer pressure line, and reposition catheter and/or limb.
- Secure catheter with Stat-Lock® device in addition to tape.
- Apply tincture of benzoin around insertion site and allow to dry.
- Apply transparent dressing to insertion site and tape pressure transducer line into place.
- Monitor waveform and correlate and NIPB with arterial pressure values.
- Check for signs of bleeding and catheter dislodgement.
- Cannulation site will be positioned so it is visible during transport.

7.16 Femoral Artery Cannulation

7.16.1 Indications:

- Consider Femoral cannulation when two or more of the following Indications exist
  - Continuous monitoring of blood pressure in patients with recent history of hypotension and/or patients for whom you are suspicious of continued hypotension during transport.
  - Patients receiving one or more vasoactive medications, particularly when they must be precisely maintained within a narrow range of blood pressure.
  - Continuous monitoring of blood pressure in patients for whom hypertensive episodes are of particular concern for contributing to morbidity or mortality.
  - Determination of blood pressure in high acuity patients when other conventional means are not available or assessment of perfusion is compromised.
  - Access site for continuous ABG and electrolyte analysis in high acuity patients over a protracted transport time.
  - Need for invasive monitoring when radial cannulation not possible.

7.16.2 Contraindications:

- Compromised circulation in the limb selected for cannulation.
- Evidence of infection in limb selected for cannulation.
- Time needed to perform procedure would unnecessarily delay patient transport in presence time sensitive injury or illness.
- Patients under 40kg.

7.16.3 Cautions:

- INR over 1.8 and/or PT over 37 seconds.
- Platelet Count under 20,000.
- Failed Allen's test (radial)
- More than 2 attempts at cannulation.
- Femoral line cannulation is a sterile procedure.
- Placement of femoral arterial line in a moving vehicle

7.16.4 Equipment:

- 250 or large bag of 0.9% NS
- Transducer set
- Pressure bag
- IV Start pack
- Face & Eye protection.
- Arterial Vessel Cath. Kit (Arrow AK-04550 or Equivalent)
- Lidocaine
- Stat-Lock® device.
- Sterile Gloves.

7.16.5 Clinical Management:

- Consider utilizing ultrasound to identify site and guide during insertion
- Prepare equipment including setup and zeroing of pressure transducer line.
- Immobilize leg to be cannulated. Don eye protection and mask.
- Open IV start kit and Vessel Catheterization Kit while maintaining sterility
- Don Sterile gloves and scrub cannulation site with Clorhexadine.
- Drape site with supplies included in catheterization kit.
- Consider local anesthetic injection of lidocaine.
- Attach 20g x 2 inch Introducer needle to 5ml syringe. Palpate femoral pulse with sterile gloved hand.
- Insert finder needle at 45 degree angle with back pressure applied to syringe until blood is aspired into syringe.
- Leave introducer needle/syringe in place and immobilize with non-dominant hand.

- With dominant hand, remove 5ml syringe from introducer needle and thread J-wire through needle hub and into femoral artery.
- Stop if resistance is felt.
- Reposition catheter and begin again if indicated.
- If artery is punctured but not cannulated, direct pressure must be held on site for 120 seconds.
- No more than two attempts at cannulation should be made at the sending facility.
- Ensure approx 6 inches of wire remains external of the artery, and remove introducer needle from artery by sliding it over the wire.
- Ensure approx 6 inches of wire remains external of the artery.
- Slide 20g x 5 inch catheter over wire and into femoral artery.
- Remove wire from vessel and attach pressure transducer line to hub of catheter and watch for favorable waveform.
    - Accidental undetected disconnection of pressure line from hub of catheter is a potentially fatal complication.
    - If waveform not visualized, check connections, stop cocks, attempt to flush transducer pressure line, and reposition catheter and/or limb.
- Secure catheter to leg with provided suture.
- Apply tincture of benzoin to site and allow time to dry before applying large transparent dressing to insertion site. .
- Apply antimicrobial transparent dressing to insertion site and tape pressure transducer line into place.
- Monitor waveform and correlate and NIPB with arterial pressure values.
- Continually check for signs of bleeding and catheter dislodgement.
- Cannulation site will be positioned so it is visible during transport.
- If excessive bleeding is noted from a failed insertion site, consider quick clot sponge as applicable

7.17 Escharotomy

7.17.1 Objective:

- To establish a guideline for field escharotomy.

7.17.2 Indications:

- The presence of burn trauma with one of the following:
- Impending or established vascular compromise of the extremities or digits
- Impending or established respiratory compromise due to torso burns.
- (Burns to do not need to be circumferential)

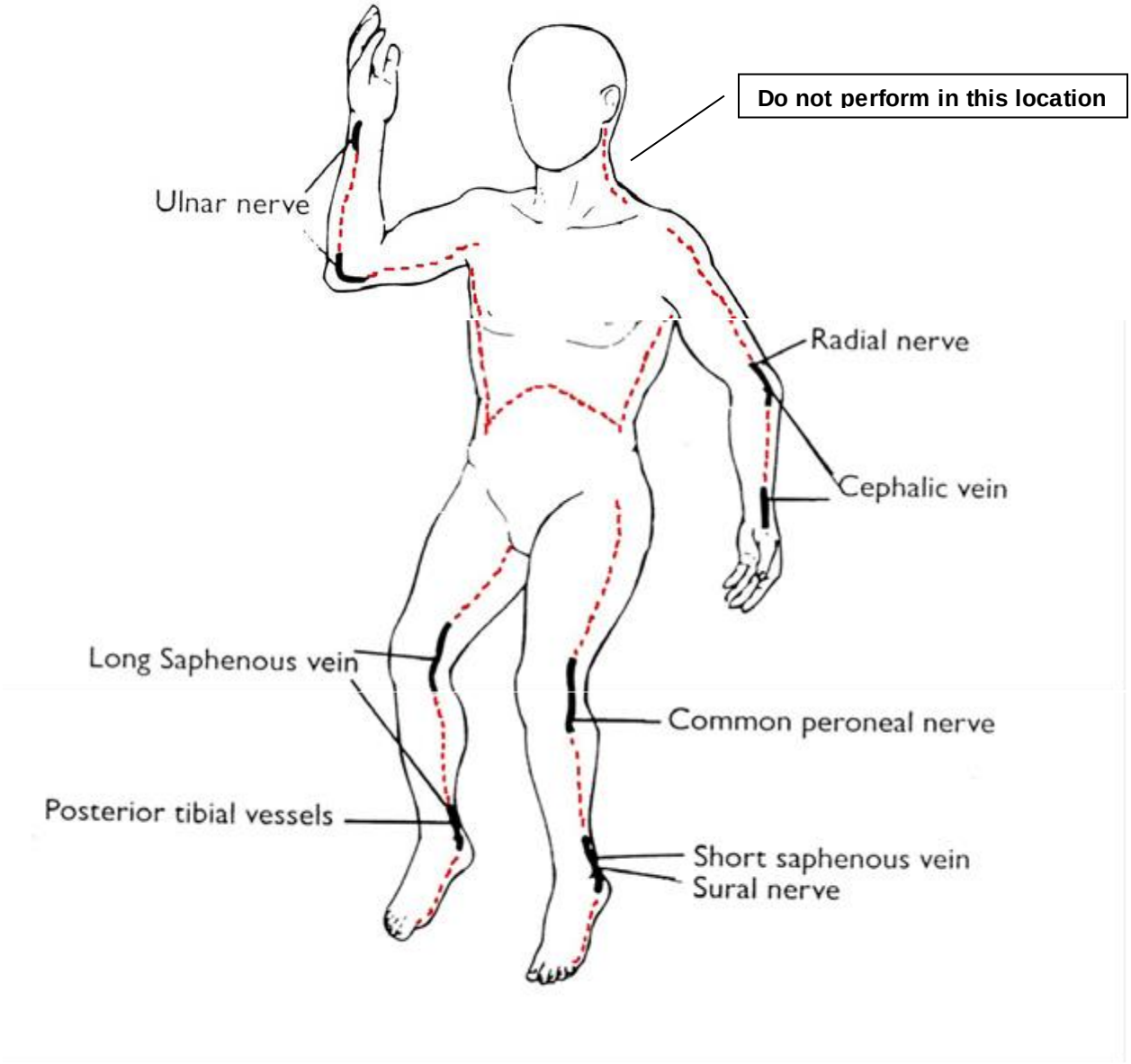
7.17.3 Special Considerations:

- Escharotomy does not take precedence over primary Airway, Breathing and Circulation interventions.
- Avoid the ulnar nerve at the elbow and common peroneal nerve at the knee (see diagram for those and other areas to avoid)
- Avoid incision on neck due to possibility of damaging great vessels.

7.17.4 Clinical Management:

- Obtain baseline circulatory/respiratory status.
- Provide pain control if indicated.
- Clean site.
- Using a sterile scalpel, perform incision through eshcar sufficiently to see obvious separation of wound edges.
- Control bleeding and cover with sterile dressings.
- **Cefazolin**, if antibiotics have not already been initiated
    - < 40kg Contact receiving clinician
    - 40 – 80kg 1g
    - ≥ 80 kg 2g
- Reassess circulatory/respiratory status.
- Elevate affected limb/s if possible.
- Chest:
    - Incise along the mid axillary lines.
    - A transverse incision across the abdomen below the costal margin and/or the top of chest can be made joining the vertical incisions.
    - Abdominal transverse incision may be especially important with pediatric patients
- Limbs:
    - Incisions should be performed on the mid-axial lines between flexor and extensor surfaces, bilaterally if indicated.
    - Use caution with incisions across the flexural creases of joints.

7.17.5 -SEE DIAGRAM ON NEXT PAGE-


Do not perform in this location
Ulnar nerve
Radial nerve
Cephalic vein
Long Saphenous vein
Common peroneal nerve
Posterior tibial vessels
Short saphenous vein
Sural nerve

7.18 Hemostatic Gauze

7.18.1 Objectives:

- To use impregnated hemostatic gauze to arrest acute exanguination in the unstable patient.

7.18.2 INDICATIONS:

- Severe bleeding

7.18.3 Cautions:

- Known hypersensitivity to hemostatic dressing

7.18.4 Clinical Management:

- Assure that the patient's airway is open and that breathing and circulation are adequate.
- Apply oxygen if needed.
- Immediately apply pressure directly on the wound with a sterile dressing.
  Note: If available and bleeding is severe, a hemostatic gauze dressing should be applied directly to the bleeding site simultaneously with direct pressure.
- If bleeding soaks through the dressing, apply additional dressings while continuing well-aimed direct pressure.
- If severe bleeding persists from the trunk, neck, head or other location where a tourniquet cannot be used, hemostatic gauze dressings should be used.

