Monroe-Livingston Regional EMS

Advanced Practice and Specialty Care Paramedic Clinical Guidelines

TABLE OF CONTENTS

MEDICAL CONTROL

Medical Control for Interfacility Transports (IFT) by any practitioner (Advanced Practice Paramedic or Specialty Care Transport Paramedic) is provided by Physicians designated by the Monroe Livingston Regional EMS Medical Director. The Provider must have a means of direct communication to the IFT Medical Control Physician on-call at all times during their care of the patient.

The presence of a phone icon next to a medication or procedure requires IFT Medical Control prior to initiating the order.

Interfacility Transport Medical Control/Communication Failure

Contact with IFT Medical Control will be dictated by protocol and should be available at all times. In the event of being unable to contact the IFT Medical Control, the following mechanism will be instituted:

1. Direct contact with a designated back-up MLREMS approved IFT Medical Control (if available).
2. Direct contact with standard medical control.
3. In the event of failure of all of the above, treatment Clinical Guidelines will be regarded as standing order, however procedures requiring absolute on-line medical command should not be undertaken unless in a life threatening emergency situation.
4. In the event of a procedure requiring absolute on-line direction being undertaken without medical control, the procedure and events surrounding it will be reviewed within 24 hours by the agency Medical Director to determine if retroactive approval is warranted.

Orders from transferring/receiving physicians

During inter-hospital transport, medical crews will be asked to continue treatment initiated at the transferring hospital. These orders must be written and signed by the referring physician. If at any time the Paramedic questions orders from a referring or receiving physician, IFT Medical Control **MUST** be contacted. Likewise, any time a transferring or receiving physician asks the Specialty Care Transport crew to carry out medical treatment for which they have not been trained, or which appears to be in conflict with established treatment Clinical Guidelines, IFT Medical Control **MUST** be contacted before initiating care.

Potentially Unstable Transports

It is the requirement of the sending facility to provide sufficient interventions to stabilize the patient prior to transport. If, in the opinion of the Paramedic, the patient is not stable for transport, discussions with the sending facility and possibly IFT Medical Control should occur to determine how best to stabilize the patient for transport. Potential solutions include further interventions (such as intubation) at the sending facility or use of another transport unit or agency with additional capabilities.

Intubation before transport is the responsibility of the sending facility and should be done by them. Transport should not commence until the sending facility has successfully managed to create a stable airway. In the event that they refuse, contact IFT Medical Control.

BLOOD PRODUCT CONTINUATION

INDICATIONS

Patients requiring blood product continuation during the course of their interfacility transport.

PROCEDURE

1. Prior to transporting the patient, the Paramedic MUST check the following:
    a. Confirm the written physician order for blood transfusion.
    b. Make sure the patient is wearing an ID bracelet with his/her name and hospital ID number from the hospital of origin.
    c. Identify the patient with the nurse and verify the Patient ID band against the blood label and blood order for name, blood type and unit identification number. Verify exact spelling of the patient's first and last name, medical record/ID number and an expiration date/time.
    d. Verify IV catheter size and document (IV catheter size should be large enough to minimize hemolysis – no smaller than 20 gauge catheter should be used. If a 20 gauge catheter is used, avoid rapid infusion under pressure).
    e. Verify the patency of the infusion site and document.
    f. Verify the infusion rate as ordered by the MD.

    Important information about blood and blood components includes the following:
    - No blood container may be vented
    - All blood components must be administered through a filter (170 to 260 microns standard)
    - No medications or intravenous solutions may be added to or infused through the tubing with blood or blood components, with the exception of 0.9% Sodium Chloride solution (Normal Saline)

2. If possible, all blood should be prepared for administration and hung prior to leaving the sending facility. If transport time exceeds the time for administration of blood hanging and additional units are required, each unit must be verified using the above procedure and the signature of the reviewing nurse and the Paramedic must be documented on the transfusion record.

3. Blood and FFP not being infused must be kept in a shipping container where the temperature is maintained between 1 and 10^0C. Dry ice is NEVER to be used to cool blood or blood components. Blood removed from this cold storage container must be used immediately. Platelets and cryoprecipitate *must* be stored between 20-24°C.

4. Prepare the Y-Type administration set.

a. Y-type blood administration sets can be used to administer a maximum of two units of whole blood or packed RBCs simultaneously, but usually only one unit at a time is hung per administration set. Should two (2) units be transfused simultaneously two (2) separate IV sites are required.
b. Close both roller clamps
c. Spike a 1000mL bag of 0.9% normal saline and prime tubing (make sure drip chamber is filled with enough saline to saturate the filter to prevent hemolysis as blood drips from the bag). Close roller clamp.
d. Spike unit of blood component.
e. Open the roller clamp between the unit and drip chamber, making sure the filter is covered with liquid.
f. Prime the remaining length of tubing.
g. Administration sets are required to be changed after four (4) hours

5. Attach the administration set to the primary IV line or insertion site.

6. Adjust the rate of infusion to infuse 10 to 15 drops per minute for the first 15 minutes.

7. Monitor the vital signs every 5 minutes during the first 15 minutes of the transfusion, then at least every 15 minutes for the remainder of the infusion. Temperature must be included in vital signs, as an increase in temperature is an early sign of transfusion reaction.

8. Monitor the patient for any signs of transfusion reaction, including temperature changes, as described above. Stop the transfusion immediately if the patient becomes agitated, short of breath, tachycardic, hyperthermic, or develops a rash, chills, hematuria, or any other symptoms described below. If the provider is concerned that there MAY be a transfusion reaction occurring, the transfusion should be stopped immediately. The following are signs of the most common types of transfusion reactions that may occur:

    a. Hemolytic reactions
        i. Hemolytic reactions are the most life-threatening. Clinical manifestations may vary considerably: fever (<1^{0}C [mild] to >2.5^{0}C [severe]), chest or back pain, pain at the infusion site, hypotension, nausea, generalized bleeding, impending sense of doom or oozing from surgical site(s), shock. The most common cause is from ABO incompatibility due to a clerical error or transfusion to the wrong patient. Chances of survival are dose dependent. Therefore, it is important to stop the transfusion immediately if a hemolytic reaction is suspected. Do not discard blood, blood product container or administration set.

b. Febrile, non-hemolytic reaction
    i. Chills and fever (rise from baseline of 1^0C or 1.8^0F)

c. Allergic reaction
    i. Characterized by appearance of hives and itching (urticaria or diffuse rash)

d. Anaphylaxis
    i. May occur after administration of only a few milliliters of a plasma-containing component. Symptoms include coughing, bronchospasm, respiratory distress, vascular instability, nausea, abdominal cramps, vomiting, diarrhea, shock and loss of consciousness

e. Transfusion-Associated Cardiac Overload (TACO)
    i. Characterized by dyspnea, headache, peripheral edema, coughing, frothy sputum or other signs of congestive heart failure occurring during or soon after transfusion (restrict fluids).

f. Transfusion-Related Acute Lung Injury (TRALI)
    i. Characterized by dyspnea, pulmonary edema and symptoms similar to Acute Respiratory Distress Syndrome (ARDS), usually within 6 hours after transfusion. Consider oxygen and ventilator support.

9. If a transfusion reaction occurs or is suspected:
    a. Stop the transfusion immediately; keep saline open at a KVO rate.
    b. Do not discard any blood, blood product container(s) or tubing used
    c. Treat the patient for shock as needed
    d. Administer Diphenhydramine 50 mg IV or IM as necessary.
    e. Consider Epinephrine per Anaphylaxis/Allergic Reaction Protocol if anaphylaxis is evident.
    f. Contact medical control prior to any administration of epinephrine intravenously.
    g. ***UNDER NO CIRCUMSTANCES MAY THE TRANSFUSION BE RESTARTED UNTIL THE PATIENT HAS BEEN EXAMINED BY A PHYSICIAN.***

10. Documentation must include the blood donor identification number and the product type transfused, amount transfused, temperature, and any adverse reactions noted, as well as any subsequent treatment.

