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CARDIAC PROTOCOL C1
ASYSTOLE

- Assess for pulselessness and breathlessness.
- Confirm asystole by monitoring in more than one lead.
- Commence CPR.
- Initiate peripheral IV intraosseous access with normal saline.
- Intubate (or place another advanced airway) and ventilate with high-flow oxygen (assess placement with ETCO2). Ventilate at a rate of 8 – 10 breaths per minute.
- Consider possible treatable causes of the arrest to help direct treatment.

SPECIAL CONSIDERATIONS:

1. Each IV dose of medication must be followed by a bolus of normal saline as follows:
   - Under the age of 6 years: 5 ml (and after IO injections);
   - Ages 6 to 12 years: 10 ml; or
   - Over the age of 12 years: 20 ml

2. Epinephrine must be given in a volume of 3 - 5 ml by endotracheal tube over the age of two years, and 1 - 2 ml under the age of two years to be effective. If dilution is required to reach this volume, normal saline must be used.

3. Endotracheal drugs can be administered if an IV or IO has not been established within three to five minutes.
Adult Cardiac Arrest Algorithm—2015 Update

1. Start CPR
   - Give oxygen
   - Attach monitor/defibrillator

2. Rhythm shockable?
   Yes → 3
   No → 9

3. VF/pVT
   Yes → 4
   No → 6

4. CPR 2 min
   - IV/IO access
   Yes → 7
   No → 5

5. Shock
   Yes → 10
   No → 8

6. CPR 2 min
   - Epinephrine every 3-5 min
   - Consider advanced airway, capnography
   Yes → 11
   No → 12

7. Shock
   Yes → 12
   No → 12

8. CPR 2 min
   - Amiodarone
   - Treat reversible causes
   Yes → 12
   No → 12

9. Asystole/PEA
   Yes → 12
   No → 12

10. CPR 2 min
    - IV/IO access
    - Epinephrine every 3-5 min
    - Consider advanced airway, capnography

11. CPR 2 min
    - Treat reversible causes

12. Rhythm shockable?
    Yes → Go to 5 or 7
    No → If no signs of return of spontaneous circulation (ROSC), go to 10 or 11

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CPR Quality
- Push hard (at least 2 inches [5 cm]) and fast (100-120/min) and allow complete chest recoil.
- Minimize interruptions in compressions.
- Avoid excessive ventilation.
- Rotate compressor every 2 minutes, or sooner if fatigued.
- If no advanced airway, 30:2 compression-ventilation ratio.
- Quantitative waveform capnography
  - If Petco2 <10 mm Hg, attempt to improve CPR quality.
  - Intra-arterial pressure
  - If relaxation phase (diastolic) pressure <20 mm Hg, attempt to improve CPR quality.

Shock Energy for Defibrillation
- Biphasic: Manufacturer recommendation (eg, initial dose of 120-200 J; if unknown, use maximum available). Second and subsequent doses should be equivalent, and higher doses may be considered.
- Monophasic: 360 J

Drug Therapy
- Epinephrine IV/IO dose: 1 mg every 3-5 minutes
- Amiodarone IV/IO dose: First dose: 300 mg bolus. Second dose: 150 mg.

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
- Abrupt sustained increase in Petco2 (typically ≥40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

Reversible Causes
- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypo-Hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary
**Pediatric Cardiac Arrest**

**Shout for Help/Activate Emergency Response**

1. **Start CPR**
   - Give oxygen
   - Attach monitor/defibrillator

2. **VF/VT**
   - **Rhythm shockable?**
     - Yes: **Shock**
     - No: **Asystole/PEA**

3. **CPR 2 min**
   - IO/IV access

4. **Rhythm shockable?**
   - Yes: **Shock**
   - No: **CPR 2 min**

5. **CPR 2 min**
   - IO/IV access
   - Epinephrine every 3-5 min
   - Consider advanced airway

6. **Rhythm shockable?**
   - Yes: **Shock**
   - No: **CPR 2 min**

7. **CPR 2 min**
   - IO/IV access
   - Epinephrine every 3-5 min
   - Consider advanced airway

8. **Rhythm shockable?**
   - Yes: **Shock**
   - No: **CPR 2 min**

9. **Asystole/PEA**

10. **CPR 2 min**
    - IO/IV access
    - Epinephrine every 3-5 min
    - Consider advanced airway

11. **Rhythm shockable?**
    - Yes: **Go to 5 or 7**
    - No: **CPR 2 min**

12. **Rhythm shockable?**
    - Yes: **Go to 5 or 7**
    - No: **Asystole/PEA** → 10 or 11

**Doses/Details**

**CPR Quality**
- Push hard (≥½ of anterior-posterior diameter of chest) and fast (at least 100/min) and allow complete chest recoil
- Minimize interruptions in compressions
- Avoid excessive ventilation
- Rotate compressor every 2 minutes
- If no advanced airway, 15:2 compression-ventilation ratio. If advanced airway, 8-10 breaths per minute with continuous chest compressions

**Shock Energy for Defibrillation**
First shock 2 J/kg, second shock 4 J/kg, subsequent shocks 2-4 J/kg, maximum 10 J/kg or adult dose.

**Drug Therapy**
- **Epinephrine IO/IV Dose**: 0.01 mg/kg (0.1 mL/kg of 1:10 000 concentration).
  - Repeat every 3-5 minutes.
  - If no IO/IV access, may give endotracheal dose: 0.1 mg/kg (0.1 mL/kg of 1:1000 concentration).
- **Amiodarone IO/IV Dose**: 5 mg/kg bolus during cardiac arrest. May repeat up to 2 times for refractory VF/pulseless VT.

**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 6-8 seconds (8-10 breaths per minute)

**Return of Spontaneous Circulation (ROSC)**
- Pulse and blood pressure
- Spontaneous arterial pressure waves with intra-arterial monitoring

**Reversible Causes**
- Hypovolemia
- Hypoxia
- Acidosis (acidosis)
- Hypoglycemia
- Hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary
References


CARDIAC PROTOCOL C2
ATRIAL FIBRILLATION FLUTTER

1. Assess ABC’s, maintain cabin altitude of 2000 ft ASL.

2. Provide the following:
   - Ensure the patient has an adequate airway and oxygenation as appropriate.
   - Provide ongoing cardiac and SpO\textsubscript{2} monitoring. A 12 lead ECG should be obtained for evaluation of ischemia.
   - Ensure resuscitative equipment is readily available.
   - If not already performed, obtain IV access.

3. If the patient is experiencing symptoms related to their rapid atrial fibrillation/flutter, consider treatment listed below in consultation with the Transport Physician/cardiologist:
   - **metoprolol**: 2.5 - 5mg SIVP over 2 minutes. Repeat in 5 minutes if no effect to a total of 3 doses. (not indicated in Peds).
   - **diltiazem**: 0.25 mg/Kg SIVP over 2 minutes. May repeat at 0.35 mg/kg if no effect within 15 minutes following the first dose.
   - **amiodarone**: 150 mg (mixed in 100 mls D5W) infused over 10 minutes. (Peds dosing is 5 mg/Kg). Maintenance infusion is at 60 mg/hr for the following 6 hours.

**NOTE:**
- Diltiazem is **NOT** indicated in the treatment of atrial fibrillation/flutter in patients with accessory bypass tracts (i.e. Wolfe-Parkinson-White) as it can precipitate V-tach.
- Diltiazem is **NOT** indicated in the treatment of sick sinus syndrome.
- Patients experiencing symptoms of cardiac ischemia (chest pressure, SOB) concurrent with rapid atrial fibrillation/flutter may be sensitive to nitroglycerin. Be cautious when administering nitroglycerin under these circumstances.
- If at any time the patient becomes unstable, refer to Clinical Protocol C9 - Unstable Tachycardia.
Adult Tachycardia With a Pulse Algorithm

1. Assess appropriateness for clinical condition. Heart rate typically ≥150/min if tachyarrhythmia.

2. Identify and treat underlying cause
   - Maintain patent airway; assist breathing as necessary
   - Oxygen (if hypoxemic)
   - Cardiac monitor to identify rhythm; monitor blood pressure and oximetry

3. Persistent tachyarrhythmia causing:
   - Hypotension?
   - Acutely altered mental status?
   - Signs of shock?
   - Ischemic chest discomfort?
   - Acute heart failure?

4. Synchronized cardioversion
   - Consider sedation
   - If regular narrow complex, consider adenosine

5. Wide QRS? ≥0.12 second
   - Yes
   - Synchronized cardioversion
     - Consider sedation
     - If regular narrow complex, consider adenosine
   - No

6. Yes
   - IV access and 12-lead ECG if available
   - Consider adenosine only if regular and monomorphic
   - Consider antiarrhythmic infusion
   - Consider expert consultation

7. No

Doses/Details

Synchronized cardioversion:
- Initial recommended doses:
  - Narrow regular: 50-100 J
  - Narrow irregular: 120-200 J
  - Biphasic or 200 J monophasic
  - Wide regular: 100 J
  - Wide irregular: Defibrillation dose (not synchronized)

Adenosine IV dose:
- First dose: 6 mg rapid IV push; follow with NS flush.
- Second dose: 12 mg if required.

Antiarrhythmic Infusions for Stable Wide-QRS Tachycardia

Procaainamide IV dose:
- 20-50 mg/min until arrhythmia suppressed, hypotension ensues, QRS duration increases >50%, or maximum dose 17 mg/kg given.
- Maintenance infusion: 1-4 mg/min.
- Avoid if prolonged QT or CHF.

Amiodarone IV dose:
- First dose: 150 mg over 10 minutes.
- Repeat as needed if VT recurs.
- Follow by maintenance infusion of 1 mg/min for first 6 hours.

Sotalol IV dose:
- 100 mg (1.5 mg/kg) over 5 minutes.
- Avoid if prolonged QT.

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References

CARDIAC PROTOCOL C3
BRADYARRHYTHMIAS

1. Assess ABC’s; maintain cabin altitude of 2000 ft. ASL.

2. Ensure:
   - adequate airway; oxygenation as appropriate.
   - ongoing cardiac and SpO2 monitoring.
   - resuscitative equipment is readily available.

3. Perform focused patient assessment including:
   - vital signs/12 lead ECG (if possible).
   - symptoms (chest pain, shortness of breath, decreased LOC).
   - signs (hypotension, shock, pulmonary congestion, CHF).

4. If serious signs and symptoms are present and due to the bradycardia:
   - initiate transcutaneous pacing (see Clinical Protocol C8 – Transcutaneous Pacing) at a rate of 60 bpm. Verify both electrical and mechanical capture and identify if they are congruent. Consider analgesia and sedation provided that the patient’s blood pressure will support it.
   - if electrical capture is present WITHOUT mechanical capture, infuse 250-500 ml of normal saline in an adult (20 ml/kg in a child) and repeat this bolus once.
   - if patient remains hypotensive consider initiation of:
     - dopamine: 2 to 10 mcg/kg/min
     or
     - epinephrine: 0.01 - 0.1 mcg/kg/min; titrate to response.
   - Contact Transport Physician.

5. Atropine may be considered to treat a symptomatic bradycardia IF:
   - the patient has mildly symptomatic bradycardia. Atropine can be given in increments of 0.5 to 1 mg q 3-5 minutes, to a total dose of 0.04 mg/kg.
   - caution should be used with atropine administration in high degree AV blocks as it may precipitate ventricular arrhythmias in patients experiencing an MI.
Adult Bradycardia With a Pulse Algorithm

1. Assess appropriateness for clinical condition. Heart rate typically <50/min if bradyarrhythmia.

2. Identify and treat underlying cause:
   - Maintain patent airway; assist breathing as necessary
   - Oxygen (if hypoxemic)
   - Cardiac monitor to identify rhythm; monitor blood pressure and oximetry
   - IV access
   - 12-Lead ECG if available; don’t delay therapy

3. Persistent bradyarrhythmia causing:
   - Hypotension?
   - Acutely altered mental status?
   - Signs of shock?
   - Ischemic chest discomfort?
   - Acute heart failure?

4. Monitor and observe
   - No

5. Yes
   - Atropine
     If atropine ineffective:
     - Transcutaneous pacing
     - Dopamine infusion
     - Epinephrine infusion

6. Consider:
   - Expert consultation
   - Transvenous pacing

Doses/Details

Atropine IV dose:
First dose: 0.5 mg bolus. Repeat every 3-5 minutes. Maximum: 3 mg.

Dopamine IV infusion:
Usual infusion rate is 2-20 mcg/kg per minute. Titrate to patient response; taper slowly.

Epinephrine IV infusion:
2-10 mcg per minute infusion. Titrate to patient response.

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PEDIATRIC CONSIDERATIONS

1. Symptomatic bradycardia in the pediatric population is usually the result of progressive hypoxemia and respiratory failure. Airway support, providing adequate oxygenation and ventilation is a priority.

2. If a pharmacologic agent is required after appropriate airway/breathing measures have been taken, contact Transport Physician or Pediatric Intensivist on call.

References


Approval: Effective Date: February, 2016 Medical Director:
CARDIAC PROTOCOL C4
CARDIOGENIC SHOCK

Cardiogenic shock is a state of crucial end-organ hypoperfusion due to reduced cardiac output. Mild hypoperfusion to profound shock may be present. Criteria to diagnose cardiogenic shock include:

1. Systolic blood pressure < 90mmHg for 30 min OR MAP less than 65 mmHg for 30 min OR vasopressors required to achieve a BP ≥ 90mmHg.
2. Pulmonary congestion or elevated left ventricular filling pressures.
3. Signs of impaired organ perfusion with at least one of the following criteria:
   - Altered mental status
   - Cold, clammy skin
   - Oliguria
   - Increased serum lactate

Consider cardiogenic shock in patients with the following:

1. Intrinsic factors:
   - Cardiomyopathies
   - MI with left ventricular failure
   - Papillary muscle rupture
   - Right ventricular failure
   - Septal defects
   - Sustained cardiac arrhythmias
   - Valvular disorders
2. Extrinsic factors:
   - Pericardial tamponade
   - Ventricular rupture
   - Pulmonary embolus
3. Risk factors:
   - Elderly
   - Diabetes Mellitus
   - MI patients with an ejection fraction of less than 35%
Transport Management

- **If cardiogenic shock is suspected, contact the Transport Physician**
- Relieve the cause of the cardiogenic shock, when applicable - e.g. needle decompression of a tension pneumothorax.
- Administer oxygen via nasal prongs or NRB mask to maintain SpO₂ above 94%. Stabilization of the patient on the ground with NPPV or intubation may be indicated.
- Treat chest pain as required. Refer to Clinical Protocol C5 - Chest Pain – Cardiac.
- Administer judicious fluid therapy; normal saline boluses of 200-250 ml may be required with assessment for fluid overload following each bolus.
- Consider diuretics; obtain order via medical control for same.
- Target mean arterial pressure of 65 - 70 mmHg, which may require administering vasopressors under the direction of medical control:
  - **norepinephrine**: Initial infusion rate varies considerably: 0.01 – 0.5 mcg/kg/min.
  - Maintenance: 0.03 – 1.5 mcg/kg/min.
  - Doses as high as 3.3 mcg/kg/minute have been used.