7.19 Surgical Cricothyrotomy

7.19.1 Indications:

- To allow rapid entrance into the airway for ventilation and oxygenation when other means of airway control (BVM, intubation, etc.) have proven unsuccessful.

7.19.2 Contraindications:

- The ability to obtain airway control and effective ventilation by less invasive means.
- Pediatric patients (less than 8 years old).
- Inability to identify proper landmarks.

7.19.3 Equipment:

- Oxygen.
- Suction.
- Bag Valve mask.
    - Using the Cook Emergency Cricothyrotomy Cuffed Set
        - Betadine.
        - #15 scalpel.
        - 10ml syringe.
        - Introducer needle.
        - TFE introducer catheter.
        - Wire guide.
        - Curved dilator.
        - Airway catheter (trach).
        - 4 x 4's.
        - Tracheal ties.
    - B. For standard surgical technique
        - Scalpel
        - 6 – 7 ETT
        - Betadine.
        - Gauze.
        - Kelly clamp.

7.19.4 Clinical Managements:

- Using the Cook Emergency Cricothyroid Cuffed Set
    - Open the airway and position the head so the neck is clearly visible.
    - If the patient has sustained any type of spinal trauma, maintain cervical spine precautions at all times.
    - After locating and palpating the cricothyroid membrane, clean the area thoroughly with Betadine or chlorohexadine.
    - Stabilize the cricothyroid membrane and make a vertical incision in the midline using the #15 scalpel blade.
        - The incision should be long enough to accommodate the dilator and trach.
    - Attach the 10ml syringe to the 18 gauge TFE catheter and advance it through the incision into the airway at a 45 degree angle to the frontal place on the midline in a caudad direction.
        - While advancing the needle forward, verify correct placement in the trachea by aspirating for free air return.
    - Remove the syringe and needle, leaving the TFE catheter in place.
        - Advance the soft flexible end of the wire guide through the TFE catheter into the airway several centimeters.
    - Remove the TFE catheter, leaving the wire guide in place.
    - Advance the handled dilator, tapered end first, into the connector end of the airway catheter until the handle stops against the connector.

- Advance the dilator over the wire guide until the proximal stiff end of the wire guide is completely through and visible at the handle of the dilator.
  - It is important to always visualize and hold the proximal end of the wire guide during the airway insertion procedure to prevent its inadvertent loss into the trachea.
- Maintain the wire guide position; advance the emergency airway access assembly over the wire guide with a rotating motion into the trachea.
  - Care should be taken not to advance the tip of the wire guide within the trachea.
- Remove the wire guide and the dilator simultaneously.
- Inflate the cuff.
- Manually secure the tracheostomy tube while beginning to ventilate the patient using a Bag Valve mask.
- Confirm placement by auscultating for equal, bilateral breath sounds and observing for equal, bilateral chest expansion.
  - Secure the tracheostomy tube in place with tracheostomy tape or ties.

- Using Standard Surgical Technique
  - Open the airway and position the head so the neck is clearly visible.
    - If the patient has sustained any type of spinal trauma, maintain cervical spine precautions at all times.
  - After locating and palpating the cricothyroid membrane, clean the area thoroughly with Betadine or chlorohexadine.
  - Stabilize the cricothyroid membrane and make a 2cm vertical incision in the midline using the #15 scalpel blade.
  - Dissect bluntly through the subcutaneous tissues until the membrane is visible.
  - Carefully make a 2-3cm horizontal incision through the membrane.
  - Use a curved hemostat to apply traction to the cricothyroid membrane allowing for tube insertion.
  - Insert an appropriately sized, cuffed endotracheal tube into the cricothyroid membrane incision, directing the tube distally into the trachea until the cuff is securely in the trachea.
  - Inflate the cuff.
  - Manually secure the tube while beginning to ventilate the patient using a bag valve mask.
    - Confirm placement by auscultating for equal, bilateral breath sounds and observing for equal, bilateral chest expansion.
  - Secure tube.
  - Continue to assist ventilation via BVM with continual assessment of adequacy of ventilation.

7.20 Needle Cricothyrotomy

7.20.1 Indications:

- Inability to effectively ventilate the patient by any other means.
- Pediatric patient (less than 8 years old) with inability to ventilate by any other means (surgical cricothyrotomy is contraindicated in this age group).
- This procedure is only used for short term (<45 minutes) of ventilation and oxygenation

7.20.2 Contraindications:

- The ability to effectively ventilate the patient by any other means.
- This procedure is not a substitute for airway control with a cuffed tube.

7.20.3 Equipment:

- Bag valve mask.
- Oxygen.
- Suction.
- Betadine.
- Jet ventilator.

7.20.4 Clinical Management:

- Open the airway and position the head so the neck is clearly visible.
- If the patient has sustained any type of spinal trauma, maintain cervical spine precautions at all times.
- After locating and palpating the cricothyroid membrane, clean the area thoroughly with Betadine or chlorohexadine.
- Attach the syringe to a 14 gauge angiocath.
- Stabilize the cricothyroid membrane between the thumb and the index finger.
- Insert the catheter into the cricothyroid membrane at a 45 degree angle in a caudad direction.
- While advancing the catheter, gently aspirate with the syringe.
    - When air is easily aspirated, the catheter lumen is in place in the trachea.
- When the tracheal lumen is entered, withdraw the needle and advance the catheter.
- Attach either the BVM or jet ventilator to the catheter and ventilate the patient.
- Confirm placement by auscultating the equal breath sounds and observing for equal, bilateral chest expansion.
- Secure the catheter to the neck.
- To ventilate using the thumb control on the valve.
    - Deliver 100% oxygen in intermittent bursts <50psi at a rate of 20 bursts / minute.

8. PEDIATRICS

8.1.1 Notes from the State of Maine Pediatric Intensivist Staff:

- Goals:
  - These guidelines are designed for Children ages 1 month to 12 years, or less than or equal to 40 kg.
  - Patients who are older or who have greater weight can be addressed as adult patients and / or discussed with medical control.
- Contacting receiving Pediatric ICU Staff.
  - For patients to be admitted to the Pediatric I.C.U. from another facility, and prior to departure with the patient, air medical crew are encouraged to achieve dialogue with a pediatric intensivist in order to ensure alignment of management plans between the sending and receiving clinicians.
  - MMC and EMMC Pediatric Intensivists are available to LOM crew for consultation and medical control for any patient under the age of 18 regardless of patient destination.

8.2 Pediatric: Monitoring and General Considerations

8.2.1 Indications:

- All pediatric patients will be monitored during transport.

8.2.2 Clinical Managements:

- All patients will be continuously monitored with EKG, pulse oximetry, non-invasive BP, and ETCO2 if intubated.
- BP's (via NIBP or transducer) will be checked at a minimum of Q 10 minutes or more frequently as condition warrants.
- Alarms should be set appropriate for age.
- Temperature will be continuously monitored during transport, (if initial temperature <36 or >38) using skin or rectal probe.
- UAC lines are always connected to a 0.45 NS with Heparin (0.5 unit/ml) infusion at 0.5 to 1 ml/hr via syringe pump and never capped off.
- UVC lines have auxiliary ports that are capped off for meds and flushed with 0.45 NS 0.15 mls every 6 hours and before and after medications.
    - Positive pressure anti-reflux valve devices are used on both lines
- Glucose assessment should be performed as a matter of routine with any critically ill child, or in whom the diagnosis is uncertain.
    - Children of one (1) year of age or less, are particularly at risk for hypoglycemia.
- Treatment of HYPOglycemia (< 80mg/dL)
    - **Dextrose** 0.2 – 0.25 g/kg (Dilute to ≤ 25%)
        - **D10** 5 mL/kg
    - **Glucagon**
        - < 20kg 0.5mg IM
        - > 20kg 1mg IM

8.2.3 General guidelines for normal pediatric vital signs are as follows:

Age	Heart Rate	Respiration
Neonate	100 – 160	30 – 60
< 1 year	100 – 160	30 – 60
1 – 3	100 – 160	24 – 40
3 – 8	70 – 140	22 – 34
8 – 12	55 – 110	12 – 24
> 12	55 – 100	12 – 24

Age	Low/Normal Systolic Blood Pressure
0 to 1 month	60
> 1 month to 1 year	70
> 1 year	70 + (2 x age in years)

8.3 Pediatric Airway Management

8.3.1 Indications:

- Pediatric patients who present with an obstructed airway, compromised spontaneous breathing (hypoventilation), unremitting hypoxemia, and apnea.