11. Calcium Chloride 10% (1 g) may be considered if massive transfusion (5-6 units) Medical Control must be contacted prior to the administration of calcium.

12. Medical control must be contacted prior to initiating any additional units of blood products.

GENERAL INDICATIONS AND GUIDELINES FOR THE ADMINISTRATION OF VARIOUS BLOOD PRODUCTS

Product	Composition/Volume	Indications	Administration
Packed Blood Red Cells	300 ml whole blood with 80% of plasma removed	Anemia, shock	100 mL/hr to wide open
Fresh Frozen Plasma	200 - 250 mL of fluid portion of blood with clotting factors (platelets, RBC's and WBC's removed)	Need for clotting factors (massive transfusion, DIC, etc.)	2 units at a time, over 60 min
Cryoprecipitate	20 – 30 mL; contains clotting factors VIII, XIII, and fibrinogen	Need for clotting factors (Von Willebrand Disease, low fibrinogen, bleeding following rTPA)	Several units (150mL) at once, wide open
Albumin 5% or 25%	50 – 100 mL of the plasma protein albumin	Shock, burns	Use 15 micron filter at 5-10 mL/min (5%) 2-3 mL/min (25%)
Platelets	200-300 mL of platelets	Massive transfusion, thrombocytopenia	Wide open for life threatening hemorrhage or total in 60 min
Whole Blood	500 mL of all blood components with added preservatives	Severe hemorrhage with volume deficit and anemia	Wide open

THORACOSTOMY (CHEST) TUBE MANAGEMENT

INFUSION MANAGEMENT

INDICATIONS

1. A medication pump is available and will enhance the safety of prehospital medication administration.
   OR
2. Patients requiring interfacility transportation are receiving medications other than isotonic crystalloids or antibiotics safe for gravity delivery.

CONTRAINDICATIONS

1. The patient is receiving more than three simultaneous infusions (Request SCT Paramedic).
2. The patient is receiving more than one medication which significantly affects patient hemodynamics (Request SCT Paramedic).
3. The paramedic has not been trained in the specific medication pump available.
4. The medications are unfamiliar to the paramedic and safety concerns cannot be resolved (Consider IFT Medical Control for further guidance).
5. No pump is available for interfacility transport of medications other than isotonic crystalloids or antibiotics safe for gravity delivery.

PROCEDURE

1. Confirm orders *including titration instructions* for each medication from sending physician, IFT Medical Control, OR the medication is given as described in the NYS ALS Collaborative Protocols
2. Check and confirm safe and reliable intravenous or intraosseous access
   a. Central access confirmed safe by the hospital is preferred for vasoactive infusions
   b. 18ga or larger IV access in the proximal arms is preferred
   c. IO access which is confirmed to be working appropriately may be considered
3. Confirm the compatibility of any medications which are infusing through a shared vascular access site
4. If the medication is not yet infusing, or requires transition from a sending facility pump to an agency-specific transport medication pump, program the pump according to prior training and manufacturers recommendations. Confirm the correct medication and infusion rate using the Medication Administration Cross Check (MACC) procedure with partner, or sending facility practitioner (physician, nurse, etc).
5. If the medication is already infusing, and the sending facility's medication pump will be utilized for the transport, confirm the medication pump is providing the ordered

medication and rate using the MACC procedure with partner or sending facility practitioner.

6. For multiple medications being transported, ensure each medication pump or channel and tubing is labeled and matches the bag or bottle infusing
7. The patient must be constantly monitored throughout the transport including:
    a. Continuous pulse oximetry.
    b. Continuous ECG monitoring.
    c. Frequent blood pressure monitoring.
    d. Frequent examination of the infusion site.
8. The medication pump should be stopped if the paramedic suspects infiltration and IFT Medical Control contacted for further orders
9. Medications may be discontinued when infusions are complete unless otherwise directed by sending physician or IFT Medical Control. If primary infusion, remove the administration tubing, flush the line with saline, and secure the saline lock. If secondary infusion, remove the administration tubing and maintain carrier infusion unless otherwise directed by sending physician or IFT Medical Control.
10. Contact IFT Medical Control for any adjustment to the infusion rate not covered by the sending facility or within the ALS Collaborative Protocols.

THROMBOLYTIC INFUSION MANAGEMENT

INDICATIONS

Patients who, while being transferred to a higher level of care, are receiving alteplase (tPA) for the treatment of an acute ST–Segment Myocardial Infarction, Pulmonary Embolism (PE), or Stroke.

INCLUSION CRITERIA

An Advanced Practice Paramedic with agency credentialing to maintain a patient on an alteplase infusion may transport provided the patient has:

- Systolic BP between 110-175 mmHg
- Diastolic BP between 60-105 mmHg
- Heart Rate between 50-120
- Oxygen saturation > 92% on NC
- No other medications or devices that require SCT transport by regional or agency policy.

MANAGEMENT GOALS

- Provide for patient comfort and safety
- Ensure completion of thrombolytic medication
- Close and frequent monitoring of patients physical and neurologic condition
- Accurate documentation of NIHSS exam throughout the transport

CARE GUIDELINES

1. Confirm tPA dose and pump settings
2. Monitor patient's vital signs and neurologic exam (i.e. NIHSS) at a minimum of every 15 minutes during the alteplase infusion as well as after the infusion during transport.
    a. If the patient's neurologic exam decompensates, stop the alteplase infusion and contact Online Medical Control.
    b. Infusion should not be restarted until evaluated by the receiving facility.
3. Monitor for hemorrhage
    a. Bleeding from gums, venipuncture sites, hematuria, hemoptysis, hematomas, ecchymosis in the absence of hemodynamic instability requires contact with Online Medical Control and consideration of stopping the alteplase infusion.
4. Monitor patient's vitals every 15 minutes with special attention to blood pressure. Any systolic >185 mmHg or diastolic >110 mmHg requires contact with Online Medical Control.

TRANSPORT VENTILATOR MANAGMENT

MANAGEMENT GOALS

- Selection of proper settings for all parameters based on patient condition
- Maintenance of oxygenation and ventilation status:
  - SpO_2 > 92%
  - $ETCO_2$ 35 - 45 mmHg
- Maintenance of cardiac output after increase in intra-thoracic pressure

CARE GUIDELINES

- Gather info: age, sex, height (IBW), PMH, current medical condition, medications, ABG's within last 30 minutes (if available), current ventilator settings (If available)
- Assess ETT placement, breath sounds, oxygenation, waveform capnography, and ventilation status.
- Assess sedation and neuromuscular blockade (if given) status.
- Select ventilation settings (use settings from referring facility, if available, as a starting point):
  - **Ventilation mode**: Initially select most appropriate mode for patient condition
  - **Set FiO_2**: Initially 100% unless previously oxygenating well on different settings.
  - Gradually lower FiO_2 after ventilation begins as tolerated.
- Set Tidal Volume and Rate:
  - Tidal volume: 6 mL/kg of IBW
  - Resp rate: 10 bpm and titrate to maintain end tidal CO_2 of 35-40 mmHg
- Set I:E Ratio: 1:2 to start (1 sec Inspiratory time, 2 sec Expiratory time)
  - 1:3 or 1:4 in patients with obstructive airway disease
  - 2:1 or 3:1 may be used in patients with severely decreased compliance (ARDS, etc.)
- Set Inspiratory Flow Rate: 0.75 – 1 L/sec, in most cases; depends on I:E ratio and desired tidal volume:
  - A slower IFR reduces turbulence and improves alveolar recruitment, but increased inspiratory time
  - A faster IFR shortens inspiratory time, but increases airway turbulence
- Set PEEP: 5 - 7 mmHg for healthy lungs, and gradually increase PRN to improve oxygenation after the FiO_2 is 100%. Monitor patient and hemodynamics to account for the concurrent increase in intrathoracic pressure.
- Set Pressure Alarms: Pressure Limit should be 10 – 15 cm H_2O greater than the peak inspiratory pressure
- Follow manufacturer's guidelines for checks prior to attaching to patient
- Turn on ventilator and then attach circuit to patient
- Assess breath sounds, chest rise, skin color, $ETCO_2$, SpO_2, airway pressures, and blood pressure