- Administration of an inotropic agent may be required to treat low cardiac output starting with the lowest possible dose:
  - **dobutamine**: 2 mcg/kg/min. Titrate to physician ordered parameters.

- Monitor output via urinary catheter.

References


CARDIAC PROTOCOL C5
CHEST PAIN (CARDIAC)

1. Perform initial assessment including:
   - Targeted history, including AMI inclusions, fibrinolytic exclusions.
   - Vital signs/focused physical exam.
   - 12 lead ECG; repeat serial ECG's as indicated (if not done within previous 30 minutes). Patients with inferior wall (II, III & aVF) ST elevation should have a second 12 lead ECG done with right-sided leads to assess for a right ventricular infarct.
   - Provide continuous ECG monitoring.

2. Consult with the Transport Physician/cardiologist and obtain orders for the following IF INDICATED:
   - Fibrinolytic agent – see Medication Protocol M15 - Tenecteplase.
   - Conjunctive therapy such as heparin (regular or LMW) administration.
   - Adjunctive therapies such as ACE inhibitor, IV nitroglycerin, etc.
   - Consider clopidogrel: 300-600mg po; must be given under the direction of a physician, preferably the receiving cardiologist.

3. Initiate general treatment:
   - IV access, O₂ administration as appropriate.
   - Morphine: 2-4 mg IV, q 5-10 minutes.
   - ASA: 325mg po.
   - Nitroglycerin: 0.3 mg sublingual q 5 minutes to a total of 3 doses IF SYSTOLIC BP IS ABOVE 90 mmHg (if there is no evidence of a right ventricular infarct).
   - Load patient head to nose, request cabin of 2,000 feet ASL.
   - Elevate head of stretcher.

4. If chest pain persists despite the administration of morphine and initiation of nitroglycerin sublingual sprays, consult the Transport Physician to initiate a nitroglycerin infusion.
   - Ensure systolic BP > 90 mmHg.
   - Pain relief (use pain scale, see Medication Protocol M10 – Pain Management).
   - Avoid MAP decrease > 20 mmHg.

   Titration of the nitroglycerin drip should be based upon and limited by the above parameters.

5. Nitroglycerin may be indicated:
   - For initial management of pain and ischemia in the setting of AMI WITHOUT HYPOTENSION (SBP > 90 mmHg).
- For AMI with hypertension, CHF and/or a large anterior wall MI.
- Recurrent ischemia (first 24-48 hours).

6. If the patient develops hypotension secondary to nitroglycerin administration:
   - Stop (or reduce) the nitroglycerin infusion.
   - Return the head of stretcher to a flat position.
   - Administer normal saline boluses in increments of 250 mls.
   - Contact medical control for further advice.

References
CARDIAC PROTOCOL C6
PULSELESS ELECTRICAL ACTIVITY (PEA)

- Assess ABC and confirm absent pulse and apnea in conjunction with ECG rhythm.
- Commence CPR.
- Intubate (or insert another advanced airway) and ventilate (confirm placement with ETCO2).
- Initiate IV or IO access with normal saline.
- Consider possible treatable causes of the arrest.
- Consider patient history and presenting problem(s) in relation to sudden arrest situation (i.e. acute ischemia, pulmonary embolism, etc.).
- Contact the Transport Physician/cardiologist for further advice.
- Transport the patient to health care facility immediately while performing CPR.
- Administer epinephrine while CPR is ongoing.

SPECIAL CONSIDERATIONS:

1. PEA includes all pulseless rhythms including idioventricular and “escape ventricular rhythms” but does **NOT** include asystole, VF and VT.
2. Each IV dose of medication must be followed by a bolus of normal saline as follows:
   - Under the age of 6 years: 5 ml (and after IO injections)
   - Ages 6 to 12 years: 10 ml
   - Over the age of 12 years: 20 ml
3. Epinephrine administered by ETT must be given in a volume of at least 10 ml in adults. If dilution is required to reach this volume, use normal saline.
4. Endotracheal drugs should be administered if an IV or IO has not been established within three to five minutes.
PULSELESS ELECTRICAL ACTIVITY (PEA)

Adult Cardiac Arrest Algorithm—2015 Update

1. Start CPR
   - Give oxygen
   - Attach monitor/defibrillator

2. Yes
   - Rhythm shockable?
     - VF/pVT

3. Shock
   - CPR 2 min
     - IV/IO access

4. Yes
   - Shock

5. Yes
   - CPR 2 min
     - Epinephrine every 3-5 min
     - Consider advanced airway, capnography

6. No
   - Rhythm shockable?
     - CPR 2 min
       - Epinephrine every 3-5 min
       - Consider advanced airway, capnography

7. No
   - Yes
     - CPR 2 min
       - Amiodarone
       - Treat reversible causes

8. Yes
   - Shock

9. Yes
   - Asystole/PEA

10. CPR 2 min
    - IV/IO access
    - Epinephrine every 3-5 min
    - Consider advanced airway, capnography

11. No
    - CPR 2 min
        - Treat reversible causes

12. No
    - Yes
        - If no signs of return of spontaneous circulation (ROSC), go to 10 or 11
        - If ROSC, go to Post–Cardiac Arrest Care

CPR Quality
- Push hard (at least 2 inches [5 cm]) and fast (100-120/min) and allow complete chest recoil.
- Minimize interruptions in compressions.
- Avoid excessive ventilation.
- Rotate compressor every 2 minutes, or sooner if fatigued.
- If no advanced airway, 30:2 compression-ventilation ratio.
- Quantitative waveform capnography
  - If PetCO₂ <10 mm Hg, attempt to improve CPR quality.
- Intra-arterial pressure
  - If relaxation phase (diastolic) pressure <20 mm Hg, attempt to improve CPR quality.

Shock Energy for Defibrillation
- Biphasic: Manufacturer recommendation (eg, initial dose of 120-200 J); if unknown, use maximum available. Second and subsequent doses should be equivalent, and higher doses may be considered.
- Monophasic: 360 J

Drug Therapy
- Epinephrine IV/IO dose: 1 mg every 3-5 minutes
- Amiodarone IV/IO dose: First dose: 300 mg bolus. Second dose: 150 mg

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
- Abrupt sustained increase in PetCO₂ (typically >40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

Reversible Causes
- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypo-hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary

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PULSELESS ELECTRICAL ACTIVITY (PEA)

SECTION: CARDIAC

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References


CARDIAC PROTOCOL C7
SUPRAVENTRICULAR TACHYCARDIAS (STABLE)

1. Assess ABC; maintain cabin altitude of 2000 ft ASL.

2. Provide the following:
   - Ensure the patient has an adequate airway and oxygenation as appropriate.
   - Provide ongoing cardiac and SpO₂ monitoring.
   - Ensure resuscitative equipment is readily available.
   - IV access.
   - If the patient at any time becomes unstable, proceed to Clinical Protocol C9 – Unstable Tachycardia.

3. Vagal maneuvers:
   - Palpate carotid pulses to ensure both are present.
   - Carotid artery massage is contraindicated in children less than twelve years of age and in patients over 60 years of age.
   - Auscultate the carotid arteries for bruits (if present do not proceed).
   - Turn patient’s head to the left.
   - Apply firm, momentary (for several seconds) pressure on the right carotid pulse as close to the angle of the jaw as possible.
   - If ineffective, apply a rotary motion for five to ten seconds. If unsuccessful, repeat twice on the same side.
   - If ineffective, carry out massage on the left carotid artery in the same manner up to three times.

4. If the previous measures are ineffective: administer adenosine: 6 mg IV as rapidly as possible followed by a 20 ml saline flush:
   - WARN THE PATIENT PRIOR TO INJECTION THAT THE DRUG MAY CAUSE TEMPORARY (1-2 minutes) CHEST TIGHTNESS, SOB AND FLUSHING.
   - Adenosine may cause brief bradycardia, VT or asystole lasting several seconds. Treatment is not required unless prolonged.
   - If the heart rate remains elevated and patient is still symptomatic 60 seconds after first bolus, administer adenosine: 12 mg IV as rapidly as possible.
   - Obtain monitor strip during treatment with adenosine for each bolus.
Adenosine is contraindicated in patients on dipyridamole (Persantine) and carbamazepine (Mazepine) as it can dramatically potentiate the effects of the adenosine.

Heart transplant patients are very sensitive to adenosine; determine a smaller dose regime with a physician prior to transport.

Adenosine may be used if hypotension is present with associated symptoms, however, if at any time the patient becomes unstable, immediate synchronized cardioversion is indicated (see Clinical Protocol C9 – Unstable Tachycardia).

5. If the previous measures prove ineffective, contact the Transport Physician/cardiologist for consideration of the following orders:
   - diltiazem: 0.25 mg/kg SIVP over 2 minutes.
   
   If no effect is seen in 15 minutes following the first bolus, administer the following:
   - diltiazem: 0.35 mg/kg SIVP over 2 minutes.

SPECIAL CONSIDERATIONS

- Always rule out a carotid bruit by auscultation prior to carotid artery massage.
- Auscultation can be difficult in flight.
- If a bruit is present, carotid artery massage is contraindicated.
- Never massage both carotid arteries simultaneously.
- All wide QRS tachyarrhythmias are to be treated as ventricular tachycardia.
- A Valsalva maneuver (forced expiration against a closed glottis) while undergoing carotid massage may improve the success rate for termination of PSVT.
- If at any time the patient becomes unstable, proceed to Clinical Protocol C9 – Unstable Tachycardia.
References

Early consultation with the Transport Physician is mandatory if patient requires transcutaneous pacing.

- Obtain and analyze ECG rhythm strip.
- Assess vital signs.
- Determine need for pacing (e.g. hemodynamic instability, etc.).
- Explain procedure to patient and reassure:
  
a) Prepare skin for pacing electrode application if required. Dry the patient’s skin and clip or shave chest hair as needed to maintain good contact with the QUIK COMBO pads.
b) Apply the QUIK COMBO pads to the patient’s chest as shown in the directions on the package.
c) Connect pacing cable to the QUIK COMBO pads.
d) Ensure the regular monitoring leads are still in place and are secured well. If they become detached in transit you may lose the ability to pace as the monitor will no longer have the ability to sense intrinsic beats.
e) Push “PACER” button.
f) Set rate at 60-70 beats per minute. The adjacent indicator will illuminate.

Key Points:

Current (energy) level will initially be set at zero mA and will need to be increased for capture. Also, the monitor will always default to a “demand” mode pacing setting. If this needs to be changed, it can be done under the options menu. The monitor will also default to a setting where it does not sense a patient’s own internal pacemaker device (presumably if you are pacing the patient at this point, it is probably not working). This setting can also be changed from the options menu.

- Observe monitor screen for each QRS sensed. Increase the QRS amplitude if needed. The adjacent indicator will flash and a pacer spike will be seen on the screen for each pacing stimulus:
  
a) Increase current slowly while observing for evidence of electrical capture (which will consist of a wide QRS and an elevated ST segment).
b) Palpate the patient’s pulse and obtain a blood pressure for evidence of mechanical capture.
c) Increase current by 10 mA above pacing threshold (to provide a safety margin).
d) Obtain a rhythm strip for analysis and documentation.
e) If required, administer sedation and/or analgesic as per protocol.

TROUBLESHOOTING

If **electrical capture is not obtained**: consider:

a) Increasing current.
b) Changing electrode position.
c) Equipment malfunction—troubleshoot cause.
d) The patient may not be viable.

In the case of **electrical capture without mechanical capture**:

a) Consider potential causes.
b) The patient may not be viable.

**Increasing current will not increase your chances of gaining mechanical capture once electrical capture has been obtained.**

If the monitor is unable to sense the rhythm adequately:

a) Increase sensitivity.
b) Change ECG lead.
c) Reposition ECG electrodes to obtain ECG signal with prominent QRS complexes.
d) Consider noisy signal; see below.

Noisy ECG signal:

i. Wash and dry skin before positioning electrodes.
ii. Use fresh ECG electrodes.
iii. Place LL ECG electrode on lower left chest well below level of pacing electrodes.
iv. Lead I may result in a cleaner signal in some patients.

DOCUMENTATION

- Obtain and analyze pre and post pacing rhythm strip for patient’s chart.
- Document VS clearly every fifteen minutes.
- Document pacing threshold, pacing rate and MA.
- Document patient’s response to the intervention.
DEFIBRILLATION DURING PACING

- Chest massage may be done while pacing, however, preferably the pacer should be turned off and placed in a monitor paddles setting.
- Assess requirement for defibrillation.
- Select energy to be delivered.
- Charge and clear the patient.
- Defibrillate patient.
- Reassess the patient and cardiac rhythm. If defibrillation is indicated, repeat steps 1 - 4.
- If external pacing is indicated, repeat pacing procedure.

TESTING THRESHOLD OF TEMPORARY TRANSVENOUS PACEMAKERS

The flight nurse/paramedic must ensure that the pacing and sensitivity threshold is within safe limits prior to transporting the patient by air. Checking of the pacing threshold should be deferred if the person is hemodynamically unstable.

- Obtain a rhythm strip prior to testing.
- Assess patient’s vital signs.
- Test pacing threshold as follows:
  a) Increase pacemaker rate 10 BPM above patient’s own heart rate. Avoid if patient’s rate is above 120/min.
  b) Assess rhythm to ensure the patient’s heart is continuously paced.
  c) Slowly turn output/MA dial down until failure to capture occurs. A second nurse or MD may help with this step.
  d) Carefully increase the output to the minimum electrical stimulus that will capture the patient’s ventricle. This is the pacing threshold.
  e) Set the MA/output dial at 2-3 increments above the threshold value. This provides a safety factor should pacing threshold vary.
f) Return pacer rate to previous setting.

g) Document pacing threshold on the patient care record.

- Test sensitivity threshold as follows:

h) Assess patient’s own cardiac rhythm and rate. If the patient’s own cardiac rhythm and rate is less than 40/min. Or causes a reduction in BP of greater than 20 mmHg, DO NOT check sensitivity threshold.

i) Reduce pacemaker rate to 10 below patient’s own rate, to ensure that patient’s own rhythm is visualized on monitor. Ensure that the pacemaker system is in demand mode.

j) Slowly reduce sensitivity by turning dial towards “Asynchronous” until failure to sense occurs.

k) Carefully increase sensitivity by turning dial towards “1.5” MV until sensing occurs. This is the patient’s sensing threshold.

l) Set sensitivity at one-half the sensitivity threshold. This provides a safety factor in the event that the sensing threshold varies.

m) Return pacemaker rate to previous rate setting.

n) Document sensitivity threshold on the nursing record.

References

Saskatoon Health Region Department of Nursing Practice and Education (2005). Temporary pacemakers learning package, pp. 11-12.
UNSTABLE TACHYCARDIA

This includes VT, PSVT, uncontrolled a-fib/flutter in adults with overt shock or those who are hemodynamically unstable with hypotension and associated symptoms such as chest pain and decreased LOC. Heart rate is usually > 150 bpm.