8.3.2 Clinical Management:

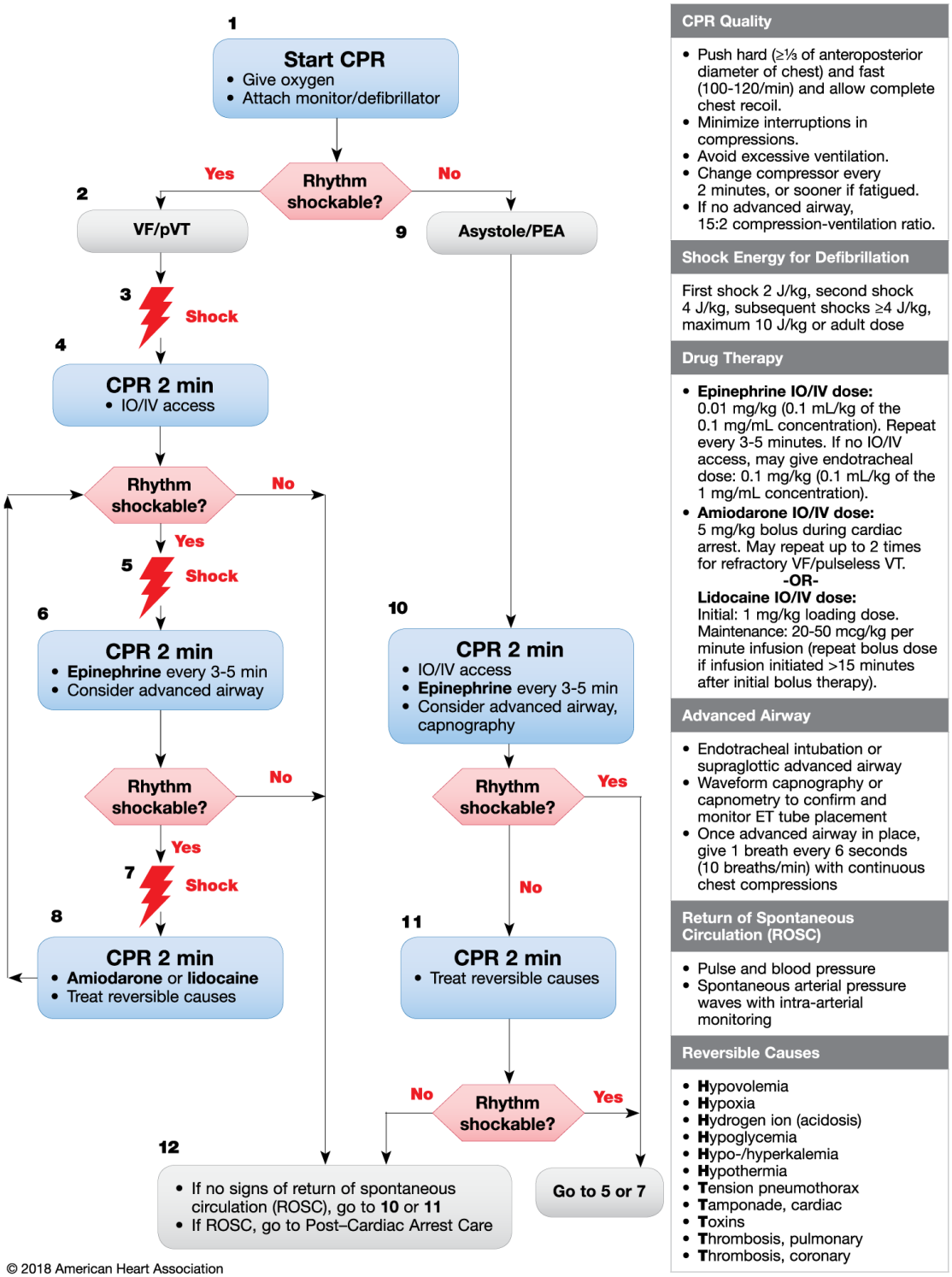
- If a patient exhibits effective spontaneous ventilation, administer oxygen appropriate for patient's condition, and attach to monitoring devices.
- If a patient exhibits ineffective ventilation, attempt to open the airway.
- In the trauma patient utilize a jaw thrust maneuver in combination with cervical spine immobilization.
- In the non-trauma patient, utilize the head tilt, chin lift maneuver.
- If apnea is present, or if ventilation is ineffective, attempt to ventilate using the bag-valve-mask with 100% oxygen. Use airway adjuncts as indicated.
    - An oropharyngeal airway is indicated for the unconscious patient without a gag reflex.
    - A nasopharyngeal airway may be better tolerated in the patient with a gag reflex.
- If unable to ventilate, reposition the head and/or neck and reattempt to ventilate. If still unable to ventilate, assess for upper airway obstruction.
    - Clear Airway (suction, Magill forceps).
    - Back blows, chest thrusts < 1yr. Heimlich maneuver > 1yr.
    - If obstruction is noted and irresolvable, surgical airway is needed.
    - Refer to Needle and Surgical Cricothyroidotomy (CCTTP 7.19 and 7.20).
- Indications for endotracheal intubation include:
    - Inadequate central nervous system control of ventilation.
    - Functional or anatomic airway obstruction.
    - The need for high peak inspiratory pressure to maintain effective alveolar gas exchange.
    - Probable loss of airway control during transport due to the nature of the illness or injury.
    - Severe systemic illness (sepsis) or injury with shock.
    - Suspected intracranial lesion (e.g., head injury with GCS <8).
    - Evidence of airway burns and/or smoke inhalation.
        - ET tube size is (age in years + 14) ÷ 4 mm. (Cuffed ETTs) Endotracheal tube depth is age in years + 8.
        - CAUTION: unless an asthmatic child is in extremis (compromised mental status), do not intubate prior to achieving communication with the pediatric intensivist.
    - Check to be sure a functioning IV/IO line is in place.
    - Connect patient to a cardiac monitor and to a pulse oximeter.
    - Allow the patient to breathe 100% oxygen by BVM (assist ventilation if indicated).
    - Pharmacologically assisted intubation: Special pediatric specific considerations below: Also see CCTTP 2.3
        - **Atropine** 0.02 mg/kg IV (Min 0.1mg to Max of 0.5mg)
        - Indicated for patients < 1 year of age
        - Consider in patients < 5years of age.
        - For prevention of laryngeal stimulation induced bradycardia and excess salivation.
        - **Ketamine**: 2 mg/kg IV or 4 mg/kg IM
        - RSI induction agent of choice in the instances of pediatric bronchospasm or hypotension.
        - Ketamine is CONTRAindicated in patients < 3 months of age
        - In instances where intracranial pressure may be elevated due to a mechanical obstruction, **Etomidate** remains the induction agent of choice.

8.4 Pediatric Cardiac Arrest

8.4.1 Protocol:

- CARDIAC ARREST per PALS Algorithms

Pediatric Cardiac Arrest Algorithm—2018 Update



CPR Quality

- Push hard (≥⅓ of anteroposterior diameter of chest) and fast (100-120/min) and allow complete chest recoil.
- Minimize interruptions in compressions.
- Avoid excessive ventilation.
- Change compressor every 2 minutes, or sooner if fatigued.
- If no advanced airway, 15:2 compression-ventilation ratio.

Shock Energy for Defibrillation

First shock 2 J/kg, second shock 4 J/kg, subsequent shocks ≥4 J/kg, maximum 10 J/kg or adult dose

Drug Therapy

- **Epinephrine IO/IV dose:** 0.01 mg/kg (0.1 mL/kg of the 0.1 mg/mL concentration). Repeat every 3-5 minutes. If no IO/IV access, may give endotracheal dose: 0.1 mg/kg (0.1 mL/kg of the 1 mg/mL concentration).
- **Amiodarone IO/IV dose:** 5 mg/kg bolus during cardiac arrest. May repeat up to 2 times for refractory VF/pulseless VT.

-OR-

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

Advanced Airway

- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement
- Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions

Return of Spontaneous Circulation (ROSC)

- Pulse and blood pressure
- Spontaneous arterial pressure waves with intra-arterial monitoring

Reversible Causes

- **H**ypovolemia
- **H**ypoxia
- **H**ydrogen ion (acidosis)
- **H**ypoglycemia
- **H**ypo-/hyperkalemia
- **H**ypothermia
- **T**ension pneumothorax
- **T**amponade, cardiac
- **T**oxins
- **T**hrombosis, pulmonary
- **T**hrombosis, coronary

8.5 Pediatric Hypothermia

8.5.1 Indications:

- Pediatric patients who are ill or injured after a history of environmental exposure or cold water submersion will be resuscitated, even if apparently lifeless.

8.5.2 Clinical Management:

- Monitor cardiac rhythm and vital signs as per protocol.
- Monitor temperature with rectal probe.
- Secure airway, ventilate as needed, and administer high flow oxygen.
- See adult hypothermia CCTTP 6.5. Differences are listed below:
    - If a perfusing cardiac rhythm is present, treat hypotension with warmed Normal Saline, 20 ml/kg IV. Repeat fluid bolus up to 3x PRN for continued hypotension.
    - If hypotension persists, refer to CCTTP 8.10
    - If blood glucose < 80 mg/dL, refer to CCTTP 8.1.2
    - Consider nasogastric tube and urethral catheter if the patient remains unconscious.
    - Continue rewarming measures during transport (warm IV fluid, hot packs, thermal blankets/sleeping bag, hood, and warm cabin).
    - Monitor for cardiac rhythm changes and the development of respiratory difficulties secondary to (prior) aspiration or pulmonary edema.

8.6 Pediatric Sepsis

8.6.1 Indications:

- A pediatric patient with known or suspected infection will receive appropriate supportive care and pharmacological intervention.
- Signs and symptoms of infection may vary with age, but generally include fever, altered level of consciousness ranging from irritability to unconsciousness.
- Additional system related signs and symptoms may occur.
- Infections can occur for a variety of reason.

8.6.2 Clinical Management:

- Maintain Respiratory Precautions
- Ensure droplet precaution isolation.
- Insure that appropriate antibiotics have been initiated.
- If febrile, administer **Acetaminophen**, 15mg/kg PR.
- If hypotension persists, refer to CCTTP 8.10
- If blood glucose < 80 mg/dL, refer to CCTTP 8.1.2

8.7 Pediatric Poisoning

8.7.1 Indications:

- Any pediatric patient who has been acutely poisoned by virtue of exposure (via any route), to a substance which exerts deleterious effects upon the body.

8.7.2 Clinical Management:

- Obtain a history of the poisoning.
    - Determine substance, route (ingestion, injection, inhalation, or topical), chronology, and medical intervention attempts.
    - Contact the Poison Control Center before leaving the scene/outside hospital, if this has not yet been done (1-800-222-1222).
- Secure electrolytes, including serum blood glucose, obtain recommended lab work before departure.
    - Always check fingerstick blood glucose. It is impossible to describe the management of every poisoning within these protocols.
    - Maintain a low threshold for contact of medical control, predeparture.
- Secure airway per pediatric Airway Management protocol, and ventilate and oxygenate per Pediatric Respiratory Failure protocol as needed.
- Obtain vascular access per protocol.
- Monitor vital signs and assess the patient, including neurological evaluation.
- Gastric lavage only if recommended by poison control.
- Syrup of Ipecac is contraindicated.
- Following lavage, and after communication with pediatric intensivist, administer **Activated Charcoal** 1gm/kg per NGT and clamp.
    - Should be given prior to departure, if indicated.
- For CNS depression, consider administration of naloxone, 0.1mg/kg IV (max dose = 2 mg).
    - Administer BEFORE transport.
    - Check finger-stick blood sugar (FSBS) to confirm that altered L.O.C. is not due to hypoglycemia, if L.O.C. deteriorates en-route.
- Secure for transport and apply restraints as needed.
- Follow Pediatric Monitoring protocol enroute, and guard airway per Pediatric Airway Management protocol.

8.8 Pediatric Respiratory Failure Including Sedation and Analgesia

8.8.1 Clinical Management:

- Maintain airway and oxygenation (per Airway Management Protocol).
- Bradycardia in the pediatric patient may be a sign of respiratory failure, and should be initially treated with oxygen and increased ventilation.
- Early conversation and the use of telemedicine with the pediatric intensivist is crucial in this patient population.

8.8.2 Upper airway causes of respiratory failure include:

- Foreign body/Mechanical obstruction
  - For Airway Management, refer to CCTTP 8.2
  - For Surgical or Needle Cricothyrotomy, refer to CCTTP 7.16 or 7.17
- Epiglottitis:
  - Signs and symptoms may include abrupt onset of stridor, high fever (> 102° F), sore throat, drooling and petechiae.
  - Airway management of epiglottitis is difficult due to severe epiglottic swelling.
  - Initial efforts should be directed toward oxygenating the patient and positioning to facilitate ventilation with minimal manipulation.
  - Drooling and tripod position are distinguishing features of epiglottitis.
  - If the patient has assumed a tripod position, continue to allow this posture during transport.
  - Consult PICU intensivist for any patient with suspected epiglottitis predeparture.
  - Optimal management of epiglottitis involves securing the airway at the facility of origin using a team comprised of Anesthesia, and Surgeon or ENT physician.
  - If this is impossible, the LOM Team MUST communicate with O.L.M.D. for all steps of decision making.
- Severe croup:
  - Provide cool mist, a quiet environment and **Racemic Epinephrine** 1:1,000 2.25% (5mg/0.5ml) solution via nebulizer.
  - This should be administered predeparture at the referring hospital with 3 ml NS.
  - **Methylprednisolone Sodium Succinate** (Solu-Medrol) 2mg/kg IV (max single dose=125mg).
  - Consider antibiotics prior to departure per dialogue with OLMD.