- Titrate ventilation settings:
  - Gradually reduce FiO_2 to the lowest fraction that will maintain an SpO_2 of 92%, ideally FiO_2 of < 0.4
  - Adjust tidal volume and/or vent rate according to patient presentation/clinical condition, and $ETCO_2$ trend to maintain target respective values
- Monitor peak airway pressure, mean airway pressure, plateau pressures, and minute volume
- All intubated patients must have $ETCO_2$ monitoring upon intubation, or at the time of transfer to the ventilator.

SPECIALTY CARE TRANSPORT SCOPE OF PRACTICE

The MLREMS Specialty Care Transport Paramedic provides a level of care above that of the Paramedic in order to safely provide interfacility transport of critically ill patients. These Specialty Care Transport Clinical Guidelines are to be used only by credentialed MLREMS SCT Paramedics and are to be used in concert with the Paramedic scope of practice when performing an interfacility transport. These Clinical Guidelines do not limit the ability of a provider to transport a patient with the physiology (pericardial effusion for example) stated in these Clinical Guidelines, but rather are only to be used during interfacility transports of patients with additional medications or devices not described under New York State Collaborative ALS Protocols including but not limited to:

- Patients that have more than one vasoactive medication.
- Patients that are orotracheally or nasotracheally intubated, or have a tracheostomy tube and are unstable, who require advanced mechanical ventilation management based on their condition.
- Patients that are being hemodynamically monitored with invasive monitoring devices, including arterial, Swan Ganz, or similar central access devices.

The following Clinical Guidelines are considered standing order except if notification is made to contact medical control, which is considered Absolute On-Line with no exception for radio or phone failure. All MLREMS Paramedic Clinical Guidelines are standing order for the Specialty Care Transport Paramedic when executing an interfacility transport except in cases identified as Absolute On-Line with no exception for radio or phone failure.

SCT STANDARD OF CARE

These “Specialty Care Transport Clinical Guidelines” are only to be used by personnel designated as a “Specialty Care Transport Paramedic” by the MLREMS Medical Director. The Clinical Guidelines are NOT to be used for routine 9-1-1 system responses for service. Routine advanced life support care is directed by the most recent version of the New York State ALS Collaborative Protocols. They are meant to act as general guidelines for rendering medical care and/or treatments and may not be inclusive for every situation. The Clinical Guidelines should be regarded as the prevailing norms of treatment and should be considered prudent in the delivery of medical care. Deviation from these Clinical Guidelines may be necessary based on patient need and must be documented.

All patients being transported by the Specialty Care Transport Team should have the following in place prior to leaving the referring facility:

- Stable airway
- Cardiac monitor – 3-lead with 12-lead capability immediately available
- If clinically indicated, a minimum of two intravenous lines (peripheral or central)
- Continuous pulse oximetry, cardiopulmonary monitoring including: blood pressure (invasive or noninvasive), and capnography (when clinically indicated; required for any patient on a ventilator)
- Vital signs taken a **minimum** of every 15 minutes unless a change occurs which requires immediate repetition of them
- Vital signs taken a **minimum** of every 5 minutes if any vasoactive or sedating type medications are being infused
- Confirmation that any medications being infused in the same IV line are compatible
- Any continuous infusion requires the use of a continuous electronic infusion device
- Continuous temperature monitoring for patients when clinically indicated

All patients should be maximally stabilized to the extent possible prior to transport, including intubation and peripheral or central venous access if necessary. It is the responsibility of the sending facility to ensure that stabilization is complete. In the event the Specialty Care Transport Team does not feel the patient is stable for transport, they must communicate with both the sending facility and IFT Medical Control before transport is initiated.

AORTIC EMERGENCIES

INDICATIONS

Known or suspected aortic dissection or aneurysm.

MANAGEMENT GOALS

- Reduce afterload
- Reduce HR and stroke volume to the lowest levels that allow for adequate systemic perfusion. Systolic blood pressures > 90 mmHg may be required to maintain MAP > 65 mmHg
- Reduce anxiety and pain

CARE GUIDELINES

1. Routine medical care

2. Ensure two patent large bore IVs

3. If HR is over 70 bpm, consider:

   - Metoprolol 5 mg q 10 minutes x 3 doses up to a max of 15 mg (hold for HR < 60 bpm).
   - Esmolol: Bolus 500 mcg/kg over 1 minute, then start infusion at 50 mcg/kg/min. May increase by 50 mcg/kg/min every 5 minutes up to a max of 200 mcg/kg/min (hold for HR < 60 bpm).

4. If SBP remains over 120 mmHg (goal is approximately 90 mmHg), consider:
   - Nicardipine: Initiate infusion at 2.5-5 mg/hr, increase by 2.5 mg/hr every 10 minutes to a max of 15 mg/hr. When at goal, decrease the infusion rate to 3 mg/hr and re-titrate to avoid hypotension from drug accumulation.

     OR

   - Sodium Nitroprusside (**Only if Nicardipine is not available**): Initiate infusion at 0.3 mcg/kg/min, increase by 0.5 mcg/kg/min every 5 minutes up to a maximum of 3 mcg/kg/min. May increase up to 10 mcg/kg/min but for no longer than 10 minutes total (usual dose 0.5 mcg/kg/min to 3 mcg/kg/min).

     OR

   - Nitroglycerin at 20-50 mcg/min (increase by 5 mcg/min every 5 minutes, up to a max of 100 mcg/min.
     - Titrate either agent to a systolic blood pressure of approximately 90 mmHg
     - **If Sodium Nitroprusside or Nitroglycerin are initiated, the patient must receive beta blockade to reduce the potential for reflex tachycardia and additional strain.**

5. Consider pain management if SBP > 100 mmHg and RR > 8 rpm:
    - Fentanyl 0.5-1 mcg/kg (max 100 mcg/dose) IV, may repeat every 10 minutes to a max of 500 mcg.
    - Do NOT use ketamine for analgesia for this disease state.

6. Consider mild sedation if patient is still anxious after adequate analgesia:
    - Midazolam 1-2.5 mg IV, may repeat every 10 minutes to max 20 mg (cautious use due to hypotension with other blood pressure lowering agents).
    - Do NOT use ketamine for sedation for this disease state.

7. Consider nausea/vomiting management:
    - Ondansetron 4 mg IV, may repeat every 15 minutes up to 16 mg.

TREATMENT CONSIDERATIONS

- Medications should be titrated by MAP and patient consciousness. Any evidence of EKG changes necessitates a higher MAP.