1. Assess ABC, request cabin altitude of 2,000 feet ASL.
2. If ventricular rate is > 150 bpm and associated with serious signs and symptoms (see definition above), prepare for immediate synchronized cardioversion.
3. Ensure:
   - Adequate airway with high flow oxygen to maintain SpO₂ > 95%.
   - Ongoing cardiac and SpO₂ monitoring.
   - Equipment for intubation and suction is readily available.
   - IV access.
4. Sedate whenever possible:
   - **midazolam**: 0.5 – 2.5 mg IV (for adult patients).

**Synchronized cardioversion**

100J
↓
If unsuccessful
↓
200J
↓
If unsuccessful
↓
300J
↓
If unsuccessful
↓
360J
If synchronized cardioversion is unsuccessful after 4 attempts, contact medical control for further orders.

SPECIAL CONSIDERATIONS

1. The cardiac monitor will need to be resynchronized after each cardioversion.
2. Treat polymorphic ventricular tachycardia as ventricular fibrillation/pulseless ventricular tachycardia (see Clinical Protocol C10 – Ventricular Fibrillation/Pulseless VTach) if no pulse is present. If pulse is present, treat as stable ventricular tachycardia (Clinical Protocol C11 - Ventricular Tachycardia (Stable)).
3. PSVT and atrial flutter may respond to energy levels as low as 50J.

Adult Tachycardia With a Pulse Algorithm

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PEDIATRIC CONSIDERATIONS

Contact medical control, preferably the pediatric Intensivist (RUH PICU 306-655-1915) or the Transport Physician.

References


1. Assess ABC, establish pulselessness and breathlessness.
2. Verify the rhythm as VT or VF.
3. Initiate CPR until defibrillator is charged. If the arrest was witnessed, administer a single shock beginning at 200 joules for biphasic units or 360 joules for monophasic defibrillators. If the arrest was unwitnessed, the patient should receive 2 minutes or 5 cycles of CPR.
   For pediatric patients use 2j/kg initially and 4j/kg each subsequent shock.
4. Continue CPR for 2 minutes or 5 cycles before re-evaluating the rhythm.
5. Place an advanced airway and ventilate with high flow oxygen. Confirm placement with end-tidal CO2.
6. Initiate IV or IO with normal saline.
7. Adult patients: see Advanced Cardiac Life Support guidelines.

For adult patients if defibrillation is successful:
- Initiate amiodarone: 1 mg/minute IV, after consultation with the Transport Physician
  - Add 450mg Amiodarone IV to 250 mL D5W
    (concentration = 1.8 mg/mL)
  - Infuse at 33 mL/hr over 6 hours (1 mg/min)
- Ensure high-flow oxygen continues to be administered.
- Evaluate vital signs and consider need for further fluid boluses or vasopressor medications to stabilize patient.

SPECIAL CONSIDERATIONS:
1. The initial defibrillation is given as rapidly as possible unless CPR has not been initiated, in which case 2 minutes of compressions should be done first.
2. Nitroglycerin patches must be removed from the chest wall prior to defibrillation as they may cause arcing, skin burns, etc.
3. The small pediatric defibrillation pads must be used in patients weighing < 10 kg.
4. Avoid placing defibrillation pads over the generation unit of implanted pacemakers or implanted cardioverter/defibrillators.
5. Patients with a core temperature of 30°C or below are only to receive one initial defibrillation. If this shock is ineffective, carry out CPR and do not administer any further shocks or drugs until the patient’s core temperature is greater than 30°C.
6. Each IV dose of medication must be followed by a bolus of normal saline as follows:
   - Under 6 years of age: 5 ml (and after IO injections)
   - Ages 6 to 12 years: 10 ml
   - Over 12 years of age: 20 ml

7. Epinephrine must be given in a volume of at least 3-5 ml by endotracheal tube over the age of two years, and 1 - 2 ml under the age of two years to be effective. If dilution is required to reach this volume, normal saline must be used for this purpose.

8. Epinephrine is administered every three to five minutes; there is no maximum dose of epinephrine.

9. If an IV cannot be successfully established in an adult (including an external jugular) or child within 90 seconds of initiation of the resuscitation attempt, start an intraosseous infusion.

10. Endotracheal drugs in the presence of an arrest situation are still permitted according to current ACLS guidelines; however their reliability of absorption has been called into question and should be used as a last resort.
VENTRICULAR FIBRILLATION/PULSELESS V-TACH

Pediatric Cardiac Arrest

Shout for Help/Activate Emergency Response

1. Start CPR
   - Give oxygen
   - Attach monitor/defibrillator

2. Rhythm shockable?
   Yes
   - VF/VT
   - Shock

3. CPR 2 min
   - IO/IV access

4. Rhythm shockable?
   No

5. Shock

6. CPR 2 min
   - Epinephrine every 3-5 min
   - Consider advanced airway

7. Rhythm shockable?
   No

8. CPR 2 min
   - Amiodarone
   - Treat reversible causes

9. Asystole/PEA

10. CPR 2 min
    - IO/IV access
    - Epinephrine every 3-5 min
    - Consider advanced airway

11. Rhythm shockable?
    No

12. CPR 2 min
    - Asystole/PEA → 10 or 11
    - Organized rhythm → check pulse
    - Pulse present (ROSC) → post-cardiac arrest care

Doses/Details

CPR Quality
- Push hard (cutoff of anterior-posterior diameter of chest) and fast (at least 100/min) and allow complete chest recoil
- Minimize interruptions in compressions
- Avoid excessive ventilation
- Rotate compressor every 2 minutes
- If no advanced airway, 15:2 compression-ventilation ratio. If advanced airway, 8–10 breaths per minute with continuous chest compressions

Shock Energy for Defibrillation
First shock 2 J/kg, second shock 4 J/kg, subsequent shocks 2–4 J/kg, maximum 10 J/kg or adult dose.

Drug Therapy
- Epinephrine IO/IV Dose: 0.01 mg/kg (0.1 mL/kg of 1:10 000 concentration). Repeat every 3–5 minutes. If no IO/IV access, may give endotracheal dose: 0.1 mg/kg (0.1 mL/kg of 1:1000 concentration).
- Amiodarone IO/IV Dose: 5 mg/kg bolus during cardiac arrest. May repeat up to 2 times for refractory VF/pulseless VT.

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 6–8 seconds (8–10 breaths per minute)

Return of Spontaneous Circulation (ROSC)
- Pulse and blood pressure
- Spontaneous arterial pressure waves with intra-arterial monitoring

Reversible Causes
- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypoglycemia
- Hypo-/hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary

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References


CARDIAC PROTOCOL C11
VENTRICULAR TACHYCARDIA (STABLE)

1. Assess ABC, maintain cabin altitude of 2000ft ASL.
2. Ensure:
   - adequate airway and oxygenation as appropriate.
   - ongoing cardiac and SpO₂ monitoring.
   - resuscitative equipment is readily available.
3. Assess patient and identify potential causes contributing to recurrent ventricular irritability such as:
   - hypoxia and or myocardial ischemia (12 lead ECG)
   - metabolic disturbances (respiratory alkalosis).
   - electrolyte imbalance (hypokalemia, hypomagnesemia).
   - proarrhythmic medication influences (e.g. procainamide, digitalis, quinidine, tricyclic antidepressant overdose, etc.).
4. Treatment with anti-arrhythmic agents may be requested in order to prevent occurrence of ventricular tachycardia or ventricular fibrillation. Pharmacologic options may include:
   - **amiodarone**: 150 mg IV (mixed in 50-100 ml normal saline) administered as an infusion over 8-10 minutes.
   - **lidocaine**: 1-1.5 mg/kg SIVP
     (NOTE: Lidocaine is a 2nd line agent and should be used in a reduced dose in the case of patients with liver failure or in elder patients. A single second dose may be administered at 0.5 – 0.75 mg/kg if the first dose is ineffective).

SPECIAL CONSIDERATIONS

1. Each IV dose of medication must be followed by a bolus of normal saline as follows:
   a) Under the age of six years: 5 ml (and after IO injections)
   b) Ages six to twelve years: 10 ml
   c) Over the age of twelve years: 20 ml
2. The antiarrhythmic identified to be successful in treating the ventricular tachycardia may be followed-up with an infusion of that agent (if required):
   a) **amiodarone**: Add 9 ml amiodarone IV (450 mg) to 250 ml normal saline (concentration = 1.8 mg/ml) Infuse at 33 ml/hr over 6 hours (1 mg/min).
   b) **lidocaine**: Add 1 gram of lidocaine to 250 ml normal saline (concentration = 4 mg/ml). Infuse at 1-4 mg/min (15-60 ml/hr) until side effects are noted, or until infusion is weaned off.
3. **Sodium bicarbonate**: 1 mEq/kg IV may be administered specifically if a tricyclic antidepressant overdose is suspected. In the stable patient this should be given **prior** to amiodarone (refer to Clinical Protocol P2 – Tricyclic Antidepressant OD).

4. **Torsades de pointes** may respond to **magnesium**: 1-2 grams IV in 50-100 mls D5W over 5-60 minutes.

5. Hyperkalemia producing wide complex rhythms may benefit from (refer to Clinical Protocol P3 - Hyperkalemia):

   - **Ca Chloride**: 8-16 mg/kg IV to a max dose of 1 gram administered over 10 minutes. This dose may need to be repeated in 60 minutes. Contact the transport physician for direction.
   - **Na Bicarbonate**: 1 mEq/kg slow IV infusion as directed by a physician. Sodium Bicarbonate is reserved for cases of hyperkalemia in the presence of metabolic acidosis.
   - **Insulin plus glucose**: 10 units regular insulin IV and 25 g of dextrose IV (50 ml D50), as directed by the transport physician.
   - **Salbutamol**: via nebulizer 2.5-5 mg.

6. Consider synchronized cardioversion in a hemodynamically stable patient if amiodarone was not successful to convert the rhythm.
Adult Tachycardia With a Pulse Algorithm

1. Assess appropriateness for clinical condition. Heart rate typically ≥150/min if tachyarrhythmia.

2. Identify and treat underlying cause
   - Maintain patent airway; assist breathing as necessary
   - Oxygen (if hypoxemic)
   - Cardiac monitor to identify rhythm; monitor blood pressure and oximetry

3. Persistent tachyarrhythmia causing:
   - Hypotension?
   - Acutely altered mental status?
   - Signs of shock?
   - Ischemic chest discomfort?
   - Acute heart failure?

4. Yes
   - Synchronized cardioversion
     - Consider sedation
     - If regular narrow complex, consider adenosine

5. No
   - Wide QRS? ≥0.12 second
     - Yes
       - IV access and 12-lead ECG if available
       - Consider adenosine only if regular and monomorphic
       - Consider antiarrhythmic infusion
       - Consider expert consultation
     - No
       - IV access and 12-lead ECG if available
       - Vagal maneuvers
       - Adenosine (if regular)
       - β-Blocker or calcium channel blocker
       - Consider expert consultation

References


Approval: Effective Date: February, 2016 Medical Director: 

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GASTROINTESTINAL PROTOCOL G11
ACUTE ABDOMINAL PAIN (NON-TRAUMATIC)

- Request pre-flight analgesia, antiemetic and IV access.
- Request or insert pre-flight nasogastric tube to facilitate GI decompression in all patients where obstruction or paralytic ileus is suspected (distension, absent bowel sounds, repeated emesis, etc.). If patient has known esophageal varices, avoid the insertion of an N/G tube. Ensure periodic decompression during flight.
- Request maximum cabin altitude of 2,000 to 4,000 feet ASL.
- Load patient head to the nose of the aircraft.
- Place patient in a position of comfort, provide appropriate oxygenation if tachypneic, or if SpO₂ drops below 95%.
- If an abdominal aortic aneurysm is suspected but the patient is not hypotensive, initiate a second large bore IV.
- If shock develops, infuse saline or ringers lactate to maintain a systolic blood pressure of 90 mmHg in the adult patient.
- Consider requirement for PRBC, contact Transport Physician for order.
- Patients who are experiencing pain during flight may receive analgesia as appropriate.
- Patients who are experiencing symptoms related intestinal spasm (cramping) or other smooth muscle spasm may benefit from an anti-spasmodic. Consider administering Buscopan: 20mg slow IV push for relief of symptoms, in consultation with the Transport Physician.

References


Request pre-flight analgesia and antiemetic, if appropriate.

Request cabin altitude of 2,000 feet ASL.

Establishment of two large bore IV’s.

If unable to establish traditional peripheral IV access, consider intraosseous or external jugular cannulation.

Administration of volume resuscitation with normal saline or Ringer’s Lactate, as required.

For patients experiencing GI hemorrhage, consider taking SAA blood box and fluid warmer on transport.

If catastrophic bleeding, consider calling Transport Physician for Tranexamic Acid order (see Medication Protocol M16 – Tranexamic Acid) and/or Octreotide order (see Medication Protocol M9 - Octreotide).

If not contraindicated, elevate the head of the stretcher to the position of comfort.

Administer oxygen as required, particularly for those patients receiving analgesics.

In patients where obstruction or paralytic ileus is suspected (distension, absent bowel sounds, repeated emesis), request a pre-flight NG insertion.

If patient has known esophageal varices, contact transport physician before inserting N/G tube.

Patients with a nasogastric tube in place should be placed on intermittent or continuous suction during the flight.

Patients who are experiencing symptoms related to intestinal spasm (cramping) or other smooth muscle spasm may benefit from an anti-spasmodic. Consider requesting order from Transport Physician for the administration of Buscopan \(^{iii}\) 20mg slow IV push for relief of symptoms.

Patients with stomas require adequate collection-bag venting; ask referral centre to send extra supplies.