8.8.3 Lower airway causes of respiratory failure

- May be caused by asthma, viral infections, bacterial pneumonia, interstitial or alveolar disease, anaphylaxis, congestive heart failure or trauma.
- Passive oxygenation with FIO2 titrated to SPO2 >92%.
- Bronchodilators via nebulization – may be administered Q 20 minutes or continuously as indicated by degree of bronchospasm.
- Albuterol 2.5 mg in 2.5 ml normal saline.
- Atrovent 0.5 mg in 2.5 ml normal saline.
- If respiratory failure continues, attempt positive pressure ventilation with bag valve mask and 100 % oxygen. Mask ventilation is not acceptable for more than a few minutes of transport however, due to the

risk of gastric distention and aspiration and should therefore be followed by intubation, per protocol, and positive pressure ventilation with 100 % oxygen.

- In trauma situations, RESPIRATORY FAILURE may be a result.
    - Place tube thoracostomy and/or INTUBATE per pharmacologically assisted intubation protocol for any of the following as indicated:
- FLAIL CHEST
- PULMONARY CONTUSION (Severe)
- PNEUMOTHORAX
- HEMOTHORAX
- OPEN THORACIC INJURY
- TENSION PNEUMOTHORAX (known or suspected):

8.9 Pediatric Seizures

8.9.1 Indications:

- For the patient experiencing seizures, the Critical Care Transport Team will attempt to identify the cause and treat accordingly.
- Common, treatable causes of acute pediatric seizures include hyperthermia, hypoglycemia, hypoxemia, trauma, metabolic and toxic disturbances, electrolyte alterations, and infections.
- Transport may also be indicated for exacerbation of chronic seizures for which causes may include: previous head injury, familial or congenital origin, and idiopathic etiologies.

8.9.2 Clinical Management:

- Assess airway, ventilate as needed, and administer high flow oxygen.
- Seizure duration should be controlled, if possible, to avoid complications. Determine cause, if possible, by history and assessment.
- Fever. Check body temperature and administer acetaminophen 15 mg/kg/PO/PR/PNGT.
- If blood glucose < 80 mg/dL, refer to CCTTP 8.1.2
- Hypoxemia. Monitor peripheral oxygen saturation via pulse oximetry. Administer oxygen as needed. High flow oxygen is most appropriate during an active grand mal seizure. Insertion of an oropharyngeal or nasopharyngeal airway is appropriate if it can be done prior to trismus.
- Be alert for signs of emesis. Suction and turn head to side to avoid aspiration. Log roll if patient has potential for spinal injury.

8.9.3 Medicate the seizing patient as indicated below:

- Choose One Benzodiazepine
  - **Midazolam** 0.1 mg/kg to MAX 2mg Repeat x 2
  - **Lorazepam** 0.15 mg/kg to MAX 2mg Repeat x 2

  Watch for respiratory depression and hypotension; be prepared to secure the airway, refer to CCTTP 2.3 if necessary
- If seizures persist and cannot be controlled
  - Age > 1
    - **Fosphenytoin** 20 pe/kg in 100mL over 10 – 20 minutes
    - MAX dose 1500 mg PE
    - Watch for cardiac dysrhythmias
    - Infuse at rate < 150 pe/min
  - If Age < 1, patient has allergy to Fosphenytoin, or continues to have seizures
    - **Levetiracetam (Keppra)** Consult with PICU intensivist
    - **Phenobarbital** Consult with PICU intensivist

8.10 Pediatric Refractory Shock

8.10.1 Objectives:

- To optimize the management of pediatric patients demonstrating the clinical signs of shock, septic or otherwise.

8.10.2 Special Considerations:

- All vasoactive medications administered to pediatric patients should be given via constant flow syringe pump.
- Consider all causes of shock including, but not limited to: pnuemothorax and hemorrhage.
- Therapeutic endpoints:
  - Normalization of heart rate
  - Cap Refill less than 2 seconds
  - Normal pulse strength with minimal difference between central and peripheral pulses.
  - Urine output greater than 1 ml/kg/hr
  - Normal mental status

8.10.3 Clinical Management:

- Identify symptoms indicative of evolving or ongoing shock.
- Manage patient aggressively – fluid replacement & airway management.
- Establish effective IV access.
- Obtain venous or capillary blood gas and glucose.
  - Frequently monitor blood glucose level and correct for hypoglycemia, refer to CCTTP 8.1.2

8.10.4 Treatment

- Initiate Isotonic Saline or colloid fluid bolus of 20ml/kg over 10 minutes. Repeat boluses as needed (total required is often up to 60-100 ml/kg).
  - Unusual cases of pure cardiogenic shock could be made worse by excessive fluids.
  - Contact Pediatric Intensivist.
- Shock refractory to fluid therapy;
  - Initiate **Dopamine** 0.5 to 20mcg/kg/min titrate to achieve therapeutic endpoints.
  - For shock refractory to fluid resuscitation and Dopamine, consider **Epinephrine** infusion 0.01 to 0.5 mcg/kg/min. Additional intravascular volume replacement likely needed in these refractory cases
  - Consider adding **Dobutamine** 2 to 30 mcg/kg/min for patients with known cardiogenic etiologies.
  - Administer antibiotics per Pediatric Intensivist order.
  - Place Foley catheter and monitor urine output.

8.11 Pediatric Spinal Injury

8.11.1 Indications:

- Any patient with a known spinal column injury, a (spinal) neurological deficit, or a mechanism of injury consistent with possible spinal injury will be properly immobilized for transport.

8.11.2 Pearls, Pitfalls and considerations:

- Follow Maine EMS protocol for spinal immobilization and refer to CCTTP 5.9 spinal injury for clearance and IFT Transport.
- If immobilization is required, a KED for immobilizing children ages 8 -10. If required, a long board underneath can be used to facilitated transport.

8.11.3 Clinical Management:

- Immobilize patient with device that functions best for patients size, at discretion of LOM crew.
- Protect the patient's airway as needed before and after immobilization. Refer to CCTTP 8.2
- Administer oxygen as appropriate.
- Initiate intravenous access and treat neurogenic shock. If the patient is hypotensive, refer to CCTTP 8.10
- Consider appropriate anxiolysis, if vital signs are adequate, if needed to prevent/decrease excessive movement within immobilization devices. Refer to CCTTP 8.12. Pediatric Sedation
- If the patient requires intubation and airway management, refer to CCTTP 2.3
- If the patient is intubated and is known to have a spinal cord injury place a foley catheter. Document residual volume and save sterile specimen for culture.
- Ensure gastric decompression by inserting and securing a nasogastric or orogastric tube.

Pediatric Considerations

* Caution should be exercised in older patients (e.g. 65 years and older) and in very young patients (e.g. less than 3 years of age), as spinal assessment may be less sensitive in discerning spinal fractures in these populations. However,age alone should not be a factor in decision-making for prehospital spinal care, yet the patient's ability to reliably provide a history should be considered

* In children using a booster seat or lap/shoulder belt during a motor vehicle collision, consider allowing the patient to self-extricate him/herself after applying a cervical collar, if needed. For the infant or toddler who is already strapped in a car seat with a built-in harness, extricate the child while strapped in his/her car seat.

* Children who do not require spinal immobilization or lying flat may be safely transported when restrained in an age-appropriate car seat secured to the stretcher. Children who do require spinal immobilization or lying flat should be directly secured to the stretcher.

8.12 Pediatric Sedation

8.12.1 Indications:

- Intubation with and without mechanical ventilation, severe pain, anxiety, agitation

8.12.2 Cautions:

- Consult attending physician for these circumstances
  - Impending respiratory failure (non-intubated)
  - Shock
  - Drug overdose
  - Altered mental status.

8.12.3 Clinical Management:

- For sedation:
  - **Midazolam**: 0.1 mg/kg to MAX 2mg IM/IV every 5 minutes.
  - **Lorazepam** : 0.15 mg/kg to MAX 2mg IV/IM/PR every 15 minutes.
  - Contact receiving pediatric intensivist for option of **Ketamine**
    - If hypersalivation is present, consider **Atropine** 0.01 mg/kg with minimum dose of 0.1mg
- For agitation/psychosis:
  - **Midazolam** 0.1 mg/kg to MAX 2mg IV/IM every 5 minutes.
  - **Lorazepam**: 0.15mg/kg to MAX 2mg IV every 15 minutes.
- For Mechanical Ventilation:
  - **Midazolam** 0.1mg/kg to MAX 5mg IV/IM every 5 minutes
  - **Lorazepam**: 0.15 mg/kg to MAX 4mg IV/IM/PR every 15 minutes
  - **Propofol**: 0.1 - 1 mg/kg bolus then 5 to 200 mcg/kg/min infusion.
  - **Ketamine** 1 mg/kg IV for hypotensive and/or bronchospastic patients.
    - CONTRAindicated in patients < 3 months of age
    - May follow initial dose with 0.25-0.5 mg/kg IV
    - May initiate an **INFUSION** 0.5-2 mg/kg/hr
    - Ketamine also possesses potent analgesic properties.

8.13 Pediatric Analgesia

8.13.1 Indications:

- Any pediatric patient with pain due to injury or disease.

8.13.2 Clinical Management:

- Maintain adequate airway and ventilation.
- Administer O2 as indicated.
- Monitor EKG and O2 saturation.
- Attempt to treat cause of pain (e.g., reposition, etc.).