CARDIOGENIC SHOCK

INDICATIONS

Hypoperfusion with systolic blood pressure < 90 mmHg and:

- PAOP > 15 mmHg (if available)

OR

- Overt signs of left ventricular failure
  - Acute pulmonary edema
  - Altered mentation
  - Cool, mottled extremities
  - Low urine output

MANAGEMENT GOALS

- Maintenance of adequate tissue perfusion, as evidenced by clinical signs and symptoms
- Improvement in cardiac output and coronary perfusion
- Target MAP of 65 mmHg or greater, target SBP greater than 80 mmHg
- Maintain urine output of at least 0.5 mL/kg/hour

CARE GUIDELINES

1. Routine medical care

2. Ensure two patent large bore IVs

3. In patients experiencing cardiogenic shock *without* pulmonary congestion, administer 100-250 mL crystalloid fluid boluses PRN to obtain and maintain management goals. Observe patient carefully for development of pulmonary congestion.

4. If tissue perfusion is inadequate, circulating volume is adequate and the patient presents with or develops pulmonary congestion, consider initiating medical therapy:

   Systolic BP > 80 mmHg with signs of inadequate tissue perfusion:

   - Dobutamine: Initiate infusion at 5 mcg/kg/min, increase by 5 mcg/kg/min every 15 minutes to max dose of 20 mcg/kg/min (titrate slowly with concern for ectopy; may co-administer with norepinephrine if blood pressure decreases).
   - If inadequate perfusion persists, and the max dose of dobutamine has been achieved, add Milrinone. Milrinone: Initiate infusion at 0.375 mcg/kg/min, increase by 0.125 mcg/kg/min every 15 minutes to max dose of 0.75 mcg/kg/min (titrate slowly with concern for ectopy; may co-administer with norepinephrine if blood pressure decreases).

Systolic BP < 80 mmHg with signs of inadequate tissue perfusion:

- First line if HR > 60 bpm: Norepinephrine: Initiate infusion at 2 mcg/min (0.03 mcg/kg/min), increase by 2 mcg/min (0.03 mcg/kg/min) every 5 minutes. If > 80 mcg/min (0.1 mcg/kg/min) contact medical control.
- Consider adding Dobutamine to further increase cardiac output if necessary. Initiate infusion at 5 mcg/kg/min increase by 5 mcg/kg/min every 5 minutes up to 20 mcg/kg/min. Hold if HR > 100 bpm.
- **<u>If HR < 50 bpm</u>**:
  - Dopamine: Initiate infusion at 5-10 mcg/kg/min, increase by 5 mcg/kg/min every 5 minutes to max dose 20 mcg/kg/min.
  - Epinephrine: Initiate infusion at 1 mcg/min (0.01 mcg/kg/min), increase by 1 mcg/min (0.01 mcg/kg/min) every 5 minutes up to 20 mcg/min (0.1-0.2 mcg/kg/min). Hold if HR > 140 bpm.
- If HR > 140 bpm or tachydysrhythmias, especially if cause of cardiogenic shock is the result of AMI, wean Norepinephrine, Dopamine or Epinephrine and begin Phenylephrine.

TREATMENT CONSIDERATIONS

- The patient in cardiogenic shock must be treated aggressively.
- Obtaining pulmonary arterial occlusion pressure (PAOP) or pulmonary capillary wedge pressure (PCWP) is not indicated during transport.
- If available, review chest x-ray for presence of pulmonary edema and/or infiltrates.
- If available, review all labs and/or diagnostic material; i.e. echocardiogram, BNP, etc.
- Central venous access is desirable if possible. If vasoactive medications are being administered.
- Continuous arterial pressure monitoring is desired if possible.
- If the patient is experiencing cardiogenic shock as a result of an MI, aspirin and anti-thrombin therapy should be initiated unless otherwise contraindicated.
- Vasodilators should be used with caution. Beta Blockers should be avoided.
- Be extremely cautious with afterload and/or preload reducing agents if instituted to increase cardiac output.
- Be cautious with Dobutamine and Milrinone. **Although Dobutamine and Milrinone increase contractility, they also decrease systemic vascular resistance (SVR) which may lead to hypotension.**

ELEVATED INTRACRANIAL PRESSURE

INDICATIONS

History of brain injury (traumatic, intracranial hemorrhage, or mass) with GCS ≤ 8

MANAGEMENT GOALS

- Prevention of secondary brain injury due to hypoxia or hypotension
- Reduction of cerebral oxygen demand
- Reduction of intracranial pressure while maintaining cerebral perfusion pressure
- MAP 80-100 mmHg (Should the MAP be markedly elevated, consider Hypertensive Emergencies Protocol).
- $EtCO_2$ 35-45 mmHg
- Minimize external stimuli and maintain normothermia
- Safe and expedient transfer to definitive care

CARE GUIDELINES

1. Routine medical care

2. Head of bed at 30 degrees

3. Consider early intubation. Maintain SpO_2 > 90% and $EtCO_2$ 38-42 mmHg. Avoid allowing $EtCO_2$ to fall below 30 mmHg.

4. Consider analgesia (optimize analgesia before initiating sedation):
   - Fentanyl 0.5-1 mcg/kg (max 100 mcg/dose) IV, may repeat every 10 minutes to a max of 500 mcg.

   OR

   - Ketamine 0.3 mg/kg (max 30 mg) in 100 mL over 15 minutes, may repeat x 1 in 30 minutes.

5. Consider sedation. Level of sedation should be maintained to a RASS Scale (see appendix) score of -3 to -4:
   - Midazolam 1-2.5 mg IV, may repeat every 10 minutes to a max of 20 mg.

   OR

   - Propofol – Initiate infusion at 10 mcg/kg/min, increase by 5-10 mcg/kg/min every 3-5 minutes to a max dose of 50 mcg/kg/min. Preferable to titrate fentanyl until a max dose is achieved, then increase propofol. Administer 10 mg boluses every 10 minutes only if

needed (be cautious with bolus doses or aggressive titration and consider risk of hypotension and bradycardia).

OR

- Ketamine (intermittent boluses) 0.5-1 mg/kg IV every 15 minutes as needed for sedation/analgesia OR (continuous infusion) 0.5-1 mg/kg IV bolus, then 0.5-1 mg/kg/hr, increase by 0.25-0.5 mg/kg/hr every 30 minutes.

6. Consider nausea/vomiting management:
   - Ondansetron 4 mg IV, may repeat every 15 minutes up to 16 mg

7. Consider paralysis per Intubated and Chemically Neuromuscularly Blocked Patient Protocol

8. Consider seizure prophylaxis:
   - Levetiracetam (Keppra) 20 mg/kg IV over 15 minutes (usual dose 500-1500 mg twice daily); status treatment doses may be as high as 40-60 mg/kg.

   OR

   - Fosphenytoin 20 mg (PE)/kg at a max rate of 150 mg/min, diluted in at least 100 mL normal saline or Phenytoin 20 mg/kg at a max rate of 50 mg/min, diluted to a max concentration of 6 mg/mL (usually 250-500 mL NS) – can cause hypotension.

9. For cerebral edema and global swelling consider:
   - Mannitol (20%-25%) 1 g/kg IV bolus (rapid to develop osmotic gradient). Hypotension is an absolute contraindication to osmotic diuresis.
   - Hypertonic saline (3%) if initiated at the sending facility, should be 30-75 mL/hr with a target serum sodium of 155 mEq/L. This should be infused through a central line but can go peripherally through a Y-site attached to free flowing fluid at 30-75 mL/hr. Do not titrate during transport.