References

\(^i\) New England Journal of Medicine, Irritable Bowel Syndrome, 2003; 349:2136-2146


\(^{iii}\) New England Journal of Medicine, Irritable Bowel Syndrome, 2003; 349:2136-2146
## GENERAL PROTOCOL G1
### CABIN ALTITUDE RESTRICTIONS

<table>
<thead>
<tr>
<th>Body System</th>
<th>Aviation Factors Affecting Condition</th>
<th>Specific Condition</th>
<th>Effect of Flight</th>
<th>Patient Care Considerations For Transport</th>
</tr>
</thead>
</table>
| Eyes, Ears, Nose and Throat | • Reduced partial pressure of oxygen (hypoxemia).  
• Reduced atmospheric pressure (gas expansion).  
• Decreased presence of water vapor (dehydration).  
• Gravitational forces.  
• Motion sickness.  
• Vibration. | Eye Trauma | • Retinal hypoxia.  
• Gas expansion in globe causes vascular or optic nerve compression, and possible extrusion of contents.  
• Corneal drying.  
• Tension on optic nerve.  
• Vomiting increases intra-ocular pressure. | • Altitude restriction (2,000 ft. ASL).  
• Administer O₂ to maintain O₂ sats 96% or more.  
• Keep eye covered. Do not instill drops if open eye injury.  
• Antiemetic to reduce vomiting.  
• Load patient with head to nose of aircraft.  
• Elevate head 30°. |
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<tr>
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<th>Aviation Factors Affecting Condition</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Dental Disease</td>
<td>Increased pain.</td>
<td>• Avoid flying within forty eight hours after dental work.</td>
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<tr>
<td></td>
<td></td>
<td>Epiglottitis</td>
<td>Swelling of epiglottis increases.</td>
<td>• Consider intubation prior to flight. • <strong>Altitude restriction (2,000 ft. ASL).</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upper Respiratory Infection or Congestion</td>
<td>Increased pain.</td>
<td>• Slow descent. • Cabin altitude restriction. • Awaken sleeping patients prior to descent. • Encourage maneuvers to equalize middle ear and sinus pressures with atmosphere. • Decongestants. • Treat infection (i.e. antibiotics).</td>
</tr>
<tr>
<td>CNS</td>
<td>Reduced partial pressure of oxygen (hypoxemia).</td>
<td>Head Trauma</td>
<td>Increase hypoxemia.</td>
<td>• <strong>O₂ supplement to maintain O₂ sats of 96% or more.</strong> • Artificial tears. • Keep eyes closed.</td>
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</tbody>
</table>
### BODY SYSTEMS AND PATIENT CARE CONSIDERATIONS

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<tr>
<td></td>
<td>Reduced atmosphere pressure (gas expansion).</td>
<td>(CVA)</td>
<td>Gas expansion and swelling leading to ICP.</td>
<td>Airway control and protection, as needed.</td>
</tr>
<tr>
<td></td>
<td>Gravitational forces.</td>
<td></td>
<td></td>
<td>Hyperventilation (controlled).</td>
</tr>
<tr>
<td></td>
<td>Motion sickness.</td>
<td></td>
<td>Vomiting and potential airway compromise.</td>
<td>Altitude restriction of 2,000 ft. ASL.</td>
</tr>
<tr>
<td>Epilepsy</td>
<td></td>
<td></td>
<td>Elevate head 30°, if C-spine and airway are intact.</td>
<td>Spinal immobilization in trauma patient.</td>
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<tr>
<td></td>
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<td>Anticonvulsants, as necessary.</td>
<td>Elevate head 30°, if C-spine and airway are intact.</td>
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<td></td>
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<td>Administer medications to reduce ICP.</td>
<td>Spinal immobilization in trauma patient.</td>
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<td></td>
<td>Protect patient.</td>
<td>Elevate head 30°, if C-spine and airway are intact.</td>
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<td></td>
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<td></td>
<td>Anticonvulsants.</td>
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<tr>
<td></td>
<td>Reduced partial pressure of oxygen (hypoxemia).</td>
<td>Hypotension</td>
<td>• Anxiety.</td>
<td>• Supplement O₂ to maintain O₂ sats of 96% or more.</td>
</tr>
<tr>
<td></td>
<td>Reduced atmospheric pressure (gas expansion).</td>
<td></td>
<td>• Redistribution of blood flow.</td>
<td>• Keep cabin dim.</td>
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<tr>
<td></td>
<td>Decreased presence of water vapor (dehydration).</td>
<td></td>
<td>• Increased hypoxemia.</td>
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<tr>
<td></td>
<td>Gravitational.</td>
<td>Anemia</td>
<td>• Hypoxemia.</td>
<td>• Altitude restriction of 2,000 ft. ASL.</td>
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<td></td>
<td>• O₂ supplementation to maintain O₂ sats of 96%.</td>
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<td></td>
<td>• Load patient head to tail of the aircraft if hypovolemia; head to nose if CHF.</td>
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<td></td>
<td>• Stabilize blood pressure with volume and/or medication.</td>
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<td></td>
<td></td>
<td>• Supplement O₂ to maintain O₂ sats of 96% or more.</td>
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<td>• Administer PRBC’s to augment hemoglobin, if extremely low.</td>
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<td></td>
<td></td>
<td>• Altitude restriction of 2,000 ft. ASL.</td>
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<tr>
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<td>Sickle Cell Anemia</td>
<td>• Sickling may occur at altitudes as low as 4,000 ft.</td>
<td>• <strong>Altitude restriction of 2,000 ft. ASL.</strong>&lt;br&gt;• Provide adequate hydration.&lt;br&gt;• O₂ supplement.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Open Wounds</td>
<td>• Increased bleeding may occur at high altitudes.</td>
<td>• Apply pressure dressing.&lt;br&gt;• Provide adequate hydration.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Angina or MI</td>
<td>• Hypoxia may aggravate existing ischemia.&lt;br&gt;• Gravitational forces may cause hypotension and tachycardia.&lt;br&gt;• Vomiting may result in vagal response.&lt;br&gt;• Anxiety may increase tachycardia.&lt;br&gt;• Resuscitation would be difficult in aircraft due to</td>
<td>• Supplement O₂ to maintain O₂ sat 96% or more.&lt;br&gt;• Position head to nose if possible.&lt;br&gt;• Administer antiemetic preflight.&lt;br&gt;• Be prepared for arrest.&lt;br&gt;• <strong>Altitude restriction of 2,000 ft. ASL</strong> if pain is present.&lt;br&gt;• Treat ischemia/MI appropriately, with emphasis on prevention of complications.</td>
</tr>
<tr>
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<tr>
<td>Respiratory</td>
<td>• Reduced partial pressure of oxygen (hypoxemia).&lt;br&gt;• Reduced atmospheric pressure (gas expansion).&lt;br&gt;• Decreased presence of water vapor.&lt;br&gt;• Gravitational forces.</td>
<td>Respiratory Insufficiency</td>
<td>• Increased hypoxemia.&lt;br&gt;• Gas expansion, possibly resulting in spontaneous pneumothorax.&lt;br&gt;• Dehydration.&lt;br&gt;• Vomiting, with potential for aspiration.</td>
<td>• Altitude restriction of 2,000 ft. ASL.&lt;br&gt;• Administer supplemental $O_2$ to maintain $O_2$ sats of 96% or more.&lt;br&gt;• Monitor for evidence of pneumothorax.&lt;br&gt;• Prevent vomiting through use of antiemetic.&lt;br&gt;• Load patient with head to nose of the aircraft.&lt;br&gt;• Put sterile water in ETT cuff.</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td></td>
<td></td>
<td>• Increased hypoxemia.&lt;br&gt;• Gas expansion enlarging pneumothorax.&lt;br&gt;• Potential for tension</td>
<td>• Supplemental $O_2$ to maintain $O_2$ sats of 96%.&lt;br&gt;• Altitude restriction of 2,000 ft. ASL.&lt;br&gt;• Decompress pneumothorax by</td>
</tr>
</tbody>
</table>
### BODY SYSTEMS AND PATIENT CARE CONSIDERATIONS

<table>
<thead>
<tr>
<th>Body System</th>
<th>Aviation Factors Affecting Condition</th>
<th>Specific Condition</th>
<th>Effect of Flight</th>
<th>Patient Care Considerations For Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>pneumothorax.</td>
<td>inserting chest tube with one way flutter valve. Tape connections securely.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>• Observe for tension pneumothorax.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Wait seventy two hours after chest tube removal prior to flight, whenever possible.</td>
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<td></td>
<td></td>
<td></td>
<td>• Use disposable underwater seal chest tube drainage systems, such as “pleurivac”.</td>
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</tr>
<tr>
<td>COPD</td>
<td>Increased hypoxemia.</td>
<td></td>
<td>• Altitude restriction of 2,000 to 4,000 ft. ASL.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spontaneous pneumothorax.</td>
<td></td>
<td>• Careful (O_2) supplementation to maintain (O_2) sats from 90 to 93%.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Provide adequate hydration.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Observe for spontaneous pneumothorax and be prepared to treat as needed.</td>
<td></td>
</tr>
<tr>
<td>Body System</td>
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<td>Specific Condition</td>
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</tr>
<tr>
<td>GI System</td>
<td>• Reduced atmospheric pressure (gas expansion).</td>
<td>Bowel Obstruction or Paralytic Ileus</td>
<td>• Gas expansion resulting in increased distention, pain and vomiting.</td>
<td>• Altitude restriction of 2,000 to 4,000 ft. ASL.</td>
</tr>
<tr>
<td></td>
<td>• Turbulence.</td>
<td></td>
<td></td>
<td>• Decompress stomach using NG to straight drainage or suction. Do not clamp during flights.</td>
</tr>
<tr>
<td></td>
<td>• Gravitational forces.</td>
<td></td>
<td></td>
<td>• Load head to nose of aircraft.</td>
</tr>
<tr>
<td></td>
<td>• Reduced water vapor.</td>
<td></td>
<td></td>
<td>• Provide adequate hydration.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nausea and Vomiting</td>
<td>• Increased motion sickness associated with flight.</td>
<td>• Administer antiemetics as needed.</td>
</tr>
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</tr>
<tr>
<td>Reproduction System</td>
<td>• Reduced partial pressure of oxygen (hypoxemia).</td>
<td>Pregnancy</td>
<td>• Maternal and fetal hypoxemia.</td>
<td>• Altitude restriction of 4,000 ft. ASL.</td>
</tr>
<tr>
<td></td>
<td>• Reduced atmospheric pressure (gas)</td>
<td></td>
<td>• Expansion of breast or uterine tissue may result in increased oxytocin hormone</td>
<td>• 0₂ supplement to maintain 0₂ sats of 96%.</td>
</tr>
<tr>
<td>Body System</td>
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<td>Specific Condition</td>
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<tr>
<td></td>
<td>• Decreased presence of water vapor (dehydration).</td>
<td></td>
<td>• Gravitational forces may enhance labor.</td>
<td>Load patient head to tail of the aircraft.</td>
</tr>
<tr>
<td></td>
<td>• Gravitational forces.</td>
<td></td>
<td></td>
<td>Monitor maternal-fetal well-being.</td>
</tr>
<tr>
<td>Musculo-skeletal System</td>
<td>Reduced partial pressure of oxygen (hypoxemia).</td>
<td>Fractures</td>
<td>• Increased pain.</td>
<td>Altitude restriction of 4,000 ft. ASL.</td>
</tr>
<tr>
<td></td>
<td>• Reduced atmospheric pressure (gas expansion).</td>
<td></td>
<td>• Increased swelling.</td>
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<tr>
<td></td>
<td>• Gravitational forces.</td>
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<tr>
<td></td>
<td>Massive Soft Tissue Injuries</td>
<td></td>
<td>• Increased pain.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Increased swelling.</td>
<td></td>
<td>• Increased swelling.</td>
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## BODY SYSTEMS AND PATIENT CARE CONSIDERATIONS

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</tr>
</thead>
</table>
| Integument System | • Reduced partial pressure of oxygen.  
• Reduced atmospheric pressure (gas expansion).  
• Decreased presence of water vapor (dehydration). | Burns | • Increased fluid loss.  
• Increased swelling.  
• Temperature loss. | • Altitude restriction of 4,000 ft. ASL.  
• Airway control if evidence of facial or airway burns.  
• Maintain warm cabin and monitor temperature.  
• Prepare burn dressings preflight.  
• Perform escharotomy if evidence of neurovascular impairment.  
• Provide adequate volume replacement (Parkland formula) in order to maintain urine output.  
• Maintain clean environment to reduce risk of infection. |
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Psychiatric</strong></td>
<td>• Fear and anxiety.</td>
<td>Anxiety Psychosis</td>
<td>• Increased anxiety and fear.</td>
<td>• Chemical and physical restraints.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Violent or combative behavior.</td>
<td>• Reassurance.</td>
</tr>
<tr>
<td><strong>All Systems</strong></td>
<td>• Reduced atmospheric pressure (gas expansion).</td>
<td>Patients with IV’s</td>
<td>• Variable flow rate.</td>
<td>• Careful securement of all IV’s, particularly during loading and off loading procedures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• IV pulled out.</td>
<td>• Maintain IV fluid bag as high as possible above IV insertion site.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Use infusion pumps to control IV rates in children and for the administration of medications by continuous infusion in all patients.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Monitor IV infusion during all phases of flight, but particularly ascent and descent.</td>
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<td></td>
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<td></td>
<td></td>
<td>• Have at least two IV sites in all seriously ill patients.</td>
</tr>
</tbody>
</table>
References

Canadian Association of Aero-medical Transportation Systems – Training Program Level 1. 2004
Transport of combative/potentially combative patients can be a stressful and dangerous experience. This may involve caring for mental health patients in crisis, patients with a head injury, space-occupying intracranial lesions or hypoxia, etc. Initial assessment and effective management of combative emergencies is crucial to air transport safety.

**PRE-TRANSPORT**

**Assessment**
Assess patient for predications of the combative behavior and have a plan of care upon initial assessment of patient.

**Stabilization**
- Reassure patients: give brief, honest answers and firm, calm direction.
- Pharmacologic restraint should be considered prior to physical restraint.
- Indications for physical restraint prior to transport:
  a) measures to alleviate precipitating cause of combativeness are unsuccessful.
  b) patients who have a history of combative/violent behaviour.
  c) pharmacological restraint is ineffective.
  d) any patient whose physical activity will hinder delivery of care or cause further injury (e.g. head-injured, combative patient attempting to remove cervical collar).

**Pharmacological Restraint**
- Initiate only after underlying causes of the combative behaviour have been addressed.
  a) Administer midazolam: 0.1 mg/kg (5 mg maximum) slow IV push or IM, depending on patient response, may repeat q 5-10 min., maximum dose of 20 mg. Airway management and/or mechanical ventilation may be required.

  b) As an alternative to midazolam or for a longer duration of action:
  Administer lorazepam: 1 – 4 mg IV or IM.
Physical restraint

Utilize the SHR supplied disposable limb holders. Restrained limbs require circulation checks q15 minutes and documentation of same.

PATIENT CARE DURING TRANSPORT

- Keep environment as quiet as possible.
- Cabin altitude restrictions should be dictated by patient condition.

UNCONTROLLABLE COMBATIVE PATIENT IN-FLIGHT

- If an unrestrained patient becomes combative:
  
  a) Administer ketamine: 0.5 – 1 mg/kg (up to 2.0 mg/kg maximum dose) IV or 4-6 mg/kg IM. Airway management and/or mechanical ventilation may be required.

  Or

  b) Administer midazolam: 2-10 mg IV or IM.

  c) If necessary, direct the pilot to land at the nearest suitable airport as soon as possible.

  d) Contact PACC to facilitate the necessary ground support required upon landing, e.g. road ambulance, local authorities, etc.

  e) All patients who have required pharmacologic restraint for violent combative behaviour must have physical restraints applied to prevent recurrence of the behaviour should the effect of the pharmacologic restraint diminish.

References


GENERAL PROTOCOL G3
DEFIBRILLATION

In ventricular fibrillation, the flight nurse/paramedic may defibrillate up to nine times before attempting to contact a physician. Refer to Clinical Protocol C10 – Ventricular Fibrillation/Pulseless VTach.

Current Emergency Cardiac Care guidelines as of 2011 recommend:

- Voltage settings of 360 joules for initial and all subsequent shocks for services using monophasic defibrillators.
- Voltage settings of 200 joules for the initial shock, with subsequent shocks at the equivalent or higher energy level using biphasic defibrillators.
- Pediatric patients: use 2 joules/kg initially with subsequent shocks at 4 joules/kg regardless of defibrillator type (pediatric Quick Combo pads are to be used in patients weighing less than 10 kg).
- Cardioversion may be carried out in patients with ventricular tachycardia who are hypotensive.
- The flight nurse/paramedic must notify the Captain of an emergency and the need to defibrillate during a flight, prior to initial discharge of the defibrillator.
- An attempt shall be made to contact the transport physician, referring or receiving physician after completion of the procedure, whenever possible.
- The Captain, shall, whenever possible, reduce altitude to maintain cabin pressure at 2,000 feet ASL.
- The flight nurse shall request that the aircraft be diverted to the nearest appropriate medical facility.
- The Captain shall notify PACC of the medical emergency. PACC shall arrange for an ambulance to be at the airport to transport the patient to the facility.