8.13.3 For pain unrelieved by other interventions, medicate with:

- **Acetaminophen** 15 mg/kg po or pr
- **Fentanyl**: 0.5-1 mcg/kg IV/IM q 5-10 minutes with titration to pain control, wakefulness and airway protection.
    - Consider 0.5 to 2 mcg/kg Intranasal route as well if there is an available atomizer.
- OR
- **Morphine Sulfate**: 0.1mg/kg IV/IM every 10 minutes PRN pain.
    - For infants < 2-3 mos. use 0.03 – 0.05 mg/kg q 10 min).
- **Zofran**: 0.1 mg/kg IV over 2-5 minutes to Max of 4mg.
    - Use caution in patients less than 12 months of age or < 10 KG
    - Dosages may be repeated every 20-30 minutes for a total of two doses
- Administer **Naloxone** (Narcan) 0.1mg/kg IV/IM (max dose = 2 mg) for respiratory depression or signs of a narcotic overdose, and manage airway as needed.
- Contact receiving pediatric intensivist if above therapies are unsuccessful for options
    - **Ketamine**
        - 0.2 mg/kg to MAX 25mg and consider infusion
    - **Ketamine infusion**
        - 0.05 – 0.2 mg/kg/hr to max dose of 20 mg/hr

8.14 Pediatric Diabetic Ketoacidosis (DKA)

8.14.1 Objective:

- To rapidly identify and begin treatment for the pediatric patient presenting with Diabetic Ketoacidosis (DKA).

8.14.2 Indication:

- Pediatric patients with known Diabetes Mellitus (DM) presenting with elevated blood glucose levels.
- Pediatric patients presenting with related signs and symptoms for possible DKA, such as Kussmaul breathing, poor peripheral perfusion, altered mental status, a history of weight loss, polyuria, polydipsia, or polyphagia.

8.14.3 Considerations:

- Consider sepsis work-up as clinically indicated for patients presenting with DKA (if CBC obtained, initial WBC will likely be elevated and may not be indicative of underlying infection).
- Rapid reductions in serum blood glucose levels (More than 100mg/dl per hour) may cause profound cerebral edema and should be avoided. High risk patients for cerebral edema include patients <5 years of age, those with an initial pH <7.0, newly diagnosed DM patients, and significantly dehydrated patients with marked elevations in BUN.
- IV Bolus of insulin is not indicated.
- Initiation of insulin infusion is not mandatory, but should be considered for worsening acidosis or a long transport.
- Call pediatric intensivist prior to initiation of insulin therapy.

8.14.4 Diagnostic Criteria for DKA:

- To meet criteria for entering DKA protocol, patients should meet one of the clinical Indications listed above, and the following biochemical parameters:
    - Glucose value greater than 200 mg/dL (may be <200 mg/dL in rare situations, especially in infants)
    - Serum bicarbonate less than 15 mEq/L
    - Venous blood pH less than 7.25 or arterial pH less than 7.3
    - Presence of elevated serum ketones (>1.5 mmol/L) or positive urine ketones (large).
- Known or high index of suspicion of diabetes mellitus.

8.14.5 Evaluation:

- Monitor vital signs, weight (in kg), oximetry, neurologic status, and cardiac rhythm.
- Obtain Venous I-STAT. Repeat Glucose every 20 minutes. Do not reduce blood sugar by more than 100mg/dl per hour.
- Repeat venous I-Stat electrolytes every hour.
- Check Neurologic status (mental status, pupil response) Q1 hour.
    - Watch for signs of cerebral edema (altered mental status, severe headache, hypertension and bradycardia) consider: Mannitol 0.25 to 1 gm/kg IV bolus.

8.14.6 Intervention:

- Fluid Management:
    - IV Bolus: Start IV/IO, and draw blood for labs.
    - Give an IV bolus of 20ml/kg NS (maximum 1 liter) over 1 hour if the child is hypotensive ONLY.
    - Consult Pediatric Intensivist if further fluid needed.
    - After completion of bolus start maintenance IV fluids of ½ NS with 20 meq of KCL added at rate described below in table.
- **Glucose** Management (when insulin infusion has already been initiated).
    - Monitor patient for falling glucose levels as described below:
    - If glucose is below 250mg/dl, change IV fluid to **1L D5W ½ NS** with **20 meq of KCL** added at rate described below in table.

- If glucose continues to fall despite D5 ½ NS with 20 meq of KCL added at rate described below in table, continue fluid and decrease **Insulin** by 0.25 u/kg/hr.
- If Insulin infusion HAS been initiated by sending facility, monitor for falling glucose levels as described below and contact pediatric intensivist:

- **Insulin** Infusion:
  - Start immediately after completion of initial fluid bolus.
  - Mix 50 u human regular **Insulin** in 500 ml NS (0.1 u/ml final concentration).
  - Run 50 ml of solution through IV tubing to saturate binding sites on the tubing.
    - Infuse IV piggyback at a rate of 0.1 u/kg/hr (1 ml/kg/hr) on IV pump for children >3 years of age.
    - Infuse IV Insulin drip rate of 0.05u/kg/hr (0.5 ml/kg/hr) for children ≤3 years of age.
    - Continue IV Insulin infusion with IV maintenance fluid infusion until serum HCO3 is ≥18mEq/L.

8.14.7 Pediatric Maintenance Fluid Requirement in DKA

Approximate Weight	ML/HR of either 0.9% NS or D5 ½ NS Saline if FSBG less than 250mg/dl
5 kg	30 ml/hr
10 kg	60 ml/hr
15 kg	75 ml/hr
20 kg	90 ml/hr
25 kg	98 ml/hr
30 kg	105 ml/hr
35 kg	113 ml/hr
40 kg	120 ml/hr

Note: above are 1½ time normal maintenance infusion

ANY IV use of **Sodium Bicarbonate** is at the discretion of the receiving pediatric intensivist

8.15 Pediatric Cyanotic Heart Disease

8.15.1 Objectives:

- Restoration of cardiac output to improve tissue oxygenation and inadequate perfusion by maintaining an open ductus arteriosus and expanding intravascular volume as appropriate

8.15.2 Clinical Management:

- Assess and manage airway, breathing and circulation.
- Monitor ETCO2 if intubated.
- Apply oxygen and determine response.
- Obtain the largest IV access for the patient's size, two if possible.
- If unable to obtain IV access, IO access should be obtained without further delay, refer to standard.
- If no improvement in hypoxia with oxygen
    - Consider initiating **Prostaglandin E1** (from sending facility), alprostadil, infusion (patient must be intubated prior to initiation).
        - Carefully monitor patient for hypotension due to vasodilatory effects with prostaglandin.
        - Start 0.1 mcg/kg/min infusion and titrate to improved oxygenation and systemic perfusion, usual 0.02 – 0.5 mcg/kg/min
- If signs of pulmonary vascular congestion and/or fluid overload are present, withhold fluid bolus and administer **Furosemide** (Lasix) 1mg/kg IV.
- If no evidence of fluid overload
    - Resuscitate with 20 ml/kg crystalloid bolus over 5-10 minutes.
    - Repeat up to two times for a total of 60 ml/kg if patient remains in shock, unless signs of fluid overload are present.
- For patients failing initial fluid bolus, initiate inotropic support
    - Dopamine 2-20 mcg/kg/min
    - Dobutamine 2-20 mcg/kg/minute.
    - Epinephrine 0.1-1 mcg/kg/min.
- If blood glucose < 80mg/dL, refer to CCTTP 8.1.2
- Monitor urine output by indwelling urinary catheter if available. Titrate resuscitation to 1ml/kg/hr.

8.16 Pediatric Fluid Resuscitation and Maintenance

8.16.1 Indications:

- Calculation of initial maintenance fluid requirements in the infant and child who has received adequate fluid resuscitation and presents with effective systemic vascular perfusion.

8.16.2 Clinical Management:

- Bolus
  - Normal Saline at 20ml/kg, then change to maintenance
- Maintenance
  - Infants smaller than 10 kilograms:
    - **D5W 0.225% NS** at a rate of 4ml/kg per hour.
  - Children 10 to 20 kilograms:
    - **D5W 0.45% NS** at a rate of 40ml/hour, plus 2ml/kg per hour for each kilogram >10 kg from 11 to 20 kg
    - (i.e., the maintenance rate for a 15-kg child is 40ml/hour + 2ml/kg per hour (2ml x 5kg) = 50ml/hour).
  - Children larger than 20 kilograms:
    - **D5W 0.45% NS** at a rate of 60ml/hour plus 1ml/kg per hour for each kilogram > 20kg
    - (i.e., the maintenance rate for a 30kg child is 60ml/hour + 1ml/kg per hour for each kg from 21-30 kg (1ml x 10kg) = 70ml/hour).

8.16.3 Pediatric Maintenance Fluid Requirement

Approximate Weight	ML/HR
5 kg	20 ml/hr
10 kg	40 ml/hr
15 kg	50 ml/hr
20 kg	60 ml/hr
25 kg	65 ml/hr
30 kg	70 ml/hr
35 kg	75 ml/hr
40 kg	80 ml/hr

9. PERI-NATAL AND OBSTETRICS

9.1 General Considerations in Pregnancy

- Pre-departure assessment and stabilization is as critically important for the pregnant patient as for the neonate;
    - Once enroute, few options are available, either diagnostically or therapeutically. Keep moving.
- If fetal distress develops, it is difficult to intervene during patient transport
- Monitor status of child pre-departure;
- If LOM team feels uncomfortable, reject the transfer; contact medical director as soon as possible.
- Physician dialogue is imperative.
- Contact OLMD if any of the following signs or symptoms are present:
    - Coagulopathy; (Disseminated Intravascular Coagulation)
    - Fetal distress
    - Excessive maternal hemorrhage
    - Regular contractions (active labor)
    - Hemodynamic instability
    - Severe abdominal pain
    - Seizures/neurological instability
    - Pulmonary edema
    - Severe hypertension
    - Advanced cervical dilatation (>4 cm) relative to gestational age
- Controlled labor, on MgS04 or other tocolytics – patient transfer is acceptable;
- Uncontrolled labor necessitates dialogue between referring clinician and peri-natologist/OB medical control;
- Indications for F.H.T. monitoring include the following:
    - Increased contractions;
    - Bleeding
    - D.I.C.

9.2 Vaginal Bleeding Associated With Pregnancy

9.2.1 Indications:

- VAGINAL BLEEDING, ABRUPTIO PLACENTA, & PLACENTA PREVIA

9.2.2 Clinical Management:

- Consider delayed transfer if maternal or fetal distress is already noted.
- Assess and manage airway, breathing and circulation control as indicated.
    - Provide supplemental oxygen.
    - If necessary, ventilate the patient with 100% oxygen using a bag valve mask or transport ventilator.
- Strict bedrest. Left lateral recumbent position.
    - If bleeding copiously, elevate legs to increase blood supply to vital organs.
- Determine if the patient has increased uterine tone or specific areas of tenderness (i.e. increased uterine irritability or cramping). Determine the amount of bleeding.
    - Estimate volume of bleeding and determine if it is arterial or venous in origin.
- Monitor cardiac rhythm, pulse oximetry, and maternal vital signs.
- Obtain large bore IV access (at least 2) and fluid resuscitate as indicated
- Establish fetal heart monitoring and determine gestational age of the fetus.
- Frequently assess fetal heart rate and report persistent late decelerations, tachycardia and loss in variability to receiving facility prior to arrival.
- If hypotension is present consider judicious crystalloid resuscitation
    - If hypotension persists, consider administration of PRBC's and blood products as indicated.
- Assess for signs of labor.
    - Vaginal exams should be avoided.
    - Vagina exam will increase bleeding in instances of placenta previa.
- Consider insertion of an indwelling urinary catheter, especially if contractions are present.
- Emotional support to the mother and family.
- Observe for signs of DIC including evidence of petechiae, coagulopathy by hematuria, ecchymosis, bleeding from IV sites, and document the PT/PTT and CBC.
- Consider administration of tocolytics in the presence of premature labor, FOR THE PURPOSE OF COMPLETING THE TRANSPORT ONLY, if ordered by receiving physician.
    - IV **Terbutaline** and **Ritodrine** are contraindicated in the presence of hemorrhage.
- For patient who exhibits a coagulopathy, obtain appropriate blood component products for administration enroute, as per referring institution.
- It is important to notify the accepting institution for any significant changes to have appropriate personnel waiting for the transporting team's arrival.