10. If an open skull fracture is suspected consider:
    - Ceftriaxone (Rocephin) 2 g IV (consider allergies).

HYPERTENSIVE EMERGENCIES

INDICATIONS

Blood pressure > 180/110 mmHg with:

- Acute end organ injury or failure thought to be directly secondary to severe hypertension
- Acute change in mental status
- New focal neurological deficit
- Acute ischemic ECG changes
- Acute LV dysfunction
- Renal failure (increased serum creatinine or increased urinary output less than 0.5 mL/kg/hr)

MANAGEMENT GOALS

- Prevention of serious cardiac or neurologic complications
- Initiation of gradual therapy to lower blood pressure to the point that immediate life-threatening complications (acute CHF, CVA) are avoided

CARE GUIDELINES

1. Routine medical care

2. Attempt to identify and correct the cause of the BP elevation (pain, pre-eclampsia, overdose, etc.); consult the appropriate collaborative protocol and contacting IFT Medical Control.

3. If blood pressure greater than 200/130 mmHg and asymptomatic; or blood pressure greater than 180/110 mmHg and accompanied by symptoms such as tachycardia, headache, nausea/vomiting, or confusion:
   - Consider Labetalol: 10-20 mg slow IV push over 2 minutes. Double the previous dose and repeat every 10 minutes as needed (max total dose 300 mg; hold for HR < 60 bpm)
   - Consider Nicardipine: Initiate infusion at 2.5-5 mg/hr, increase by 2.5 mg/hr every 10 minutes to a max of 15 mg/hr. Once at goal, reduce to 3 mg/hr and re-titrate to avoid hypotension.
   - Consider Esmolol: Bolus 500 mcg/kg over 1 minute, initiate infusion at 50 mcg/kg/min. Increase by 50 mcg/kg/min every 10 minutes up to a max of 200 mcg/kg/min.
   - Consider Nitroglycerin: Initiate infusion at 20-50 mcg/min, increase by 5 mcg/min every 5 minutes up to a max of 100 mcg/min.
   - Consider Nitroprusside infusion **(Only if Nicardipine unavailable):** Initiate infusion at 0.3 mcg/kg/min, increase by 0.5 mcg/kg/min every 5 minutes to a max of 3 mcg/kg/min. May increase up to 10 mcg/kg/min but for no longer than 10 minutes total (usual dose 0.5 mcg/kg/min).

TREATMENT CONSIDERATIONS

- Rapid reduction in BP is indicated in the setting of AMI, hypertensive encephalopathy, and subarachnoid hemorrhage. In all other cases, BP should be lowered no more rapidly than 10% per hour until a baseline blood pressure is reached.
- Consider adequate pain management as an initial step in patients with cephalalgia
- If an aortic emergency is known or suspected, see Aortic Emergencies Protocol
- If hypotension or bradycardia occurs, discontinue antihypertensive infusions, elevate patients' feet and administer 250 mL crystalloid fluid bolus as needed. Repeat as needed to maintain MAP of at least 65 mmHg and HR > 60 bpm and contact IFT Medical Control.

IMPLANTED CARDIAC DEVIES – TOTAL ARTIFICIAL HEART (TAH)

INDICATIONS

Patients who have an implanted cardiac device

MANAGEMENT GOALS

- Provide for patient comfort and safety
- Ensure device functionality
- Optimize patient perfusion

CARE GUIDELINES

1. Routine medical care.

2. TAH patients will have BP and HR obtainable by conventional means, but no electrical activity.
   - Target SBP < 130 mmHg
   - Pulse rate set and normal, between 120-135 bpm
   - Normal fill volume is variable, 50-60 mL/beat and displayed on the unit

3. Assess device functionality and operation
   - Defined by:
     - Device power
     - Fault alarms from driver unit
   - If driver is not operating, the patient has no pulse or blood pressure, or fault alarming; change to backup driver or hand pump
     - Hand pump at a rate of 120 bpm where 1 beat is equivalent to '1 down and up'

4. Ensure patent IV access

5. If problems continue, immediately contact IFT Medical Control

6. If SBP is > 110 mmHg, consider
   - Nitrates

     Nitroglycerin 0.4 mg SL q 5 minutes

     OR

     Nitroglycerin infusion: 20-50 mcg/min may increase by 5 mcg/min every 10 minutes to a max of 50 mcg/min or SBP < 110 mmHg
   - If SBP elevation persists:

     Consider Labetalol 10-20 mg slow IV push over 2 minutes. May double the previous dose and repeat every 10 minutes as needed for desired effect (max total dose 300 mg hold for HR < 60 bpm).

7. Assess for hypervolemia:

- If fill volumes are > 60 mL and patient has complaints of respiratory distress administer IV furosemide 40 mg

8. Assess for hypovolemia:
    - If SBP < 90 mmHg or fill volumes < 45 mL with evidence of distributive shock, blood loss, or dehydration :

        250 mL bolus IV 0.9% Normal Saline or Lactated Ringers; May repeat if necessary.

ADDITIONAL CONSIDERATIONS

- Under no circumstances will chest compressions provide any benefit
- TAH patients are on multi-agent anticoagulation
- Insufficient cardiac support may be due to:
    - Hypervolemia, not hypotension and hypovolemia; Kevlar chambers can accommodate no more than 70 mL at a time.
    - Degradation or damage to the drivelines. Examine drivelines for venting air. Repair kit is in patient support kit
- Transport patient with both drivers, hand pump, all batteries and power cords
- Contact receiving hospital
    - Strong Hospital Artificial Heart Program 1-800-892-4964
    - Rochester Regional VAD Program 585-922-9899
    - Syncardia ® Emergency number 1-866-771-9437

INTUBATED AND NEUROMUSCULARLY BLOCKED PATIENTS

INDICATIONS

Patients who are intubated and mechanically ventilated.

MANAGEMENT GOALS

- Provide for patient comfort and safety
- Optimize ventilator parameters

CARE GUIDELINES

Analgesia:

- Fentanyl: Bolus 0.5-1 mcg/kg (max 100 mcg/dose) IV once. Initiate infusion at 25-100 mcg/hr, increase by 25-50 mcg/hr every 10 minutes (bolus with each dose increase) up to max 3 mcg/kg/hr or 250 mcg/hr.
- Ketamine at analgesic doses is not appropriate for this indication.

Sedation (must initiate and optimize with active neuromuscular blocking agents; tachycardia or change in heart rate may be indicators of inadequate sedation in the setting of paralytic use):

- Midazolam: Bolus 1-2 mg, and initiate infusion at 1-2 mg/hr. Increase by 1-2 mg/hr every 10 minutes as needed up to 6 mg/hr.

OR

- Propofol: Initiate infusion at 10 mcg/kg/min, increase by 5-10 mcg/kg/min every 3-5 minutes to max of 50 mcg/kg/min. Administer 10 mg boluses every 10 minutes only if needed (be cautious with bolus doses or aggressive titration and consider risk of hypotension and bradycardia).

OR

- Ketamine: (intermittent boluses) 0.5-1 mg/kg IV every 15 minutes as needed for sedation/analgesia **OR** (continuous infusion) 0.5-1 mg/kg IV bolus, then 0.5-1 mg/kg/hr, increase by 0.25-0.5 mg/kg/hr every 30 minutes up to 4.5 mg/kg/hr.

If adequate sedation is not achieved with max doses of analgesics and sedating medications, contact IFT Medical Control for further recommendations

1. Soft restraints should be used for patient safety.
2. All intubated patients may be re-dosed with neuromuscular blockers if needed to maintain ventilator synchrony or patient safety. If required, Rocuronium should be dosed at 0.5 mg/kg IV (ideal body weight) every 20-40 minutes. **ALL patients MUST have continuing ANALGESIC and SEDATIVE agents with continued neuromuscular blockade.**

3. If continuous infusion of a different paralytic agent (e.g. atracurium, cisatracurium, vecuronium) is started by the sending facility, continue it and re-dose with Rocuronium if a bolus is needed.

4. If unable to sedate/neuromuscularly block, ensure IV lines are in place and patent. In the event of continued failure to neuromuscularly block, IFT Medical Control should be contacted.