References
GENERAL PROTOCOL G4
END TIDAL CO2 MONITORING

1. **INDICATIONS**
   - Monitor the adequacy of ventilation.
   - Detect hypoventilation, esophageal intubation and ventilator disconnection.
   - Early indicator of circulatory and pulmonary problems.
   - To monitor for return of spontaneous circulation in cardiac arrest patients.

2. **DEFINITION**
   - Maximal CO$_2$ concentration detected at the end of the expiratory cycle.
   - Represents the general effects of three body functions: metabolism, circulation and ventilation.

3. **METHODOLOGY**
   - Uses infrared absorption spectroscopy to measure ETCO$_2$.
   - Monitor directed infrared light through a sampling chamber containing exhaled CO$_2$ and a reference chamber containing CO$_2$ of a known concentration; the monitor then calculates the patient’s CO$_2$ concentration for each breath.
   - Uses a mainstream sensor.

4. **EQUIPMENT SETUP – FILTERLINE SET**
   a) Insert the threaded end of the filterline set into the Lifepak 15.
   b) Attach the airway adapter and sensor cable in-line proximally to the patient, in one of several ways: between the endotracheal tube, or tracheal tube and the ventilator circuit, or bag valve mask. An HME filter may help keep your ETCO$_2$ adaptor clear of secretions, while still providing ETCO$_2$ readings. Carefully press and twist the adapter onto the airway tubing with the larger end toward the patient.
   c) In the case of a non-intubated patient for whom you wish to perform continuous ETCO$_2$ monitoring, attach a Microstream Smart Capnoline Plus O2 to your patient the same way you would apply a nasal cannula. Then attach the threaded ETCO$_2$ capnoline to the Lifepak 15 monitor.
5. **ETCO₂ SETUP FUNCTIONS**

- As soon as the Lifepak 15 identifies the application of the Filterline set or Smart Capnoline Plus O₂ set, it will automatically display an ETCO₂ reading as well as a respiratory rate. In order to bring up a waveform on screen, you must highlight one of the three monitoring channels and manually change the waveform from none, to CO₂. You will then receive a graphic representations of your patients ETCO₂ output. It is recommended that the scale be left to autoscale.

**Calibration**

a) The ETCO₂ sensor automatically and continuously calibrates itself.

b) The Lifepak 15 continuously draws air samples for ETCO₂ gas analysis. If the sensor becomes obstructed during use, the Lifepak 15 will attempt to purge the ETCO₂ line with compressed air. If the obstruction cannot be relieved, the monitor will read “CO₂ Filterline Blockage” and the ETCO₂ tubing may need to be replaced.
6. **INTERPRETATION OF THE CAPNOGRAM**

1. Is there exhaled CO$_2$?
2. Define and analyze the four phases of the capnogram.
   - I  Inspiratory baseline
   - II  Expiratory upstroke
   - III  Expiratory plateau
   - IV  Inspiratory downstroke

**NORMAL CAPNOGRAM**

3. Check minimum inspired and peak inspired (end-tidal) CO$_2$.
4. Check the relationship between ETCO$_2$ and PaCO$_2$ (P(a-ET) CO$_2$ gradient).

*With healthy lungs and normal airway conditions, end tidal CO$_2$ provides a reasonable estimate of arterial CO$_2$ (within 2-5 mmHg).*

*With diseased/injured lungs there is an increased end tidal arterial CO$_2$ gradient due to ventilation-perfusion mismatch. Related changes in patient condition will be reflected in a widening or narrowing of the gradient, conveying the V/Q imbalance and therefore the pathophysiological state of the lungs.*

CO$_2$ elimination in normal lung:
5. Search for causes of hypo or hypercapnia (if present).
6. Hypocapnea
   I. Normal respiratory rate.
      Causes:
      - minute volume too high on ventilator (washout)
      - shock
      - hypothermia
      - metabolic acidosis
   II. Slow respiratory rate
      Causes:
      - ventilator rate too low with a high minute volume
      - respiratory depression (spontaneous breathing)
III. **Respiratory rate:**

![Graph of respiratory rate]

**Causes:**
- ventilator rate is high with a high minute volume
- pain, metabolic acidosis, hypoxia (spontaneous respiration)
- severe shock

7. **Hypercapnia**

I. **Normal respiratory rate.**

![Graph of normal respiratory rate]

**Causes:**
- minute volume too low on ventilator
- rapidly rising body temperature

- low body temperature
II. **Slow respiratory rate**

Causes:
- both respiratory rate and minute volume are set too low on ventilator
- Respiratory depression

III. **Fast respiratory rate**

Causes:
- anaesthetic gases being inhaled
- ventilator running at high rate with a low tidal volume

IV. **Severe hypoventilation**
Causes:
- respiratory paralysis (spontaneous respiration)
- malfunctioning ventilator or leak in system

7. FACTORS INFLUENCING ETCO₂ MEASUREMENT

I. Altitude
   ETCO ↓

II. Temperature
   - Instrument is calibrated to the normal temperature of expired air (33°C). Every increase of 5°C will reduce reading by 1.6%.

III. Water vapor
   - Insignificant influence.

IV. O₂, N₂O
   - Oxygen does not absorb infrared light but inversely influences absorption of CO₂.
   - N₂O enhances absorption of light.

8. SUMMARY

I. If the capnogram is normal, you can (almost?) be sure:
   - minute volume is ok
   - expiratory valve is working
   - lung perfusion is ok
   - cardiac output is ok
   - patient’s temperature and metabolism are stable

II. If the capnogram is NOT normal:
   - ventilation, perfusion, temperature or metabolism problems are suspect technical fault with equipment (monitor, ventilator etc)

References
GENERAL PROTOCOL G5
INTRA-AORTIC BALLOON PUMP (IABP) COUNTERPULSATIION

- Goals of Therapy:
  a) increase coronary perfusion
  b) decrease afterload
  c) decrease cardiac work
  d) decrease myocardial oxygen consumption
  e) increase cardiac output

- Perfusionist is required for transport.

- Monitoring Considerations:
  a) maintain cardiac monitoring to transport monitor and the balloon pump.
  b) record 12 lead ECG and monitor ST segment continuously.
  c) arterial pressure waveform.
  d) hourly urinary output.
  e) peripheral pulses all extremities hourly; monitor CSM in the limb peripheral to the IABP line.
  f) hemodynamics as available (e.g. CVC).
  g) oxygen saturation continuously, ETCO₂ as required.

- Manage arrhythmias promptly as per ACLS protocols; consider the need for Quik Combo electrode placement throughout the transport.

- Maintain a cabin altitude of 2000 feet.

- Special Arrangements for transport:
  a) request that the perfusionist utilizes the longest extension tubing for the transfer (6 feet).
  b) inform receiving ambulance service of increased space requirement and ask for a special transport vehicle when available and the requirement for additional support for loading.
  c) use the stretcher with the brownline tracking attached to employ the use of ratcheting cam straps to carry and secure the IABP.
d) when securing the IABP, ensure it is secured close to the head of the second stretcher and positioned so that the side with the lines exiting is closest to the patient.

e) during the loading and unloading have 1 team member guard the distance between the 2 stretchers to prevent any tension on the lines.

f) whenever possible have the pilot arrange to load and unload the patient in a hangar.

SPECIAL CONSIDERATIONS

1. Head of bed cannot be elevated beyond 25 degrees.

2. Check the femoral insertion site for bleeding and intact dressings. In case of bleeding apply direct pressure.

3. The central lumen of the IABP tubing should not be used for any blood draw.

REFERENCES

GENERAL PROTOCOL G6
INTRAOSSEOUS INFUSION

1. Prepare equipment and don personal protective equipment.
   - Select appropriate sized needle: if the EZ-IO Gun is being used, calculations for needle size are weight based.

   **Between 3 – 39 Kg:** use the pediatric #15 gauge 15 mm needle
   **Over 40 Kg:** use the adult #15 gauge 25 mm needle
   **Bariatric patients:** use the #15 g 45 mm needle (defined by manufacturer as “excess tissue”)

   - If the BIG (Bone Injection Gun) Intraosseous device is used, depth of needle placement can be dialed into the device for use in infants and children under 12 years of age.

<table>
<thead>
<tr>
<th>Needle Sizes</th>
<th>Needle Size</th>
<th>Proximal Tibia Insertion Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants 0 to 3 years</td>
<td>18 g (Red)</td>
<td>0.5 – 0.7 cm (0.2 – 0.3 in)</td>
</tr>
<tr>
<td>Children 3 to 6 years</td>
<td>18 g (Red)</td>
<td>1 – 1.5 cm (0.4 – 0.6 cm)</td>
</tr>
<tr>
<td>Children 6 to 12 years</td>
<td>18 g (Red)</td>
<td>1.5 cm (0.5 in)</td>
</tr>
<tr>
<td>Adult</td>
<td>15 g (Blue)</td>
<td>Prox Tibial or Humerus 2.5 cm (1 inch)</td>
</tr>
</tbody>
</table>

- Chlorohexadine antiseptic solution/swabs (alcohol for infants < 2 months of age)
- 0.9% saline-10 ml syringe with leur lock
- 3-way stop cock
2. Don sterile gloves.

3. Select puncture site.
   - **Anteromedial Tibia**: First choice site for all ages.
     - **Landmark:**
       - Less than 12 years of age: locate tibial tuberosity, and move medial and 1 to 3 cm (approximately one fingerbreadth) **below** the tibial tuberosity, away from joint and epiphyseal plates.
       - Over 12 years of age: locate tibial tuberosity, move medial and 1-2 cm **above**, ensuring away from joint space
       - If puncture unsuccessful at this site, attempt at the same location on the other leg.
   
   - **Distal Tibia (for older children and adults)**
     - **Landmark:**
       - One fingerbreadth above the medial malleolus.
       - If puncture unsuccessful at this site, attempt at the same location on the other ankle.
       - Do not use this site on same limb that attempted anteromedial tibial IO.
   
   - **Proximal humerus (for older children and adults)**
     - **Landmark:**
       - Adduct elbow at 90 degrees by placing patient’s hand over umbilicus.
       - Hold the humeral head with non-dominant hand and palpate for greater tubercle of proximal humerus which is on the lateral midline of shoulder.
       - If puncture unsuccessful at this site, attempt at the same location on the other shoulder.

4. Cleanse site with appropriate antiseptic.
   - Begin cleaning the skin at the centre of the desired puncture site and make increasingly larger circular motions on the skin until an area approximately six centimeters is covered.

5. In the conscious patient, infiltrate site with 2% Lidocaine, per physician’s order.
   - Adult- Lidocaine 2%: 20 to 40 mg
   - Pediatric -Lidocaine 2%: 0.5 mg/kg mg/kg to max of 40 mg

6. Insert IO needle:
   - **Power Drill Intraosseous Insertion Method:**
- Attach a drill to compatible needle of an appropriate size. Line up needle with site at a 90 degree angle to the bone.
- Depress “on” button to activate drill. Using gentle pressure, push the needle through the skin until you feel the needle contact bone.
- At this point with the needle tip touching the bone verify you can see the 5 mm markings on the needle. The 5 mm marking is the one closest to the IO hub.
- If the 5 mm marking is visible, continue with insertion. If the 5 mm marking is not visible, do not continue with the procedure as the needle may not reach the IO space. Procedure may be restarted then with a longer needle.
- Using mild pressure on the drill, press trigger until needle “pops” through the bone cortex at which time a decrease in resistance will be felt.
- Gently remove drill from needle device. Unscrew stylette from inner cannula, leaving cannula in place.
- Attach 10 mL syringe and aspirate for blood/bone marrow to confirm placement.
- Attach saline flushed IV connection device.
- Secure with dressing and tape.
- Observe site for extravasation of fluid into the tissue.

- **BIG (Bone Injection Gun) Intraosseous Device**
  - Working away from growth plate, hold barrel of device with non-dominant hand, at 90 degrees to insertion site.
  - While maintaining patient contact, squeeze and pull the red safety latch out with dominant hand. Retain safety device for IO stabilization later.
  - Holding barrel with non-dominant hand and 90 degree contact with site, position dominant hand in a syringe-like fashion with heel of hand covering top of device.
  - Trigger device with dominant hand by pushing down with the heel of the hand. Do not attempt to use thumb or strike to top of device to trigger device.
  - Ensuring the IO needle portion of device remains intact in bone; remove the insertion portion of the device by carefully pulling upward with a slight side-to-side movement to clear needle hub.
  - Slide the red safety latch around the base of the needle. Tape red safety latch to skin to stabilize.
  - Remove the stylette from the center of the needle by pulling and rotating upward. The IO cannula should remain in the bone.
  - Confirm placement by aspirating for blood/bone marrow.
  - Connect to saline flushed IV extension set or stopcock for infusion.
  - Secure with dressing and tape.

7. If the patient is hypotensive, infuse 20 ml/kg of normal saline as rapidly as possible, utilizing 60 ml syringe to draw fluid from the IV bag followed by injection into the IO needle via the three way stopcock.

8. Restrain the leg to prevent movement and the inadvertent dislodgement of the intraosseous needle.

9. Monitor for complications of the IO insertion, specifically the flow of fluid into the soft tissue of the leg which will result in an increasing diameter of the leg. If this occurs, discontinue the IO infusion immediately and remove the needle.

IO insertion sites can be used and maintained for up to 24-48 hours until more definitive vascular access can be obtained. In a life-threatening situation where a peripheral IV cannot be obtained (including an external jugular approach), an IO infusion may be initiated without the prior consent of a physician or medical control.

SPECIAL CONSIDERATIONS:

1. Contraindications to IO insertion:
   a) current or recent fracture of long bone intended for use.
   b) osteogenesis imperfecta.
   c) osteoporosis.
   d) overlying soft tissue infection.
   e) sternal and upper extremity punctures (in peds patients).

2. Flush the line with at least 5 ml of fluid after all boluses of drugs to ensure that the medication enters the central circulation as quickly as possible.

3. Any drug that can be administered IV can be given via the intraosseous route.

4. Intraosseous lines have higher resistance than intravenous lines and, therefore, may require higher infusion pressures.

5. Patients who are conscious may experience pain with the infusion of meds or crystalloid.

References

GENERAL PROTOCOL G7
OXYGEN THERAPY

Oxygen can be administered by one of several methods:

1. **Nasal Prongs**
   - The method of choice for providing low flow rates of $O_2$ (i.e. 2 to 4 litres per minute).
   - Provides up to 44% $O_2$.
   - Flow rates greater than 6 litres per minute do not improve oxygenation and can be uncomfortable to the patient (see Oxygen Delivery Chart).