9.3 Pain and/or Nausea In Pregnancy

9.3.1 Indications:

- Pregnant patients who have pain from labor or from an illness or injury who are hemodynamically stable should be medicated to help reduce or alleviate pain.
- Pregnant patients who have nausea and/or vomiting may be treated with a medication to relieve symptoms and increase comfort.

9.3.2 Clinical Management:

- Assess patient's hemodynamic status and level of pain and/or nausea.
- For pain administer:
  - **Fentanyl** (Class C). 0.5 – 2 mcg/kg to MAX 150mcg IV PRN.
- For nausea and/or vomiting administer:
  - **Zofran** (Class B) 4mg IV push. For persistent nausea/vomiting may need repeat q 20-30 minutes prn up to 16 mg.
- Reassess patient hemodynamically and document level of relief of pain and/or nausea.
- **Naloxone** may be used to reverse respiratory depression induced by narcotics (Class B).

9.4 Pregnancy Induced Hypertension

9.4.1 Indications:

- BP greater than 140/90 or a 30mmHg rise in systolic pressure or 15mmHg rise in diastolic pressure above baseline (pre-eclampsia) after the 20th week of pregnancy.
- This may be accompanied by proteinuria and edema.
- Treatment is more urgent if any of the following have occurred:
- Preterm labor
- Intra-cerebral bleeding,
- Seizures.
- Severe, continuous headache, often frontal or occipital.
- Dimness or blurring of vision.
- Persistent vomiting.
- Decreased urine excretion (<400 ml/24 hours); increased proteinuria (3+-4+).
- Fetal growth retardation.
- Cardiac decompensation, pulmonary edema, or cyanosis.
- In addition, staff must be cognizant of the potential of HELLP syndrome if the patient complains of RUQ abdominal pain.

9.4.2 Clinical Management:

- Definitive treatment can only be accomplished through delivery of the fetus(es).
    - This should be considered prior to transfer if the hospital has the capability to perform the delivery
- Assess and manage airway, breathing and circulation.
    - Provide supplemental oxygen to maintain SpO2 > 95%.
- Place patient in the left lateral recumbent position and decrease sensory stimulation as much as possible in transport
- Large bore IV access. Total hourly intake is usually limited to between 100 and 125ml.
- Monitor cardiac rhythm, maternal vital signs, deep tendon reflexes, and fetal heart rate by doppler, q 15 min.

9.4.3 Seizure Prophylaxis

- **Magnesium Sulfate** is used for prevention of seizures.
    - DOSAGE:
        - Mix 4 grams **Magnesium Sulfate** in 50 ml of NS and administer over 10 minutes.
        - Follow this with a drip (concentration of 1 gram = 25ml, for example 4 Gm in 100 ml), and begin continuous infusion at 2 grams per hour.
        - This may need to be increased if seizure occurs or in the presence of hyperreflexia.

9.4.4 Magnesium Toxicity

- Absent reflexes
- Respiratory or Cardiac Depression
    - Stop Magnesium Infusion
    - Administer Calcium Gluconate
        - 1 gram IV over 1-2 minutes.
- Magnesium Toxicity:
    - Absent reflexes:
        - Stop Magnesium
    - Respiratory or Cardiac depression:
        - Stop Magnesium
- **Calcium Gluconate** 1gm IV over 10 minutes
- Monitor intake and urine output. Consider insertion of a foley catheter.

9.4.5 Seizures

- Seizure activity should be treated with supportive care first:

- Treatment of choice is to load on **Magnesium Sulfate** 4-6g bolus, then a continuous infusion of 1-2g/hour, unless receiving physician prefers **Phenytoin**.
    - **Phenytoin** 18-20 mg/kg IV @ 12.5-25 mg/min (slower than usual dose due to altered protein binding).
    - **Lorazepam** 0.15 mg/kg to MAX dose of 2mg and may repeat twice
- Cerebral edema may be minimized by mild hyperventilation if the patient is intubated.
- Contact OLMD if considering an antihypertensive agent.
    - **Nicardipine** or **Labetolol** can be used to control blood pressures greater than or equal to 110 diastolic. Refer to CCTTP 4.14
    - The goal is to keep the diastolic pressure at approximately 90 to 105 mmHg and the systolic around 160 mmHg.
    - Avoid diastolic pressure of less than 90.
- Avoid the use of diuretics.
- If acute pulmonary edema is present with respiratory distress consider:
    - Head of bed up
    - Airway intervention with positive pressure ventilation
    - Consider **Furosemide** but use ONLY WITH RECEIVING OB O.L.M.D. CONSULT (20-40mg IV over 2 to 4 minutes).

9.5 Preterm Labor

9.5.1 Indications:

- Preterm Labor is defined as regular and rhythmic contractions that produce cervical changes after the 20th week of gestation and prior to the 37th week of gestation.
- The cause cannot always be identified.

9.5.2 Clinical Management:

- Prepare for imminent delivery.
- Assess and manage airway, breathing and circulation.
- Initiate cardiac monitoring, pulse oximetry and serial vital signs.
- Administer oxygen 2 to 4L/nasal cannula or 6-10L/mask as indicated to maintain SpO2 > 95%.
- Maintain left lateral recumbent position, not only to improve uterine perfusion and decrease uterine irritability, but to decrease pressure on the cervix from the presenting part.
- Avoid letting the patient sit or bend to avoid pressure on the cervix during transport.
- Initiate or maintain IV access and volume resuscitate as appropriate.
    - In general you can infuse 125ml per hour of NS.
    - Contractions can be caused by dehydration in the mother so a 250ml or 500ml bolus may be considered prior to tocolytic therapy when there is history of fluid depletion.
- Monitor contraction frequency and duration. Avoid vaginal exams if the membranes are ruptured unless delivery is imminent or fetal bradycardia develops.
- Emotional support to the mother and family.
    - This may include coaching the mother with breathing during contractions.
- Be prepared for delivery.
- You may be asked to continue antibiotics as initiated at the referring institution.
- Antepartum steroids may have been administered to the patient prior to your arrival to accelerate fetal lung maturity.
- The decision to administer tocolytic agents should follow upon a dialogue between the referring clinician and accepting perinatologist.
    - The air medical crew must achieve clarity as to the management plan, to include contingencies, prior to departure with the patient.

9.5.3 Tocolysis Options

- **Terbutaline** - 0.25mg SQ q 20 minutes until total of 0.75mg
- Hold if maternal pulse >120.
- Magnesium Sulfate:
    - Mix 4 grams Magnesium Sulfate in 50 ml NS and administer over 20 minutes.
    - Follow this with a drip (concentration of 1 gram=25ml, for example 4 Gm in 100 ml), and begin infusion at 2 grams per hour.
    - May increase by 1 gm/hr every 60 minutes for persistent contraction. Observe for magnesium toxicity (see below).
    - Note: Calcium Gluconate is used for the reversal of Magnesium Sulfate when signs of Magnesium toxicity are present.
        - Signs of Magnesium Sulfate toxicity
        - Respirations decreased to 12 per minute or less
        - Decreasing or absent deep tendon reflexes
        - Extreme muscular weakness.
    - If Magnesium Toxicity is present, consider **Calcium Gluconate**: 1 gram of 10% solution IV over 10 minutes.
        - Additional dose, dependent on patient condition may be administered 10 minutes after initial dose.

9.6 Premature Rupture of Membranes

9.6.1 Indications:

- Rupture of the amniotic membranes in a pregnancy of preterm gestation (prior to 37 weeks gestational age).

9.6.2 Clinical Management:

- Assess and manage airway, breathing and circulation.
- Administer oxygen 2 to 4L/cannula or 6-10L/mask as indicated to maintain SpO2 > 95%..
- Initiate cardiac monitoring, pulse oximetry and serial vital signs.
- Maintain left lateral recumbent position, not only to improve uterine perfusion and decrease uterine irritability, but to decrease pressure on the cervix from the presenting part. Avoid letting the patient sit or bend to avoid pressure on the cervix during transport.
- Initiate or maintain IV access and maintain 0.9% Normal Saline at a maintenance rate.
- Monitor contraction frequency and duration. Avoid vaginal exams if the membranes are ruptured unless delivery is imminent or fetal bradycardia develops.
- The use of tocolytics is controversial.
    - Generally, they may be administered to facilitate transport to an appropriate care facility or until a course of steroids is complete.
    - See previous discussion regarding use of tocolytics. (CCTTP 9.5.3)
- You may be asked to continue antibiotics as initiated at the referring institution.
- Antepartum steroids may have been administered to the patient prior to your arrival to accelerate fetal lung maturity.
- Remember the major complication associated with pre-term labor is delivery of an immature fetus. Be prepared for delivery and resuscitation should it occur.
- Emotionally support to the mother and family.

9.7 Trauma In Pregnancy

9.7.1 Indications:

- Any trauma, no matter how minor, blunt or penetrating, during pregnancy.

9.7.2 Clinical Management:

- Initiate trauma care as outline in the LifeFlight of Maine Trauma Protocol Section.
- Assess and manage airway, breathing and circulation.
    - Airway management as indicated.
    - Administer supplemental O2 to maintain SaO2 > 97%.
- The pregnant trauma patient should have spinal immobilization as indicated for any trauma patient.
    - The board should be tilted to the left with blankets to avoid compression of the great vessels
- Initiate or maintain at least 2 large bore IV's with NS infusing.
    - Vigorous volume resuscitation as indicated.
    - Avoid hypovolemia as fetus will be compromised early due to uterine vasoconstriction to shunt blood to vital maternal organs.
    - Request packed red blood cells from transferring hospitals if indicated.
- Assure monitoring of cardiac rhythm, maternal vital signs, fetal movement (if mother can speak), fetal heart rate, oxygen saturation and ETCO2.
- If uncontrollable vaginal bleeding and shock are present or if there are signs of a non-reassuring fetal heart rate, emergent Cesarean Section may be indicated immediately on arrival at the receiving facility.
    - Contact the receiving facility as soon as possible.
- A modifications of CPR in Pregnancy is the left lateral tilt position.
- The recommendation for drugs is to use standard doses.
- If facts and circumstances of the patient's demise are such that that peri-mortem caesarean section is a consideration, consultation with Online Medical Control must be accessed before cessation of resuscitative efforts. Possible Indications include:
    - Witnessed Arrest.
    - Effective CPR.
    - Unsuccessful R.O.S.C.
    - Gestational age greater than 30 weeks.