POST THROMBOLYTIC (TPA; ALTEPLASE OR TENECTEPLASE) ADMINSITRATION

INDICATIONS

Patients who have had a thrombolytic administered prior to transfer for the conditions of Stroke (CVA), Pulmonary Embolus (PE), or Acute Myocardial Infarction (AMI)

MANAGEMENT GOALS

- Provide for patient comfort and safety
- Ensure completion of thrombotic medication
- Close and frequent monitoring of patient's disease specific physical condition, neurologic condition, and bleeding events.

CARE GUIDELINES

1. Monitor patient's vital signs and neurologic exam at a minimum of every 15 minutes during the infusion as well as after the infusion during transport (i.e. NIHSS for patients being treated for stroke).
    a. If the patient's neurologic exam decompensates, stop the infusion and contact the receiving facility and IFT Medical Control.
    b. Infusion should not be restarted until evaluated by the receiving facility.

2. Monitor for major/minor bleeding
    a. Major bleeding i.e. intracranial, retroperitoneal, gastrointestinal, urinary
    b. Minor bleeding i.e. gums, venipuncture sites, hematuria, hemoptysis, hematomas, ecchymosis
    c. If bleeding complications occur, contact the receiving hospital and IFT Medical Control and consider stopping the infusion.

3. Monitor vital signs every 15 minutes
    a. Special attention to blood pressure keeping the systolic < 185 mmHg and diastolic < 105 mmHg
        i. Labetalol 10-20 mg slow IV push over 2 minutes. May double the previous dose and repeat every 10 minutes as needed (max dose 300 mg and hold for HR < 60 bpm).

        OR

        ii. Nicardipine: Initiate infusion at 2.5-5 mg/hr, increase by 2.5 mg/hr every 10 minutes to max of 15 mg/hr. Once at goal, reduce rate to 3 mg/hr and re-titrate to avoid hypotension. If BP drops below 140/80 mmHg immediately discontinue medication.

iii. Contact IFT Medical Control in the setting of acute hypertension that has not responded to treatment. i.e. blood pressure that is continually elevated SBP > 185 mmHg or DBP > 105 mmHg despite 2 doses or titrations.

ADDITIONAL CONSIDERATIONS

Any decompensation in neurologic condition that occurs during transport needs to be immediately reported to the IFT Medical Control and the receiving facility. If the infusion is running at this time it should be stopped immediately. The infusion will not be restarted prior to evaluation at the receiving facility or with IFT Medical Control.

TITRATION OF VASOACTIVE MEDICATIONS

INDICATIONS

Patients being transported with intravenous vasoactive medications

MANAGEMENT GOALS

Provide for safe titration and use of intravenous vasoactive medication during transport

CARE GUIDELINES

1. All vasoactive medications must be controlled utilizing a Continuous Electronic Infusion Device (commonly referred to as a medication pump).

2. Whenever possible, vasoactive medications should be given through a central access device (central line, PICC line, etc.). If this is not possible, the vasoactive medication should be infused through the Y-site of free flowing peripheral IV of normal saline (0.9% NS).

3. The primary carrier IV of normal saline (0.9% NS) should have a flow rate of 125 mL/hr and should not be titrated. This can be achieved with either a flow restricting device or as a channel on the Continuous Electronic Infusion Device. A stopcock or "Y-site" should be used for each infused medication proximally to the flow restrictor.

4. NO medications should ever be bolused through the IV line infusing vasoactive medications.

5. Whenever possible, initial administration of vasoactive substances should begin in the sending facility. Addition of vasoactive medications during transport should be made after IFT Medical Control consultation.

6. Unless otherwise specified by the sending facility or IFT Medical Control, vasoactive medications should generally be titrated to achieve a MAP of 65 mmHg or greater.

7. Titration of vasoactive substance should be performed utilizing an understanding of the medication's pharmacokinetics, with typical half-life determining the period of observation to determine medication effect. Use the Appendix: Continuous Infusion Titratable Medical Reference.

TRANSVENOUS or TRANSCUTANEOUS (TEMPORARY) PACEMAKER

INDICATIONS

Patients being transported with a transvenous (temporary) pacemaker

MANAGEMENT GOALS

Provide for safe transfer of patients with a transvenous (temporary) pacemaker

CARE GUIDELINES

- Check to assure the insertion site dressing is clean and dry and the pacing electrode position is anchored securely with tape.
- Secure the pacing generator and place the plastic cover over the pacemaker controls.
- Manage complications, should they develop, according to the following:

1. **Failure to capture** – due to electrode displacement or a high stimulation threshold
    - Check and tighten all connections.
    - Call Specialty Care Transport Medical Control immediately and report if effective capture is not regained after the above interventions.
    - Increase the pacemaker output/mA.
    - Turn the patient to a left lateral recumbent position.
    - Place the external pacer on the patient and pace if needed for symptomatic bradycardia following the Collaborative Protocol (General: Bradycardia/Heart Blocks – Symptomatic).
    - Turn off any internal pacer if one is present.

2. **Failure to pace with no spike present** – caused by a broken or loose connection, electrode fracture, inhibition of pacemaker output, battery or circuit failure.
    - 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.
    - Call Specialty Care Transport Medical Control immediately and report if effective pacing is not regained after the above interventions.
    - Place the external pacer on the patient and pace if needed for symptomatic bradycardia following the Collaborative Protocol (General: Bradycardia/Heart Blocks – Symptomatic).
    - Turn off any internal pacer if one is present.

3. **Failure to sense** – occurs when the pacemaker does not sense an intrinsic beat.
    - Check and tighten all connections.
    - Increase the sensitivity of the pacing unit.

- Place the patient in a position where adequate sensing was last observed. A left lateral recumbent position is usually best.
- 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.
- Call Specialty Care Transport Medical Control immediately and report if effective pacing is not regained after the above interventions.
- Place the external pacer on the patient and pace if needed for symptomatic bradycardia following the Collaborative Protocol (General: Bradycardia/Heart Blocks – Symptomatic).
- Turn off any internal pacer if one is present.

4. Over-sensing – occurs when the pacemaker sensitivity is set too high. (It should be suspected when pauses are seen intermittently on the ECG or when the paced rate falls below that set on the pacemaker generator. The pacemaker-induced problem may be mistaken for electrode fracture or impending generator failure. Over-sensing leads to under-pacing).
    - Decrease the sensitivity on the pacemaker.
    - Replace the pacemaker generator if the problem continues.
    - Call Specialty Care Transport Medical Control immediately and report if effective pacing is not regained after the above interventions.
    - Place the external pacer on the patient and pace if needed for symptomatic bradycardia following the Collaborative Protocol (General: Bradycardia/Heart Blocks – Symptomatic).
    - Turn off any internal pacer if one is present.

5. Sedation and Analgesia
    - Consider analgesia if SBP < 90 mmHg: Fentanyl 0.5-1 mcg/kg (max 100 mcg/dose) IV, may repeat every 10 minutes to a max of 500 mcg.
    - Consider sedation: Midazolam 1-2.5 mg IV, may repeat every 10 minutes to a max of 20 mg or SBP < 90 mmHg
    - Do NOT use ketamine for this indication.

STEMI / ACUTE MI MANAGEMENT

INDICATIONS

Patients presenting to the outlying Hospital Emergency Departments lacking interventional cardiac capabilities, with ST elevation ≥ 1 mm in 2 contiguous leads, new LBBB with symptoms less than 12 hours in duration or LBBB with ST/T wave abnormalities which meet diagnostic criteria for MI (e.g. Sgarbossa).

MANAGEMENT GOALS

- Provide for patient comfort and safety
- Optimize transport times to meet AHA guidelines for "door to balloon" time of 90 minutes or less.