2. **Face Masks**
   - Provides up to 60% $O_2$.
   - Do not use flow rates less than 6 litres per minute as this will result in the rebreathing of exhaled carbon dioxide (see Oxygen Delivery Chart).
   - Flow rates greater than 8 to 10 litres per minute do not improve oxygenation and may cause drying and irritation of the mucous membranes of the nose.

3. **Non Rebreathing Masks**
   - Do not use flow rates less than 6 litres per minute as this will result in the rebreathing of exhaled carbon dioxide (see Oxygen Delivery Chart).
   - This is the device of choice for providing high concentrations of oxygen at 80 – 100%
   - The reservoir bag should not collapse completely when the patient inhales. If this does occur, increase the oxygen flow rate by 2 litres per minute until the bag remains inflated (usually requires 10 to 12 litres per minute).
   - All patients in respiratory distress, shock or where carbon monoxide poisoning is suspected (headache, nausea and vomiting, decreased level of consciousness after exposure to smoke or fumes from a vehicle in an enclosed space) should receive 100% oxygen.

Administer oxygen to a child in any manner that is acceptable to the patient. As children may not tolerate nasal prongs or a face mask, hold the prongs or mask as close to the face as the child will allow. Allowing a patient or other care giver to do this may make it more acceptable to the child.

**THERE ARE NO CONTRAINDICATIONS TO PROVIDING HIGH FLOW OXYGEN TO CHILDREN.**

- Oxygen does not cause toxicity in short term therapy (i.e. scarring of the lung or eye tissue).
- Humidity is not required in an air ambulance, unless the underlying disease process warrants its use.
# Oxygen Therapy

## Oxygen Delivery Chart

<table>
<thead>
<tr>
<th>Flow Rate (l/minute)</th>
<th>Nasal Cannula (%)</th>
<th>Face Mask</th>
<th>Non Rebreathing Mask</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24%</td>
<td>contraindicated</td>
<td>contraindicated</td>
</tr>
<tr>
<td>2</td>
<td>28%</td>
<td>contraindicated</td>
<td>contraindicated</td>
</tr>
<tr>
<td>3</td>
<td>32%</td>
<td>contraindicated</td>
<td>contraindicated</td>
</tr>
<tr>
<td>4</td>
<td>36%</td>
<td>contraindicated</td>
<td>contraindicated</td>
</tr>
<tr>
<td>5</td>
<td>40%</td>
<td>contraindicated</td>
<td>contraindicated</td>
</tr>
<tr>
<td>6</td>
<td>44%</td>
<td>40%</td>
<td>60%</td>
</tr>
<tr>
<td>7</td>
<td>44%</td>
<td>50%</td>
<td>70%</td>
</tr>
<tr>
<td>8</td>
<td>44%</td>
<td>60%</td>
<td>80%</td>
</tr>
<tr>
<td>9</td>
<td>44%</td>
<td>60%</td>
<td>90%</td>
</tr>
<tr>
<td>10</td>
<td>44%</td>
<td>60%</td>
<td>95%+</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td>95%+</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td>95%+</td>
</tr>
</tbody>
</table>
OXYGEN ENDURANCE CHART

<table>
<thead>
<tr>
<th>Cylinder Size</th>
<th>D</th>
<th>E</th>
<th>G</th>
<th>Q</th>
<th>M</th>
<th>H/K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity (litres)</td>
<td>300</td>
<td>600</td>
<td>1,000</td>
<td>2,000</td>
<td>3,450</td>
<td>6,500</td>
</tr>
<tr>
<td>Flow Rate (litres per min.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2:30</td>
<td>5:00</td>
<td>8:20</td>
<td>16:40</td>
<td>28:45</td>
<td>54:00</td>
</tr>
<tr>
<td>4</td>
<td>1:15</td>
<td>2:30</td>
<td>4:10</td>
<td>8:20</td>
<td>14:20</td>
<td>27:00</td>
</tr>
<tr>
<td>6</td>
<td>0:50</td>
<td>1:40</td>
<td>2:45</td>
<td>5:30</td>
<td>9:35</td>
<td>18:00</td>
</tr>
<tr>
<td>8</td>
<td>0:35</td>
<td>1:10</td>
<td>2:05</td>
<td>4:10</td>
<td>7:10</td>
<td>13:30</td>
</tr>
<tr>
<td>10</td>
<td>0:30</td>
<td>1:00</td>
<td>1:40</td>
<td>3:20</td>
<td>5:45</td>
<td>11:00</td>
</tr>
<tr>
<td>15</td>
<td>0:20</td>
<td>0:40</td>
<td>1:05</td>
<td>2:10</td>
<td>3:50</td>
<td>7:15</td>
</tr>
<tr>
<td>20</td>
<td>0:15</td>
<td>0:30</td>
<td>0:50</td>
<td>1:40</td>
<td>2:50</td>
<td>5:30</td>
</tr>
<tr>
<td>25</td>
<td>0:12</td>
<td>0:24</td>
<td>0:40</td>
<td>1:20</td>
<td>2:20</td>
<td>4:20</td>
</tr>
</tbody>
</table>

NOTE:
- Endurance times in hours and minutes are approximations based on full bottle pressure at start of flow rate.
- Oxygen regulators are calibrated for accuracy at sea level. Therefore, at altitude oxygen will flow faster than the setting on the flow meter.
- As altitude increases, oxygen requirements increase.
- As altitude decreases, oxygen requirements decrease.
- Always estimate flight time plus two hours, to ensure adequate oxygen supply.

References
Physician’s orders are required for any treatment/intervention that does not fall under a SAA Clinical Protocol, or where the protocol requires an order from a physician.

When obtaining telephone orders, the flight nurse/paramedic must:

a) speak directly to the physician issuing the order.

b) repeat the order back to the physician for confirmation.

c) write the order on the patient care record, including the time it was obtained, the physician’s name and location.

d) place a check mark in front of the order, write “given” and sign your name.

In emergency/acute situations where the delay of immediate intervention is deleterious to the patient, the flight nurse/paramedic shall follow authorized protocols and then attempt to telephone a physician as soon as possible.

A Transport Physician is available for consultation and direction as deemed necessary by the flight nurse/paramedic.
GENERAL PROTOCOL G9
SUCTION

- Maintenance of an open airway has priority over all other treatments, including control of the cervical spine.
- If unable to keep the airway clear of secretions which are blocking the airway, roll the patient onto his or her side to allow for gravity drainage. If time permits, first stabilize the cervical spine in a trauma patient with a suspected spinal injury.
- Rigid suction devices such as tonsil suction should be used for suctioning of the upper airway.
- Catheter suction is only useful for suctioning the airway of infants and small children.
- A bulb syringe should be used for suctioning of the airway of newborns (mouth followed by nose). Always squeeze the bulb syringe prior to inserting into the airway, releasing once it is in the mouth or nose.
- Inline suction catheter devices are required for suctioning the endotracheal tube in intubated patients.
- Wear personal protective equipment when suctioning.
- Do not suction for longer than ten seconds at a time.
- Suction pressure higher than those recommended below may result in damage to the mucosa of the trachea and bronchi.

### RECOMMENDED SUCTION PRESSURE

<table>
<thead>
<tr>
<th>Age</th>
<th>Suction Range (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premature or low birth weight</td>
<td>60 - 80</td>
</tr>
<tr>
<td>Term infants</td>
<td>80 - 100</td>
</tr>
<tr>
<td>Children</td>
<td>100 - 120</td>
</tr>
<tr>
<td>Adults</td>
<td>120 - 150</td>
</tr>
</tbody>
</table>

- Portable hand powered suction devices may be useful in some circumstances as they:
  - do not require power;
  - generally have a larger bore to suction through; and
• may be safer than electrical or battery powered suction as they generate lower pressures (120-150 mmHg) than mechanical suction which can exceed 300 mmHg.

• Only those portable hand powered suction devices that have been approved by Emergency Medical Services may be used for this purpose. These include the following models:
  
  • V-Vac
  • Resp-o-vac

**NOTE:** Hand powered suction units may not be adequate for the suction of an endotracheal tube.
Saskatchewan Air Ambulance – CLINICAL PROTOCOLS

GENERAL PROTOCOL G10
TRANSPORT OF POTENTIAL ORGAN DONORS

- Saskatchewan Air Ambulance may be requested to provide interfacility transport of a patient who is a potential heart-beating donor subject to the following conditions:
  a) the transport must never conflict with emergent or urgent patient transport.
  b) non heart-beating tissue donors will not be transported by Lifeguard.
  c) identification of heart-beating donors will be done by the Saskatchewan Transplant Program and only this agency may request transfer.
  d) transportation costs will not be incurred by donor families.

- Guidelines for organ donation are outlined in the Saskatchewan Transplant Program Manual located in the Flight Nurse library.
- The primary aim of organ donor maintenance is to maintain the donor in a state of equilibrium; this must be achieved by artificial means.
- During air transportation of the organ donor candidate the principle guidelines for donor management include:
  a) Hemodynamic stability.
  b) Cardiac function.
  c) Adequate ventilation/oxygenation.
  d) Evaluation and maintenance of urine output.
  e) Temperature regulation.
  f) Prevention of infection.
  g) Resuscitation of the patient from spontaneous hypotension.

MULTI-ORGAN DONOR MAINTENANCE

- Process is initiated by the referring centre in consultation with the Saskatchewan Transplant Coordinator.
- Once consent for organ donation is obtained, the transplant coordinator will contact Saskatchewan Air Ambulance and request transfer to a tertiary hospital.
- Request maximum cabin altitude of 2,000 - 4,000 feet ASL.
- Load patient head to nose of the aircraft.

HEMODYNAMIC STABILITY:

- Maintain systolic BP > 100 mm Hg.
- 2 peripheral lines.
Control circulatory volume with a maintenance infusion of Ringer’s lactate or normal saline at 2 mg/kg/hr.

Bolus normal saline or Ringer’s lactate at 5 ml/kg over 30 minutes if systolic BP drops below 100 mmHg.

If unable to maintain a systolic BP > 100 mmHg following an infusion of 1-2 liters of crystalloid; administer 500 - 1000 ml of 5% Albumin if available.

Vasopressors will be used ONLY when adequate hydration does not achieve systolic BP > 100 mmHg. Initiate dopamine infusion as per protocol, attempt to keep dose < 10 mcg/kg/min (least nephrotoxic).

CARDIAC FUNCTION:

The following ECG abnormalities may be seen:

- a) ST segment elevation or depression.
- b) atrial arrhythmias.
- c) prolonged Q-T intervals.
- d) intraventricular conduction delays
- e) Q-waves.

Sinus tachycardia

- a) Rule out hypovolemia, vasodilator/vasopressor effect.
- b) If persistent, with clinical compromise, administer metoprolol: 5 mg IV push; repeat X 1 in 5 minutes, prn.

Symptomatic Bradycardia

- a) Initiate transcutaneous temporary pacing; atropine is not effective (brain dead donors do not have vagus nerve function).

All other dysrhythmias should be managed by protocol.

ADEQUATE VENTILATION/OXYGENATION:

- Maintain SpO2 at 98 - 100%
- FIO2:1.0
- Rate: 10-15
- Vt: 6-10 ml/kg

ARDS and pulmonary edema may be present in organ donors, utilize PEEP as necessary.

EVALUATION AND MAINTENANCE OF URINARY OUTPUT:

- Maintain urine output at 1-2 ml/kg/hr. Diabetes insipidus is frequently seen in brain dead donors (caused by inadequate secretion of antidiuretic hormone).
- If possible serum potassium and serum sodium levels should be drawn prior to transport.
- If serum sodium < 130 mmol/l, normal saline is the recommended IV solution.
- If indicated, add 10 meq KCL/litre to IV fluid, run at previous hour’s urine output PLUS 2 ml/kg/hr. DO NOT bolus with IV solution containing KCL.
- Aqueous pitressin may be required for treatment of diabetes insipidus; contact receiving Intensivist for treatment guidelines.
TEMPERATURE REGULATION:
- Maintain temperature (core) above 35°C.
- Increase aircraft cabin temperature.
- Cover head and body with warm blankets.

TRANSPORT ORIGINAL DOCUMENTS WITH DONOR
- Authorization for transfer of organ donor (if available).
- Physician statement documenting brain death (if available).
- Family consent for organ donation.
- Recent chemistry results (if available).
- Copy of patient history.
- Copy of CXR and ECG (if available).

References
MEDICATION PROTOCOL M1
AMIODARONE

PHARMACOLOGY
Amiodarone is a vasodilator and has a slight negative inotropic effect, which may result in small decreases in blood pressure. Amiodarone IV has complex electrophysiologic effects.

**Hemodynamically unstable patients in VT should receive immediate cardioversion** (see Clinical Protocol C9 - Unstable Tachycardia).

INDICATIONS
Prior to discussing the case with a physician, the Flight Nurse or Paramedic may initiate amiodarone for treatment of the following:

1. **Refractory ventricular fibrillation/pulseless ventricular tachycardia** (see Clinical Protocol C10 - V-Fib/Pulseless V-Tach).
2. **Hemodynamically stable ventricular tachycardia** (see Clinical Protocol C11 - Ventricular Tachycardia (stable)).

The Flight Nurse or Paramedic must contact the Transport Physician as soon as possible following the initiation of amiodarone.

CONTRAINDICATIONS
1. Known hypersensitivity to amiodarone, iodine, or benzyl alcohol.
2. Second or third degree AV block.
3. Sinus node dysfunction.

CAUTIONS/INTERACTIONS
The SHR IV Medication Reference Manual shall be used to guide appropriate administration with consideration given to contraindications, drug interactions/incompatibilities and precautions.\(^1\)

DOSE\(^2\)
**Ventricular Fibrillation/ Pulseless V-Tach:**
1. Adults: **300 mg IV push** (may repeat once at 150mg)
2. Peds: **5 mg/kg IV push**
Stable V-Tach:

1. **Initial rapid infusion: 150 mg over 10 minutes (15mg/min)**
   Add 3 mL amiodarone IV (150 mg) to 100 mL D5W
   (concentration = 1.5 mg/mL)
   Infuse 100 mL over 10 minutes (15 mg/min)

2. **Follow with slow loading infusion: 360 mg over 6 hours (1mg/min)**
   Add 9 mL amiodarone IV (450mg) to 250 mL D5W
   (concentration = 1.8 mg/mL)
   Infuse at 33 mL/hr over 6 hours (1 mg/min)

3. **Follow with: maintenance infusion 540 mg over 18 hours (0.5 mg/min or 17 mls/hr with the above concentration)**

**ADMINISTRATION**

1. Refer to the SHR IV Medication Administration Manual or product monograph.
2. Amiodarone should be mixed in D5W and have an in-line filter placed on the distal end of the pump tubing.
3. Amiodarone concentrations > 2 mg/mL infusing for longer than 1 hour should ideally be administered through a central venous catheter (CVC) due to the high incidence of peripheral vein phlebitis, thrombosis and tissue extravasation.
4. Amiodarone infusions lasting longer than 2 hours must be administered in an++ polyolefin (non-PVC) IV bag containing D5W. Polyvinyl chloride (PVC) tubing can be used.
5. Continuous ECG monitoring and hemodynamic monitoring is required prior to the initiation of an amiodarone infusion. Vitals should be recorded every 15 minutes while the infusion is ongoing.
# AMIODARONE

**450 mg**

250 ml D5W (non PVC bag only with in-line filter)

Concentration 1.8 mg/ml

<table>
<thead>
<tr>
<th>CARDIAC ARREST</th>
<th>DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BOLUS DOSE – OVER 10-20 MIN.</strong></td>
<td><strong>DOSE 300 mg IVP</strong></td>
</tr>
<tr>
<td>150 mg in 100mls D5W (1.5 mg/ml)</td>
<td>150 mg</td>
</tr>
<tr>
<td>Infuse @ 600 mls/hr = 15 mg/min.</td>
<td></td>
</tr>
<tr>
<td>Maximum rate of infusion 30 mg/min.</td>
<td></td>
</tr>
<tr>
<td><strong>SECOND INFUSION – OVER 6 HRS</strong></td>
<td><strong>DOSE</strong></td>
</tr>
<tr>
<td>450 mg in 250 mls D5W</td>
<td>360 mg</td>
</tr>
<tr>
<td>Infuse @ 34 mls/hr = 1mg/min.</td>
<td></td>
</tr>
<tr>
<td><strong>MAINTENANCE INFUSION – OVER 18 HRS</strong></td>
<td><strong>DOSE</strong></td>
</tr>
<tr>
<td>Decrease infusion to 16.7 mls/hr = 0.5mg/min</td>
<td>540 mg</td>
</tr>
<tr>
<td>Total dose over 24 hours should not exceed 2.2 g. May repeat a bolus dose of 150 mg for recurrent ventricular tachycardia.</td>
<td></td>
</tr>
</tbody>
</table>

Monitor for: bradycardia, hypotension, QT prolongation and torsades de pointes.