9.8 Unplanned Deliveries

9.8.1 Indications:

- In general, transport should NOT be considered if delivery is imminent or likely to occur during transport.
  - Caution should be used in patients that are actively laboring:
- Multiparous patients
- Cervix dilated 3-4cm or more with active labor and a substantially effaced cervix
- Contractions less than 5 minutes apart
- History of rapidly progressing labor
- Primiparous patients
- Cervix substantially thinned and dilated 4cm or more with active labor

9.8.2 Guidelines For Unplanned Delivery:

- Vertex Delivery (head presentation)
  - Position the Mother appropriately.
    - Put a towel underneath her buttocks so that you can pull down to deliver the shoulders of the baby.
    - Put sterile gloves on and drape the delivery area with a sterile towel.
    - Have bulb suction, clamps, and sterile scissors within reach.
  - Give reassurance to the mother and encourage her to take slow deep breaths between contractions, and to pant with contractions.
  - When there is pressure on the perineum gently support it with one hand.
    - If the amniotic sac is still intact, rupture the membrane.
  - Support the infant's head as it emerges and rotates externally.
    - Wipe the face gently and aspirate mucus from the mouth and throat with a bulb syringe.
    - After suctioning the mouth, gently suction the nose with the bulb aspirator.
    - Check the infant's neck for coils of umbilical cord.
    - If it is coiled around the neck tightly and cannot be slipped over the head, it must be clamped doubly, and cut between the clamps, and then unwound.
  - During a uterine contraction gently grasp the baby's head and depress it towards the rectum.
    - This enables the anterior shoulder to emerge under the symphysis pubis.
  - Next raise the head and the posterior shoulder can be born over the perineum.
  - Keeping the infant below the level of the placenta, tie or clamp the cord at least eight inches from the infant's navel.
  - Use two clamps or ties placed two inches apart.
  - Cut the cord between the clamps or ties and examine the ends to be sure there is no bleeding.
  - Dry and wrap the infant in a blanket; if the infant's and mother's conditions are stable, the mother can hold the baby.
- Delivery of the placenta should occur within thirty minutes after the delivery of the infant.
  - Apply gentle traction on the umbilical cord to deliver the placenta.
  - Do not pull.
  - Signs of placental separation include:
    - Lengthening of the cord
    - Gush of bright red blood
    - Fundus rises up in the abdomen.
- Apply direct pressure to any tears of the perineum that may be bleeding.
  - If bleeding is suspected other than a perineal tear, massage the fundus of the uterus. If bleeding is not excessive then massage the fundus every 15 minutes.
- Evaluation/Management of the Infant
  - Suction the oropharynx first, then both nares with the bulb syringe when the head is delivered.
  - If meconium is present, after the delivery the laryngoscope is employed to see whether there is meconium at or below the level of the vocal cords.

- If there is any meconium it should be suctioned out before any resuscitative measures are done, especially positive pressure ventilations.
- Suction with multiple times until the tube is clear of meconium.
- Administer blow-by 100% O2 until the baby is pink centrally. Support ventilations if the apical rate is less than 100 and/or respirations are absent or depressed.
- Maintain body temperature.
- Initiate cardiac compressions of > than 100/minute if the apical rate is less than 80 per minute.
- If drug therapy or volume resuscitation is indicated, consider cannulating the umbilical vein for vascular access.

9.8.3 APGAR scores should be noted at one and five minutes after birth.

SCORE	0	1	2
Appearance, color	Blue, Pale	Centrally Pink	Completely Pink
Pulse, HR	None	Less than 100	Greater than 100
Grimace, reflex	None	Grimace	Cough, gag, cry
Actitivy	Flaccid	Some Flexion	Well Flexed, active
Respiratory Effort	None	Weak, Irregular	Good, crying

9.9 Complications Of Delivery

9.9.1 Indications:

- For use in management of patients experiencing a complicated delivery

9.9.2 Breech Presentation (buttocks) or feet presentation):

- If delivery is in progress, allow the buttocks and trunk of the baby to deliver spontaneously.
- Direct the mother to push with contractions.
- Once the legs and arms are delivered, support the body on the palm of your hand and insert your finger into the baby's mouth and bring the chin down to allow the head to deliver.
- Have an assistant provide supra-pubic pressure to facilitate delivery of the head.

9.9.3 Shoulder Dystocia (the situation in which the head has been born but the shoulders cannot be delivered by the usual methods)

- Place the patient in a semi-Fowler position.
- The patient's legs are flexed, with the knees pulled back up onto the thighs.
- Hips are abducted out as much as possible increasing the AP diameter of the pelvis
- Suprapubic pressure can be used to attempt and push the anterior shoulder under the symphysis bone. Do not use fundal pressure.
- Consider reaching into the vagina to deliver the anterior shoulder by trying to rotate it into the pelvis, extraction of the posterior arm, or using a corkscrew maneuver to rotate the shoulders out of the pelvis.
- Delivery of anterior shoulder must occur within several minutes.

9.9.4 Prolapsed Cord:

- The umbilical cord lies beside or below the presenting part.
- Compression of the umbilical cord between the presenting part and the maternal pelvis reduces or cuts off the blood supply of the fetus and if uncorrected leads to fetal death.
- If fetal bradycardia occurs after rupture of the membranes, prolapsed cord should be considered.
- A diagnosis is made by seeing the cord either outside of, or in the, vagina; or feeling the cord on exam.
- Place a hand in the vagina and push and hold the presenting part up and away from the cord. Maintain until patient is in the operating room.
- Alternatively, the bladder may be filled via Foley catheter to maintain the head in a favorable position.
- Minimize manipulation of the cord.
- At the same time preparations are made for delivery.
- The woman is placed in the knee-chest or Trendelenburg position, with the hips elevated and the head low.
- Oxygen by NRB to the Mother.
- Fetal heart rate is checked by Doppler if available, and may possibly be palpated in the cord.
- Terbutaline 0.25mg sq as a tocolytic agent, to decrease frequency of contractions.
- If the baby is okay and the cord is protruding out of the vagina, a gauze with sterile saline may be placed on it.

9.9.5 Amniotic Fluid Embolus:

- Amniotic fluid embolus occurs when amniotic fluid gains access to the maternal circulation during labor or delivery resulting in obstruction of the pulmonary vasculature.
- In addition to the actual amniotic fluid causing emboli, particulate matter such as meconium, lanugo hairs, fetal squamous cells, bile, fat, and mucin may also cause pulmonary emboli.
- Maintain airway and supplemental ventilation and oxygen as indicated. PEEP may be indicated beginning at 5cm.
- Two large bore IV's and fluid resuscitate as needed.
- Monitor mother and fetus frequently and treat mother's symptoms as indicated.
- Watch for evidence of D.I.C.

9.9.6 Post-Partum Hemorrhage: (PPH) Continuous bleeding after delivery.

- Fundal massage

- Bimanual uterine massage
- Observe and treat for hemorrhagic shock
- Oxytocin 20 units added to 1000ml of NS and delivered at 300ml/hr.
- If bleeding continues administer Prostaglandin (15 methyl prostaglandin F2 alpha) 250 ug IM. (contraindicated in asthma)
- If Bleeding continues administer: Misoprostol/Cytotech 1000mcg PR, if available.
- Lacerations (cervical or perineal)
- Direct pressure until it can be repaired
- Fluid resuscitation as indicated

9.9.7 Uterine Rupture

- Monitor and treat for hemorrhagic shock
- Administer Oxytocin 20 units IM.
- If bleeding continues administer Oxytocin 20-40 units in 1000ml of NS at 200-300ml per hour.
- Increase rate at 15-30 minute intervals.

9.10 Ruptured Ectopic Pregnancy

9.10.1 Goal:

- Once identified, the ruptured ectopic pregnancy is a true obstetrical emergency.
- Patients must be transported to a center where an emergent exploratory laparotomy can be completed to correct this potential source of bleeding.

9.10.2 Clinical Management:

- Assess and manage airway, breathing and circulation.
- Provide supplemental oxygen to maintain SpO2 > 95%.
- Establish 2 large bore IV's, with NSS infusing as needed for hypovolemia.
- Obtain PRBC's from referring facility if available, and transfuse as needed.
- Keep head of patient flat, if hypotensive.
- Notify receiving facility of patient condition, and need for emergent operative intervention.
- Keep patient NPO. Decompress stomach with NGT as needed.

10. INTUBATION TIPS

10.1.1 PREPARATION

- Four Cornerstones (Minimum requirements for emergency intubation)
  - 1. Laryngoscope with both straight and curved blades
  - 2. ET tube with backup tube size
  - 3. Suction
  - 4. Bougie
- Failed Airway Options
  - Minimum requirements for emergency intubation:
    - Supraglottic airway (e.g. - King, LMA)
    - Surgical airway kit
- HELP Position
- LARYNGOSCOPY
  - Wide View Laryngoscopy ("heads up")
    - Keep your own eyes up and away from the patient's face. Although some would argue that true binocular vision does not always occur or is not always necessary, the "heads up" position generally provides optimum vision because it increases the focal distance to the cords. The importance of focal distance is illustrated when intubating patients while sitting on the floor and behind the patient's head; keeping your own head up and away from the patient provides an optimum focal distance and visual field for intubation. The other advantage of the "wide view" ("heads up") position is that it allows the laryngoscopist to see more than the cords in the visual field – an important concept in managing most emergency intubations in uncontrolled conditions.
  - Bimanual Laryngoscopy ("two hands")
    - Use both hands to find the cords. While one hand holds the laryngoscope, the other should be kept free to open the mouth, remove teeth and foreign material, help control the tongue, etc. During RSI, cricoid pressure is generally applied by an assistant. If the view of the cords (POGO) still needs to be improved, that can best be done by the laryngoscopist him/herself, again as long as the second hand remains free. External Laryngeal Manipulation (ELM) can be done by the laryngoscopist to improve the POGO score as needed. Once optimal POGO is obtained, the assistant then takes over cricoid pressure in the "new and improved" position. "Hand over hand" is a variation of this technique.
  - Incremental Laryngoscopy ("walk the tongue")
    - Emergency airway management generally involves unscreened patients with a variety of anatomical variations, including the "ugly airway." In this technique, the laryngoscope is progressively and carefully moved through the pharynx in increments, identifying anatomical landmarks and variations along the way ("walking the tongue"). When the epiglottis has been identified, the tip of the blade is then placed in correct position in relation to the epiglottis. Finding anatomical landmarks and proper placement of the laryngoscope blade should not be hurried, and should be expected to take at least 5-10 seconds in most unscreened patients. Only after landmarks have been identified, and the blade optimally placed in relation to the epiglottis, should any significant pressure be applied to open the airway with the laryngoscope blade. If the cords are then sufficiently visible enough to confidently pass the ETT or bougie, one of these is then passed and the intubation is completed.
  - If landmarks are still uncertain at this point
    - Consider removing the laryngoscope blade completely, and making some adjustments before proceeding further. In a truly difficult airway, it is generally good practice to anticipate this kind of "orientation pass" and to make these changes now, rather than to continue further into unknown territory. Possible helpful adjustments might include

ELM (see below), changing head position ("sniff, "ramp," and HELP), use of suction or forceps to remove foreign material, use of the rigid suction tip as probe, changing blade type (curved vs straight vs Howland lock), etc.