CARE GUIDELINES

1. Routine medical care.
2. Serial 12 lead EKG's during transport; do NOT delay transport to obtain.
3. Ensure two patent IVs.
4. If not already administered or started by sending facility:
   - Aspirin 324 mg chewed PO x 1

     AND
   - Clopidogrel (Plavix), 300-600 mg PO x 1 **OR** Ticagrelor 180 mg PO x 1
5. Consider anticoagulation/antiplatelet administration (monitor for signs of bleeding):
   - Heparin 60 units/kg (max 4,000 units) IV bolus x 1, followed by 12 units/kg/hr infusion (max of 1,000 units/hr)
   - Eptifibatide (Integrilin): 180 mcg/kg (max 22.6 mg) IV bolus x 2, 10 minutes apart then 2 mcg/kg/hr infusion (max 15 mg/hr). If GFR or CrCI < 50 mL/min then only one bolus and reduce infusion to 1 mcg/kg/hr (max 7.5 mg/hr). If GFR or CrCI < 30 mL/min do not administer.

     OR
   - Tirofiban (Aggrastat): 25 mcg/kg (max 3,825 mcg) IV over 5 minutes or less, then 0.15 mcg/kg/min (max 23 mcg/min) continued up to 18-48 hours. If GFR or CrCI <60 mL/hr bolus is the same, but rate decreased to 0.075 mcg/kg/min (max 11.5 mcg/min).
6. Consider nitrates if SBP > 110 mmHg in the absence of RV infarct:
   - Nitroglycerin 0.4 mg SL q 5 minutes prn pain
   - Consider Nitroglycerin infusion: Initiate infusion at 20-50 mcg/min, increase by 5 mcg/min every 10 minutes up to a max of 100 mcg/min while maintaining SBP > 110 mmHg.
7. Should patient's condition deteriorate to MAP < 65 mmHg, contact IFT Medical Control.

APPENDIX
CONTINUOUS INFUSION MEDICATION REFERENCE

Medication (Drug Class)	Dose+	Additional Information Adverse Drug Effect (ADE)
Sedation/Analgesia (unless chemically paralyzed, then titrate sedation as appropriate)		
Midazolam (Sedative)	Intermittent: 0.05-0.1 mg/kg, may repeat every 10 min to max 20 mg Cont Infusion Initial: 1-2 mg/hr (bolus with initial starting dose) Titration: Increase by 1-2 mg/hr every 10 min as needed for sedation (bolus x 1 with the dose of the new rate at each titration) Usual: 1-6 mg/hr	Onset: 1-2 min Duration: 15-60 min ADE: hypotension
Propofol (Sedative)	Initial: 10 mcg/kg/min Titration: Increase by 5-10 mcg/kg/min every 5 min (may bolus with 10 mg every 10 min only if needed for sedation) Usual: 10-50 mcg/kg/min	Onset: 30-40 sec Duration: 1-3 min ADE: severe hypotension, bradycardia; be cautious with boluses and rapid titration
Fentanyl (Analgesic)	Intermittent: 0.5-1 mcg/kg, may repeat 0.5 mcg/kg every 10 min up to max 500 mcg Cont Infusion Initial: 25-100 mcg/hr (bolus with initial starting dose) Titration: Increase by 25-50 mcg every 5 min (bolus x 1 with the dose of the new rate at each titration) Usual: 50-250 mcg/hr	Onset: immediate Duration: 10-30 min ADE: serotonergic properties, do not use in suspected antidepressant overdose
Ketamine (Dissociative anesthetic – sedative and analgesic)	Intermittent: 0.5-1 mg/kg IV every 15 min as needed for sedation/analgesia (post-RSI), 1-2 mg/kg (RSI), 0.1-0.3 mg/kg max 30 mg in 100 mL NS over 15 min (analgesia, not intubated) Cont Infusion Initial: 0.5-1 mg/kg/hr (bolus with initial starting dose) Titration: Increase by 0.25-0.5 mg/kg/hr every 30 min (consider slower titration 0.1 mg/kg/hr if using lower doses; 0.05-0.5 mg/kg/hr) Usual: 0.1-4.5 mg/kg/hr	Onset: 1-2 min Duration: 15 min ADE: hypertension, tachycardia, do not use in cardiac ischemia
Vasopressors/Inotropes (Central line preferred. If only a peripheral line is available, Y-site with free flowing fluid)		
Norepinephrine (Vasopressor – alpha and beta [lesser effect] agonist)	Initial: 2 mcg/min (0.03 mcg/kg/min) Titration: Increase by 2 mcg/min (0.03 mcg/kg/min) every 5 min as needed for goal blood pressure Usual: 4-80 mcg/min If > 80 mcg/min (0.1 mcg/kg/min) contact Medical Control	Onset: immediate Duration: 2-5 min ADE: hypertension, bradyarrhythmias
Dopamine (Vasopressor – alpha and beta agonist; increasing dose increases alpha agonist effects)	Initial: 5-10 mcg/kg/min Titration: Increase by 5 mcg/kg/min every 5 min as needed for goal blood pressure up to 20 mcg/kg/min Usual: 5-20 mcg/kg/min	Onset: immediate Duration: 1-2 min ADE: hypertension, tachyarrhythmias
Epinephrine (Vasopressor – potent alpha and beta agonist)	Initial: 1 mcg/min (0.01 mcg/kg/min) Titration: Increase by 1 mcg/min (0.01 mcg/kg/min) every 5 min as needed for goal blood pressure Usual: 10-20 mcg/min (0.1-0.2 mcg/kg/min)	Onset: immediate Duration: 1-2 min ADE: hypertension, tachyarrhythmias
Phenylephrine (Vasopressor – potent alpha agonist)	Initial: 25 mcg/min Titration: Increase by 25 mcg/min every 5 min as needed for goal blood pressure Usual: 25-200 mcg/min	Onset: immediate Duration: 15-30 min ADE: hypertension, reflex tachycardia

Vasopressin (V1 agonist – vasoconstrictor; used in refractory sepsis)	Usual: 0.01-0.04 units/min	Onset: immediate Duration: 10-20 min ADE: hypertension, bradycardia, dysrhythmias
Dobutamine (Inotrope – beta agonist, increases cardiac output)	Initial: 5 mcg/kg/min Titration: Increase by 5 mcg/kg/min every 15 min as needed for tissue perfusion up to 20 mcg/kg/min Usual: 5-20 mcg/kg/min	Onset: immediate Duration: 1-2 min ADE: hypotension and tachydysrhythmias
Milrinone (Inotrope – phosphodiesterase III enzyme inhibitor, inhibits cAMP and increases ventricle contractility and cardiac output)	Initial: 0.375 mcg/kg/min Titration: Increase by 0.125 mcg/kg/min every 15 min as needed for tissue perfusion up to 0.75 mcg/kg/min Usual: 0.375-0.75 mcg/kg/min	Onset: 5-15 min Duration: 1-2 hr ADE: hypotension, ventricular arrhythmias (SVT, VT), shorten AV node conduction, dose reduce in renal impairment
Cardiovascular		
Esmolol (Beta-1 selective antagonist)	Load: 500 mcg/kg over 1 min Initial: 50 mcg/kg/min Titration: Increase by 50 mcg/kg/min every 5 min as needed for goal blood pressure and heart rate up to 200 mcg/kg/min Usual: 50-200 mcg/kg/min	Onset: 2-10 min Duration: 10-30 min ADE: hypotension, bradycardia, heart block
Nicardipine (Calcium channel blocker)	Initial: 2.5-5 mg/hr Titration: Increase by 2.5 mg/hr every 10 min as needed for goal blood pressure up to 15 mg/hr. Once at goal blood pressure, decrease rate to 3 mg/hr to prevent accumulation and hypotension (due to long half-life of the medication). Re-titrate as described above. Usual: 5-15 mg/hr	Onset: 5-10 min Duration: 15-30 min up to 4 hr ADE: hypotension
Nitroglycerin (Vasodilator – more effect on peripheral veins than arteries)	Initial: 20-50 mcg/min Titration: Increase by 5 mcg/min every 5 min as needed for goal blood pressure and pain control up to 100 mcg/min Usual: 20-100 mcg/min	Onset: immediate Duration: 1-3 min ADE: hypotension, bradycardia
Nitroprusside (Vasodilator – more effect on arteries than veins)	Initial: 0.3 mcg/kg/min Titration: Increase by 0.5 mcg/kg/min every 5 min as needed for goal blood pressure up to a max of 3 mcg/kg/min (may increase up to 10 mcg/kg/min but for no longer than 10 minutes total) Usual: 0.5-1 mcg/kg/min	Onset: < 2 min Duration: 1-10 min ADE: hypotension, reflex tachycardia, cyanide toxicity at high doses or renal impairment