## REFERENCES


2. 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science, Chapter 8 – Adult Advanced Cardiac Life Support

Approval: Effective: February, 2016  
Medical Director: [Signature]
BACKGROUND

Patients undergoing air ambulance transport are subjected to a number of different stressors. One of the most common complaints or sequelae which occurs is the onset of nausea and vomiting. Oxygen therapy has been shown to improve symptoms of nausea & vomiting in clinical trials and may be of some benefit to the patient.

DIMENHYDRINATE

The Flight Nurse and/or Paramedic may administer dimenhydrinate without the prior expressed consent of a transport physician in the following instances:

INDICATIONS

1. To relieve or provide relief from nausea/vomiting caused by motion sickness, pharmaceutical agents and all other causes.

CONTRAINDICATIONS

1. Hypersensitivity to dimenhydrinate.
2. Not recommended in children less than 2 years of age.

CAUTIONS/INTERACTIONS

1. Dimenhydrinate may potentiate the CNS depressant effects of opiates, ethanol and other sedatives.
2. Dimenhydrinate may potentiate the anticholinergic effects of tricyclic antidepressants.
3. Use in caution in patients with asthmatics, patients with cardiovascular disease and in the elderly.
4. Use in caution in patients who would be sensitive to the anti-cholinergic side effects of dimenhydrinate. (i.e. narrow angle glaucoma, prostatic hypertrophy).

DOSE

1. Adult: 25-50 mg IV q 4 hrs.
2. Peds: 1 mg/kg IV q 4 hrs (maximum of 50 mg/dose).

ONDANSETRON

The Flight Nurse and/or Paramedic should consult the Transport Physician prior to administering ondansetron for the following instances:
INDICATIONS

1. To relieve or provide relief from nausea/vomiting caused by motion sickness, pharmaceutical agents and all other causes.

PHARMACOLOGY

Ondansetron is a serotonin 5-HT3 receptor antagonist used mainly as an antiemetic often following chemotherapy. Its effects are thought to be on both peripheral and central nerves. Ondansetron reduces the activity of the vagus nerve, which deactivates the vomiting center in the medulla oblongata, and also blocks serotonin receptors in the chemoreceptor trigger zone. It does this without any depression in CNS function.

CONTRAINDICATIONS

1. Hypersensitivity to ondansetron.

CAUTIONS/INTERACTIONS

1. Hypersensitivity to ondansetron.
2. Patients with sensitivities to other 5-HT3 receptor antagonists (granisetron, tropisetron)
3. Ondansetron is not as effective as dimenhydrinate in preventing motion-induced nausea and vomiting.
4. Patients with hepatic function impairment should receive smaller doses with a MAXIMUM of 8 mg/day.

DOSE

1. Adults: 4 – 8 mg slow IV push over 2-3 minutes q 8 hrs.
2. Peds: 0.15 mg/Kg to a maximum single dose of 4mg IV (slow over 2-3 min).

REFERENCES

1 A Randomized Controlled Trial of Oxygen for Reducing Nausea and Vomiting During Emergency Transport of Patients Older Than 60 Years With Minor Trauma; Alexander Kober, MD, Roman Fleischackl, BS, Thomas Scheck, BS, Frank Lieba, BS, Helmut Strasser, BS, Alexander Friedmann, MD and Daniel I. Sessler, MD; Mayo Clinic Proceedings January 2002 vol. 77 no. 1 35-38

MEDICATION PROTOCOL M3
DOBUTAMINE

PHARMACOLOGY
Clinically, dobutamine increases cardiac output by selectively augmenting stroke volume; this is associated with a decrease in total peripheral vascular resistance that is mediated, in part, by reflex withdrawal of sympathetic tone to the vasculature. This hemodynamic profile of dobutamine makes the drug of value in the management of low output cardiac failure.

INDICATIONS
Prior to initiating a dopamine infusion, the Flight Nurse or Paramedic will consult the Transport Physician regarding the initiation of the infusion. Dobutamine is indicated for the treatment of hemodynamically significant hypotension:
1. Low output cardiac failure.

CONTRAINDICATIONS
1. Hypersensitivity to dobutamine or sulphites.
2. Known pheochromocytoma.
3. Idiopathic hypertrophic subaortic stenosis.
4. Uncorrected tachyarrhythmias.

CAUTIONS/INTERACTIONS
1. Hypovolemia must be corrected prior to starting dobutamine.
2. Myocardial Infarction – Excessive doses of dobutamine may increase ischemia.
3. Hyperthyroidism/HTN – exaggerated pressor response may occur.
4. MAOIs and TCAs may potentiate the pressor response from dobutamine.

DOSE
1. Initiate the infusion at 2-3 mcg/kg/min.
2. Titrate in 2-3 mcg/kg/min increments at 10 – 30 minute intervals depending on response. Dosing range is between 2 and 20 mcg/kg/min.

TO MINIMIZE ADVERSE EFFECTS, THE LOWEST INFUSION RATE THAT RESULTS IN SATISFACTORY HEMODYNAMIC and CLINICAL RESPONSE SHOULD BE USED.
ADMINISTRATION


2. Hemodynamic monitoring should be initiated before the initiation of the dobutamine infusion and vitals performed every 5 minutes until patient displays some of the following signs of adequate perfusion:
   1. A mean arterial pressure of > 70 mmHg.
   2. A systolic blood pressure of at least 90 mmHg.
   3. Urine output of 0.5-1 ml/kg/hr.
   4. Return of peripheral pulses.
   5. Improved level of consciousness.

REFERENCES

1. 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care; Part 9: Post–Cardiac Arrest Care.

MEDICATION PROTOCOL M4
DOPAMINE

PHARMACOLOGY
Dopamine hydrochloride is a chemical precursor of norepinephrine that stimulates dopaminergic, B1 adrenergic and ß-adrenergic receptors in a dose dependent fashion.

HEMODYNAMIC EFFECTS

<table>
<thead>
<tr>
<th>SITE</th>
<th>EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac output</td>
<td>- dose dependent</td>
</tr>
<tr>
<td></td>
<td>- most pronounced at moderate infusion rates (2-10 mcg/kg/min)</td>
</tr>
<tr>
<td>Total peripheral resistance</td>
<td>- dose dependent</td>
</tr>
<tr>
<td></td>
<td>- increases with higher doses</td>
</tr>
<tr>
<td></td>
<td>- predominates at high infusion rates (&gt; 10 mcg/kg/min)</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>- often not affected or slightly decreased at low infusion rates (1-2 mcg/kg/min)</td>
</tr>
<tr>
<td></td>
<td>- at moderate infusion rates (2-10 mcg/kg/min) B.P. may respond to the increased heart rate that predominates at this dosage range.</td>
</tr>
<tr>
<td></td>
<td>- at moderate to high dosage (10-15 mcg/kg/min), the medication resembles Epinephrine with an increase in systolic B.P.</td>
</tr>
<tr>
<td></td>
<td>- at high infusion rates (15-20 mcg/kg/min) alpha vasoconstriction is pronounced, the medication acting more and more like Norepinephrine.</td>
</tr>
</tbody>
</table>
INDICATIONS
Prior to a discussion with the transport physician, the Flight Nurse or Paramedic may initiate a dopamine infusion in the presence of hemodynamically significant hypotension with evidence of:
1. Poor tissue perfusion.
2. Oliguria.
3. Changes in mental status.

CONTRAINDICATIONS
1. Hypovolemic shock.
2. Uncorrected tachycardias.
3. Known pheochromocytoma.

CAUTIONS/INTERACTIONS:
1. Patients with peripheral vascular disease are more prone to peripheral vasoconstriction.
2. Dopamine may aggravate primary pulmonary HTN.
3. Dopamine may aggravate ischemic heart disease.
4. TCAs: May potentiate dopamine’s vasopressor response.
5. MAOIs: Reduce the initial dose by 90%.
6. Phenytoin IV: When given concomitantly with dopamine may cause bradycardia and hypotension.
7. B-Blockers: Will need increased rates of infusion to achieve therapeutic effect.

DOSE
1. Initial rate: **2-5 mcg/kg/min**
2. Titrate by 1 to 5 mcg/kg/min at 2–5 minute intervals until the patient displays some of the following signs listed under the administration section of this protocol. Final dosage range is **5-20 mcg/kg/min**.

TO MINIMIZE ADVERSE EFFECTS, THE LOWEST INFUSION RATE THAT RESULTS IN SATISFACTORY HEMODYNAMIC PERFORMANCE SHOULD BE USED.

ADMINISTRATION
1. Refer to SHR IV Medication Administration Manual.
2. Hemodynamic & ECG monitoring should be initiated prior to the initiation of a dopamine infusion and must be performed every 5 minutes until patient condition stabilizes as defined by:
   1. MAP > 70 mmHg.
   2. SBP of at least 90 mmHg.
3. Urine output of 0.5 - 1 ml/kg/hr.
4. Return of peripheral pulses.
5. Improved level of consciousness.

DOPAMINE INFUSION

<table>
<thead>
<tr>
<th>WEIGHT</th>
<th>DOSAGE (mcg/kg/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>lb</td>
<td>1.0</td>
</tr>
<tr>
<td>kg</td>
<td>88</td>
</tr>
<tr>
<td>98</td>
<td>45</td>
</tr>
<tr>
<td>110</td>
<td>50</td>
</tr>
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REFERENCES


MEDICATION PROTOCOL M5
KETAMINE

PHARMACOLOGY
Ketamine is a rapid-acting general anesthetic producing an anesthetic state characterized by profound analgesia, maintenance of some pharyngeal-laryngeal reflexes, normal or slightly enhanced skeletal muscle tone, cardiovascular and respiratory stimulation, and occasionally a transient and minimal respiratory depression. Ketamine serves as an excellent induction agent for patients in need of intubation because of respiratory distress as it produces some bronchodilation (particularly asthmatic patients).

INDICATIONS
1. To facilitate rapid sequence induction intubation (see Clinical Protocol R4 - Rapid Sequence Induction).
2. To chemically restrain a combative patient while in flight (See Clinical Protocol G2 - Combative Patient).
3. Continuous infusions of ketamine may only be administered after consultation with the Transport Physician and orders are received.

CONTRAINDICATIONS
1. Hypersensitivity to ketamine.
2. Intracranial hemorrhage or any other condition with increased ICP (relative).

CAUTIONS/INTERACTIONS
1. Concurrent administration of ketamine with other CNS depressants is likely to produce an additive effect and subsequent prolonged sedation.
2. Ketamine has been shown to increase both intra-ocular pressures as well as intra-cranial pressures, particularly in patients with space occupying lesions. Use with caution with these patients.
3. Ketamine has been documented to produce “emergence reactions” which can range from dissociative dream-like states to full delirium. These reactions occur in 12% of cases and can potentially be avoided by slower injection rates and smaller doses. Concomitant use of midazolam may help attenuate any unwanted side effects.¹
4. Rapid administration of ketamine is associated with respiratory depression and in some cases, brief periods of respiratory arrest.
5. Patients with myocardial ischemia, CHF or a tendency to arrhythmias should receive smaller doses as ketamine has a tendency to cause CVS stimulation.
DOSE

1. Rapid sequence induction: 1 – 1.5 mg/kg IV (adults and peds).

2. Combative Patient: 0.5 – 1 mg/kg IV (adults and children).
   
   4 – 6 mg/kg IM
   
   Onset: 45 - 90 seconds IV; 3 – 4 minutes IM
   
   Duration: 5 - 10 minutes IV; 12 – 25 minutes IM

REFERENCES


MEDICATION PROTOCOL M6
LABETOLOL

PHARMACOLOGY
Antihypertensive: Non selective β1, β2 and selective α1 adrenergic blocker.

INDICATIONS
For the emergency treatment of severe hypertension. 
Requires physician’s order prior to administration.

CONTRAINDICATIONS
1. Hypersensitivity to labetalol.
2. Cardiogenic shock.
4. Greater than first degree heart block.
5. Sinus bradycardia.

CAUTIONS/INTERACTIONS
1. Bronchial asthma and lung disease; may induce bronchospasm.
2. Congestive heart failure.
3. Diabetes mellitus.
4. Hyperthyroidism.
6. Calcium channel blockers (e.g. verapamil); additive negative effects on myocardial contractility, heart rate and AV conduction.
7. Halothane, enflurane, isoflurane: increased risk of myocardial depression and hypotension.
8. Diuretics, or other hypotensive agents: may increase hypotensive effect.

PREGNANCY/BREAST FEEDING: Contact pharmacy for most recent information.
SIDE EFFECTS

1. Orthostatic hypotension/dizziness. May require NS boluses, elevating patient’s legs, or vasopressors.
2. Ventricular arrhythmias; intensification of AV block.
3. Bradycardia, may respond to atropine. Possible reduced risk of occurrence compared to other beta-blockers.
4. Congestive heart failure; responds to digitalis and diuretics.
5. Dyspnea, wheezing, bronchospasm. Possible reduced risk of occurrence compared to other beta-blockers.
6. Tingling of scalp or skin.
7. Flushing, sweating.
8. Hypersensitivity reactions, skin rash.

DOSE

ADULT

Direct IV
- Initial dose: as per physician’s order.
- Additional doses can be given at 10 minute intervals until desired BP is achieved.
- Usual dose range 50 to 200 mg. Recommended maximum cumulative dose: 300 mg per event.

Infusion
- Initial rate: 2 mg/minute, then adjust to BP response.