- The point is to take the necessary time to identify landmarks, and proceed carefully in increments when challenged by a truly difficult emergency airway.

- Bougie Tips and Perspectives
  - The gum elastic bougie (Eschmann, "tube changer," etc.) is a practical and effective first-line device for securing even extremely difficult airways, particularly in the presence of blood, vomitus, or anatomic deformities. It can generally be placed by direct vision easier than a cuffed ET tube, and can often be placed by "feel" of the tracheal rings even when anatomic structures are obscured. "If the ET tube cannot be quickly and confidently passed through the cords under direct vision, it is generally best to first pass the bougie to secure tracheal placement, then pass the ET tube over the bougie."
  - Select the right bougie
    - All bougies are not equally effective. Select one that is stiff enough, even at the high temperatures that might be found in an ambulance or aircraft on a hot day.
  - Shape the bougie
    - Bougies tend to take on the shape of their packaging. When coiled in a small pack, for example, the bougie will need to be appropriately shaped before use. Note that bougies all have "short term memory" and can be re-shaped quickly and easily.
  - Rotate to feel rings
    - Tracheal rings are usually easy to identify when the bougie is in the trachea, with the coude' tip angled anteriorly, toward the front of the trachea. However, sometimes it is necessary to rotate the bougie tip through 180 degrees to get the best "feel" of the rings, even when the bougie is correctly placed.
  - Rotate to pass obstructions
    - Even when correctly placed in the larynx, the bougie can still hang up on anatomical structures, such as the true vocal cords and the anterior commissure. When encountering an obstruction, back the bougie a bit, and rotate gently ("back and roll") to walk the tip past the obstruction.
  - Troubleshoot with laryngoscope
    - The laryngoscope can be used as a "troubleshooting tool" for a variety of situations during intubation. When difficulties occur in passing the bougie through the cords, particularly when passing the bougie by feel in a "blind" Procedure, the laryngoscope can often be used to help provide some helpful orientation to the position of glottic structures and to the position of the bougie tip, even if the cords themselves cannot be seen.
  - Bury the bougie
    - The tip of the gum elastic bougie (and its plastic variations) is generally considered to be an atraumatic tip if handled gently and carefully. After the trachea is identified, place the bougie deep into the trachea. This prevents flipping the tip out of the trachea and into the esophagus when the ET tube is guided "around the corner" of the pharynx.
  - Afterload the tube
    - It is generally best to afterload the bougie with an ET tube, after it is placed and confirmed in the trachea. Preloading might save a few seconds, but that kind of time savings is not generally significant. More importantly, preloading the ET tube interferes with the proper "feel" of the bougie tip on the tracheal rings, and also interferes with rotation of the bougie tip.
  - Control the bougie when loading
    - If the bougie tip were to be placed just beyond the cords, it would be necessary to use the second hand at the mouth to firmly stabilize bougie in the trachea when loading the ET tube. This makes afterloading the ET tube difficult, since the proximal end of the bougie is not well stabilized. If the patient is sedated and paralyzed during RSI, however, and

the bougie is placed deep in the trachea ("bury the bougie"), the second hand can adequately stabilize the bougie at the proximal end. This makes loading the ET tube much faster and easier.

- Straighten the airway
  - Once the ET tube is loaded over the bougie, it must now be guided around the angle of the pharynx at the base of the tongue. Straightening the airway makes this step much easier and quicker. The airway can be straightened with the second hand by using a laryngoscope (even without the light), or by simply lifting the tongue and jaw with the thumb of a gloved hand.
- Passing obstructions
  - Even when properly placed, the ET tube can still hang up on anatomic structures, much the same as the bougie. And as with the bougie, the tip of the ET tube can sometimes be moved back and rotated ("back and roll") to clear the obstruction. And as with any type of cuffed tube, a gentle reciprocating action is generally helpful, and can be combined with rotation.
- Troubleshoot with laryngoscope
  - Just as the laryngoscope can be used as a "troubleshooting tool" when passing the bougie, it can also be used to navigate through obstructions that might be encountered when passing the tube over the bougie. Not only does it provide some visual orientation, it also helps to straighten the airway.
- Feel the tube pass
  - Whether or not a bougie is used first for placement, the passing of the ET tube cuff through the larynx can generally be felt by the assistant who is holding cricoid pressure.

11. MECHANICAL CIRCULATORY SUPPORT DEVICE CHECKLIST

11.1.1 Note: This guideline is not designed to determine the appropriate use of ECMO, IABP, LVAD, Tandem Heart or Impella devices, rather its function is to edit the critical care transport team to ensure all logistics have been addressed prior to transport.

☐ Critical Care Transport Equipment

- Mechanical ventilator.
- Cardiac monitor with appropriate adjuncts to continuously monitor venous and arterial pressures
- Black bag.
- Medication bag as well as narcotic satchel.
- Appropriate number of Braun Pumps or functioning alternative for use in transport environment

☐ Prepared Blood Products in cooler

- One to two units of Type O negative as per standard protocol
- Cross-matched PRBC (appropriate for distance of transport) packed in cooler (minimum of one unit) of there is concern for ongoing bleeding
- Platelets in cooler if count <100 or evidence ongoing bleeding
- Liquid plasma (LP) if INR >1.4 or evidence of ongoing bleeding
- Cryoprecipitate if fibrinogen <150 or evidence of ongoing bleeding

☐ Access

- Functional arterial line (radial or femoral access)
- Central Venous Access (Three lumen central line minimum)
- Cordis as needed

☐ Equipment/medication specific to ECMO or other supplemental hemodynamic or ventilatory support

- If patient is being transported with perfusion from your facility, ensure perfusion has addressed any ECMO circuit incompatibilities with receiving center prior to transport.
- Suitable blood pump, centrifugal or roller
- Membrane oxygenator, appropriate for the patient size
- Device(s) for heating and regulating circuit blood temperature (less critical for adult transports)
- Medical gas tanks, regulators, hoses, connectors, flow meters, and blenders for provision and adjustment of blended sweep gas to the oxygenator.
- I-Stat or other suitable Point of care anticoagulation monitoring equipment to assess blood gases, electrolytes, hemoglobin, glucose and anticoagulation (e.g., Activated Clotting Time)
- Emergency pump or manual control mechanism in the event of primary pump failure or power failure
- Uninterruptable power source(s) capable of meeting the electrical power needs of all equipment during transfer between vehicles and in the event of vehicle power source failure
- If Impella – spare purge cassette and tubing
- If LVAD – Spare batteries as indicated
- If Tandem heart, Consult sending team prior to transfer
- If inhaled epoprostenol – new bag of medication (appropriate for minimum two to three times transport distance)

- If intravenous vasoactive medications – new bag of each medication (appropriate for minimum two to three times transport distance)
- If continuous sedation/analgesia/NMB – new bag of each medication (appropriate for minimum two to three times transport distance)

☐ Personnel
- Perfusionist – confirm from sending/receiving. If from sending hospital, confirm will require plan for return if applicable
- Surgeon/ECMO specialist – if accompanying from sending hospital, confirm will require plan for return if applicable
- On arrival of transport team, expectation for conference call with sending attending physician, receiving attending physician, transport team
- Flight team consisting of critical care paramedic and flight nurse.

☐ Preparation
- Pre/post membrane and systemic blood gas within 30 minutes of initialization of transport
- CBC, PT/ INR, Fibrinogen, CMP within four hours of initialization of transport
- Lactate within two hours of initialization of transport.

☐ Logistics of Transport
- Imaging copied and placed in chart
- ED note, History and Physical, Discharge Summary or other appropriate clinical notes included.
- Laboratory Results
- EMTALA form signed
- Completion of Physician Report as well as Nurse to Nurse Report
- Appropriate transport notifications (Ground Teams, Ambulance Logistics and Rotor / Fixed Wing details addressed.)

12. DRUG MIXING REFERENCE

Mixed Drug	Supplied	Drug	Diluent	NS	D5W	Sterile Water	Infusion Rate Limits
Amiodarone	50mg/mL	180mg	100mL		Non-PVC		15mg/min
Calcium Gluconate	1 g/10mL	1g	100mL	Y	Y		50 mg/min
Cefazolin	1g Powder	1 - 2g	10mL	INF		BOLUS	250 mg/min
Diltiazem	125 mg/25mL	125mg	100mL	Y	Y		15 mg/hr
Dobutamine	250 mg/20mL	250mg	230mL	Y	Y		20 mcg/kg/min
Dopamine	400 mg/20mL	400mg	230mL	Y	Y		20 mcg/kg/min
Epinephrine	1 mg/1mL	2mg	250mL	Y	Y		0.5 mcg/kg/min
Famotidine	20 mg/2mL	20mg	100mL	Y	Y		1 mg/min
Fosphenytoin	500 pe/10mL	20mg/kg	50/100mL	Y	Y		150 pe/min
Nicardipine	25 mg/10mL	25mg	250mL	Y	Y		15 mg/hr
Nitroglycerin	50 mg/10mL	50mg	250mL	Non-PVC	Non-PVC		200 mcg/min
Norepinephrine	4 mg/4mL	4mg	250mL	Y	Y		0.6 mcg/kg/min
Octreotide	1000 mcg/10mL	1000mcg	100mL	Y	Y		50 mcg/hr
Oxytocin	10 units/mL	20units	1000mL	Y			None
Pantoprazole	40mg/10mL	80mg	80mL	Y			20 mg/min
Vasopressin	20 u/mL	20units	50 mL	Y	Y		0.4 u/min
Vecuronium	10mg/10mL	10mg	10mL			Y	None