This chart is not all inclusive. Please consult electronic medication references or medical control with questions or unfamiliar medications.

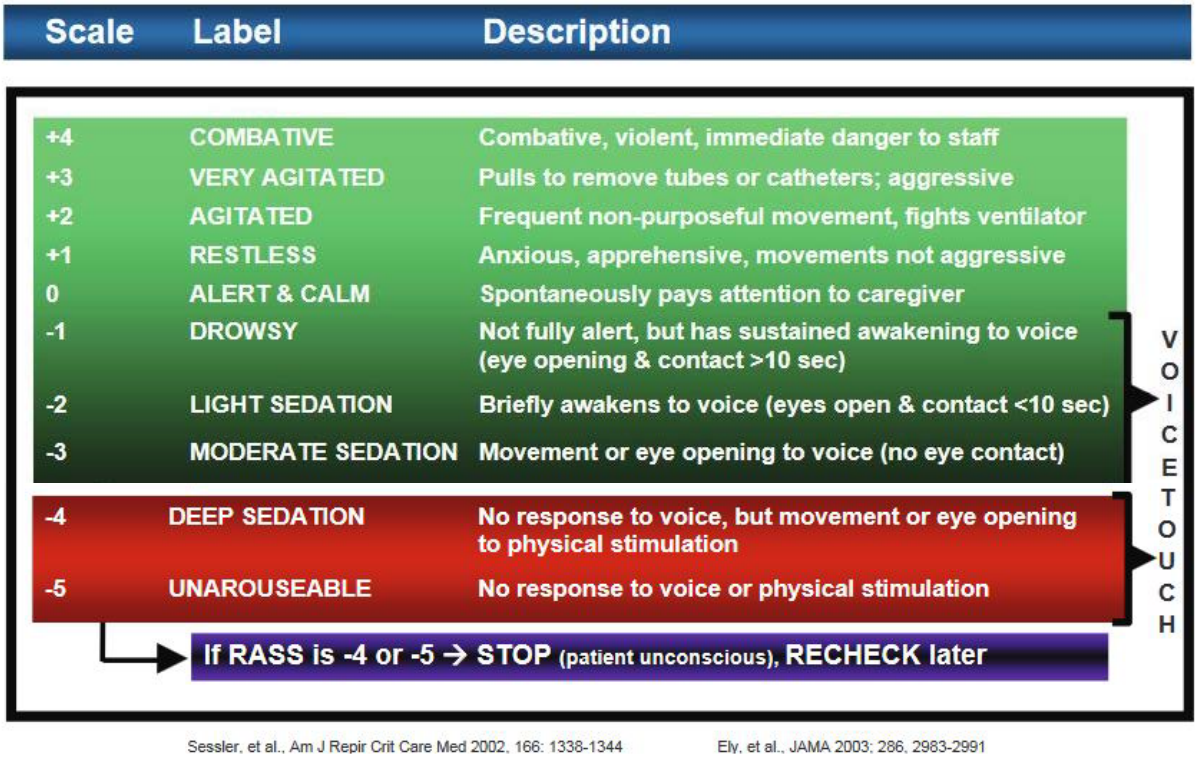
Doses outside of the ranges listed should be discussed with medical control.

APPENDIX
IDEAL BODY WEIGHT TABLE FOR VENTILATOR TIDAL VOLUME CALCULATION

Male							Female						
Height (in)	**IBW (Kg)**	**4mL /kg**	**5mL /kg**	**6mL /kg**	**7mL /kg**	**8mL /kg**	**Height (in)**	**IBW (Kg)**	**4mL /kg**	**5mL /kg**	**6mL /kg**	**7mL /kg**	**8mL /kg**
46	26	103	129	155	180	206	**46**	26	102	128	153	179	205
47	28	110	138	166	193	221	**47**	27	109	136	163	191	218
48	29	118	147	177	206	236	**48**	29	115	144	173	202	231
49	31	125	157	188	219	250	**49**	31	122	153	183	214	244
50	33	133	166	199	232	265	**50**	32	129	161	193	225	257
51	35	140	175	210	245	280	**51**	34	135	169	203	237	271
52	37	147	184	221	258	295	**52**	35	142	177	213	248	284
53	39	155	194	232	271	310	**53**	37	148	186	223	260	297
54	41	162	203	243	284	324	**54**	39	155	194	233	271	310
55	42	170	212	254	297	339	**55**	40	162	202	243	283	323
56	44	177	221	266	310	354	**56**	42	168	210	252	294	337
57	46	184	231	277	323	369	**57**	44	175	219	262	306	350
58	48	192	240	288	336	384	**58**	45	181	227	272	318	363
59	50	199	249	299	349	398	**59**	47	188	235	282	329	376
60	52	207	258	310	362	413	**60**	49	195	243	292	341	389
61	54	214	268	321	375	428	**61**	50	201	252	302	352	403
62	55	221	277	332	387	443	**62**	52	208	260	312	364	416
63	57	229	286	343	400	458	**63**	54	214	268	322	375	429
64	59	236	295	354	413	472	**64**	55	221	276	332	387	442
65	61	244	305	365	426	487	**65**	57	228	285	342	398	455
66	63	251	314	377	439	502	**66**	59	234	293	351	410	469
67	65	258	323	388	452	517	**67**	60	241	301	361	422	482
68	66	266	332	399	465	532	**68**	62	247	309	371	433	495
69	68	273	342	410	478	546	**69**	64	254	318	381	445	508
70	70	281	351	421	491	561	**70**	65	261	326	391	456	521
71	72	288	360	432	504	576	**71**	67	267	334	401	468	535
72	74	295	369	443	517	591	**72**	68	274	342	411	479	548
73	76	303	379	454	530	606	**73**	70	280	351	421	491	561
74	78	310	388	465	543	620	**74**	72	287	359	431	502	574
75	79	318	397	476	556	635	**75**	73	294	367	441	514	587
76	81	325	406	488	569	650	**76**	75	300	375	450	525	601
77	83	332	416	499	582	665	**77**	77	307	384	460	537	614
78	85	340	425	510	595	680	**78**	78	313	392	470	549	627
79	87	347	434	521	608	694	**79**	80	320	400	480	560	640
80	89	355	443	532	621	709	**80**	82	327	408	490	572	653

APPENDIX

RICHMOND AGITATION-SEDATION SCALE (RASS)



Sessler, et al., Am J Repir Crit Care Med 2002, 166: 1338-1344 Ely, et al., JAMA 2003; 286, 2983-2991