PEDIATRIC

Direct IV
- 0.2 - 1 mg/kg/dose q 10 minutes as required. Maximum single dose: 20 mg.

Infusion
- 0.4 - 1 mg/kg/hr., to max of 3 mg/kg/hr. May initiate with a 0.2 - 1 mg/kg bolus. Maximum bolus dose: 20 mg.
ADMINISTRATION

<table>
<thead>
<tr>
<th>Mode</th>
<th>Direct into IV tubing</th>
<th>Intermittent Infusion</th>
<th>Continuous Infusion</th>
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<td>Adult</td>
<td>Slowly, max. over 2 min.</td>
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<td>Withdraw 40mls from a 100ml minibag. Add 200mg Labetalol (40mls) to the remaining 60mls for 2 mg/ml.</td>
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MONITORING

REQUIRED

Direct into IV tubing:

- Continuous BP and HR, or q 5 minutes x 2 after each injection and until stable.
- Continuous ECG while drug is administered.

Continuous infusion:

- Continuous BP, or q 5 minutes until stable, then q 30 minutes x 2 hours, then q 1h.
- Continuous ECG

RECOMMENDED

- Due to potential for postural hypotension and fainting during the initial 3 hours post dose, the patient’s ability to tolerate the upright position should be established prior to first ambulation.
# Labetolol Infusion

**Dosage**: 200 mg (40 ml) in 50 ml NS at 4 mg/ml. Remove 50 ml N/S from 100 ml bag. Add Labetolol 200 mg (40 ml).

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**References**


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**Approval:** Effective February, 2016

**Medical Director:**

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MEDICATION PROTOCOL M7
NITROGLYCERIN

PHARMACOLOGY
Nitroglycerin relaxes vascular smooth muscle, inhibiting venous return and reducing left ventricular filling pressure. The subsequent decrease in ventricular work and wall tension frequently improves sub-endocardial perfusion. Nitroglycerin also dilates large coronary arteries, antagonizes vasospasm and increases collateral blood flow to ischemic myocardium.

Contact the Transport Physician prior to initiating a nitroglycerin infusion in the following circumstances (see Chest Pain – Cardiac Clinical Protocol – C5):

INDICATIONS
1. Unstable angina pectoris.
2. Acute myocardial infarction.
3. Congestive heart failure.
4. Acute pulmonary edema.

CONTRAINDICATIONS
1. Right ventricular wall MI.
2. Hypotension or uncorrected hypovolemia (defined by MAP < 70 mmHg or systolic pressure < 100 mmHg).
3. Increased intracranial pressure.
5. Pericardial tamponade.
6. Recent use of Viagra (sildenafil), Cialis (tadalafil) or Levitra (vardenafil) in the past 24 hrs.

CAUTIONS/INTERACTIONS
1. Heparin: may have a decreased anticoagulant effect.
2. Tricyclic antidepressants: potentiates hypotensive and anticholinergic effects.
3. Antihypertensives: may have additive hypotensive effects.

The Saskatoon Health Region IV Medication Reference Manual shall be used to guide appropriate administration with consideration given to contraindications, drug interactions and precautions.
DOSE

Initial rate: **5-10 mcg/min IV**; increase by increments of 5-10 mcg/min q 3-5 minutes until the desired hemodynamic or clinical response is achieved (e.g. fall in systemic vascular resistance or left ventricular filling pressure, relief of chest pain), to a maximum dosage of 200 mcg/min.

TO MINIMIZE ADVERSE EFFECTS, THE LOWEST INFUSION RATE THAT RESULTS IN SATISFACTORY HEMODYNAMIC AND CLINICAL RESPONSE SHOULD BE USED

ADMINISTRATION

1. Systolic blood pressure must be greater than or equal to 100 (with a MAP of 70 or greater).
2. Establish continuous ECG monitoring, a baseline blood pressure as well as a blood pressure every 5 minutes while titrating the dose of nitroglycerin. Once the pain is control is achieved, monitor blood pressures every 15 minutes.

REFERENCES

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MEDICATION PROTOCOL M8
NOREPINEPHRINE

PHARMACOLOGY

Norepinephrine is a major endogenous neurotransmitter released by postganglionic adrenergic nerves. Norepinephrine is a potent α1-adrenergic receptor agonist but has only modest β-agonist activity, which renders it a powerful vasoconstrictor with less potent direct inotropic properties. Norepinephrine primarily increases systolic, diastolic, and pulse pressure yet has a minimal net impact on CO. Furthermore, norepinephrine has minimal chronotropic effects, which makes it attractive for use in settings in which heart rate stimulation may be undesirable.¹

INDICATIONS ¹

The Flight nurse or Paramedic may initiate a norepinephrine infusion prior to a discussion of the case with the transport physician in the following instances:

1. To help restore adequate perfusion/blood pressure in patients with acute hypotension or shock states. (i.e. sepsis, neurogenic shock, etc.)*

   * Norepinephrine must be administered after or in conjunction with aggressive fluid boluses to correct the hypotension. Start with crystalloid boluses of 500-2,000 mls and repeat as necessary.

CONTRAINDICATIONS

1. Hypersensitivity to norepinephrine or sulphites.

2. Suspected mesenteric infarction or thrombosis. Norepinephrine will almost certainly increase the area of the infarct (relative contraindication).

CAUTIONS/INTERACTIONS

1. Use with caution in patients with occlusive vascular disease or elderly patients.

2. Hypercapnia & Hypoxia: cardiac arrhythmias are far more likely.

3. Digoxin: may increase the risk of cardiac arrhythmias.

4. B – Blockers: may result in blunted effects of the norepinephrine.

5. MAOI’s & TCA’s: may potentiate norepinephrine’s vasopressor response.

DOSE

1. Initial starting dose: 0.1 mcg/kg/min.

2. Titrate at 2 – 5 minute intervals until the patient displays some of the following signs of adequate perfusion:
a. MAP > 70 mmHg.
b. SBP of at least 90 mmHg.
c. Urine output of 0.5 - 1 ml/kg/hr.
d. Return of peripheral pulses.
e. Improved level of consciousness.

3. **Maintenance:** 0.03 – 1.5 mcg/kg/min (equivalent to 2.4 - 120 mcg/min in an 80 kg patient); doses as high as 3.3 mcg/kg/minute have been used. Maximum pediatric dose is 2 mcg/kg/min.

4. Do not stop infusion abruptly; rate should be gradually tapered.

**ADMINISTRATION**

1. Refer to the Saskatoon Health Region IV Medication Reference Manual or product monograph.
2. Norepinephrine is preferably administered through a central venous catheter as it can produce severe tissue damage with extravasation. Norepinephrine can be administered via peripheral IV (large vein preferable) in the transport environment where it is critical to stabilize the hemodynamics of the patient. Monitor site frequently. If extravasation is evident, stop the infusion and consider phentolamine.
3. Prior to the infusion of norepinephrine, hemodynamic and ECG monitoring **MUST** be initiated and be repeated every 5 minutes until the patient’s condition stabilizes. Because of norepinephrine’s peripheral vasoconstriction effect, monitoring of blood pressure is preferred via an arterial catheter. Frequent vital signs are imperative and the use of arterial line monitoring will return far more accurate information.
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## NOREPINEPHRINE (Levophed) INFUSION

16mg

250 ml D5W

CONCENTRATION = 64 mcg/ml

### mcg/kg/min

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<td>135</td>
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<td>323</td>
<td>329</td>
<td>335</td>
<td>342</td>
</tr>
</tbody>
</table>
REFERENCES

i Inotropes and Vaspressors, A Review of Physiology and Clinical Use in Cardiovascular Disease Christopher B. Overgaard, MD; Vladimír Džavík, MD; Circulation. 2008; 118: 1047-1056


Approval: Effective: February, 2016 Medical Director: 

SECTION: Medications Reviewed May 2016 Page M8-8
MEDICATION PROTOCOL M9
OCTREOTIDE

PHARMACOLOGY
Synthetic somatostatin analogue.

INDICATIONS
For the emergency treatment of variceal hemorrhage.
Requires physician’s order prior to administration.

CONTRAINDICATIONS
1. Hypersensitivity to octreotide.

CAUTIONS/INTERACTIONS
1. Monitor blood glucose in bleeding cirrhotic patients: at risk for developing insulin dependent diabetes and those with pre-existing diabetes may experience changes in insulin requirements.
2. Dialysis patients may require dose reduction.
3. Elderly patients require dose reduction and may be more sensitive to side effects.

PREGNANCY/BREAST FEEDING: Contact pharmacy for most recent information.

SIDE EFFECTS
1. Nausea, abdominal cramps, diarrhea, malabsorption of fat, flatulence: dose dependent.
2. Cholelithiasis (rare).

DOSE
ADULT
Direct IV
- Management of variceal hemorrhage: 50-100mcg bolus, followed by continuous infusion of 25-50 mcg/hour for up to 5 days.
### OCTREOTIDE INFUSION

- **mcg/hr**
- **500mcg**
- **250 mls N/S or D5W**
- **25mcg/ml**

<table>
<thead>
<tr>
<th>DOSAGE (mcg/hr)</th>
<th>RATE (ml/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 mcg/hr</td>
<td>12.5 ml/hr</td>
</tr>
<tr>
<td>30 mcg/hr</td>
<td>15 ml/hr</td>
</tr>
<tr>
<td>35 mcg/hr</td>
<td>17.5 ml/hr</td>
</tr>
<tr>
<td>40 mcg/hr</td>
<td>20 ml/hr</td>
</tr>
<tr>
<td>45 mcg/hr</td>
<td>22.5 ml/hr</td>
</tr>
<tr>
<td>50 mcg/hr</td>
<td>25 ml/hr</td>
</tr>
</tbody>
</table>

### REFERENCES


Approval:  
Effective Date:  
Medical Director: [Signature]
Saskatchewan Air Ambulance – CLINICAL PROTOCOLS

MEDICATION PROTOCOL M10
PAIN MANAGEMENT

INDICATIONS

Medscape®  www.medscape.com

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facial expression</td>
<td>No muscular tension observed</td>
<td>Relaxed, neutral 0</td>
</tr>
<tr>
<td></td>
<td>Presence of frowning, brow lowering, orbit tightening, and levator contraction</td>
<td>Tense 1</td>
</tr>
<tr>
<td></td>
<td>All of the above facial movements plus eyelid tightly closed</td>
<td>Grimacing 2</td>
</tr>
<tr>
<td>Body movements</td>
<td>Does not move at all (does not necessarily mean absence of pain)</td>
<td>Absence of movements 0</td>
</tr>
<tr>
<td></td>
<td>Slow, cautious movements, touching or rubbing the pain site, seeking attention through movements</td>
<td>Protection 1</td>
</tr>
<tr>
<td></td>
<td>Pulling tube, attempting to sit up, moving limbs' thrashing, not following commands, striking at staff, trying to climb out of bed</td>
<td>Restlessness 2</td>
</tr>
<tr>
<td>Muscle tension</td>
<td>No resistance to passive movements</td>
<td>Relaxed 0</td>
</tr>
<tr>
<td>Evaluation by passive flexion and extension of upper extremities</td>
<td>Resistance to passive movements</td>
<td>Tense, rigid 1</td>
</tr>
<tr>
<td></td>
<td>Strong resistance to passive movements, inability to complete them</td>
<td>Very tense or rigid 2</td>
</tr>
<tr>
<td>Compliance with the ventilator (Intubated patients)</td>
<td>Alarms not activated, easy ventilation</td>
<td>Tolerating ventilator or movement 0</td>
</tr>
<tr>
<td></td>
<td>Alarms stop spontaneously</td>
<td>Coughing but tolerating 1</td>
</tr>
<tr>
<td></td>
<td>Asynchrony: blocking ventilation, alarms frequently activated</td>
<td>Fighting ventilator 2</td>
</tr>
<tr>
<td>OR</td>
<td>Talking in normal tone or no sound</td>
<td>Talking in normal tone or no sound 0</td>
</tr>
<tr>
<td>Vocalization (extubated patients)</td>
<td>Sighing, moaning</td>
<td>Sighing, moaning 1</td>
</tr>
<tr>
<td></td>
<td>Crying out, sobbing</td>
<td>Crying out, sobbing 2</td>
</tr>
<tr>
<td>Total, range</td>
<td></td>
<td>0-8</td>
</tr>
</tbody>
</table>

Source: Am J Crit Care © 2006 American Association of Critical-Care Nurses

SPECIAL CONSIDERATIONS

- Analgesics do not have amnesic qualities. You should strongly consider the concomitant use of sedatives (see Clinical Protocol M13 - Sedation Management). Remember that the combined use of benzodiazepines and opiates can lead to severe respiratory depression.
- This protocol should not be first line treatment for pain caused by cardiac ischemia (see Clinical Protocol C5 - Chest Pain - Cardiac).
PHARMACOLOGY/DOSAGE/CAUTIONS

SPECIAL CONSIDERATIONS

- Analgesics do not have amnesic qualities. You should strongly consider the concomitant use of sedatives (see Clinical Protocol M13 - Sedation Management). Remember that the combined use of benzodiazepines and opiates can lead to severe respiratory depression.
- This protocol should **not** be first line treatment for pain caused by cardiac ischemia (see Clinical Protocol C5 - Chest Pain - Cardiac).

PHARMACOLOGY/DOSAGE/CAUTIONS

<table>
<thead>
<tr>
<th>DRUG</th>
<th>DOSING *</th>
<th>DRUG METABOLISM</th>
<th>CAUTIONS/CONTRAINDICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FENTANYL</strong></td>
<td>• Strength - 50mcg/ml Onset is faster than Morphine and Fentanyl will not aggravate bronchospasm NB - see Med Reference Manual for pharmacology and other indications.</td>
<td>Onset of Action • 1 - 3 min. Peak Effect • 3 - 5 min. Duration of action • 20 - 30 min.</td>
<td>Cautions</td>
</tr>
<tr>
<td></td>
<td>• 0.5 - 2 mcg/kg IV or 20 - 200 mcg IV over 1 - 3 min. • May repeat q5min. • Titrate to response.</td>
<td></td>
<td>Contraindications</td>
</tr>
<tr>
<td><strong>MORPHINE</strong></td>
<td>• Strength - 10 mg/ml (Usual single dose being 2-5mg).</td>
<td>Onset of Action • 1 - 3 min. Peak Effect • 20 min. Duration of action • 2.5 - 7 hrs.</td>
<td>Cautions</td>
</tr>
<tr>
<td></td>
<td>• 0.05 – 0.1 mg/kg IV over 2-3 min.</td>
<td></td>
<td>Contraindications</td>
</tr>
</tbody>
</table>

* NOTE: Titrate as indicated to meet the needs of the patient. IV drug users, young healthy patients, etc. may require higher than usual doses and more frequent dosage repeats. If you require RAPID pain control, fentanyl has been shown to have a much faster onset of peak effect and thus, a better choice.
ANTIDOTE

1. **Naloxone HCL (Narcan)**
   - Administer 0.4 mg diluted in 10 ml (0.04 mg/ml) and give in 1-2 ml increments for cases of unintended overdose. Repeat if necessary in 2-3 minutes if patient develops respiratory depression or hypotension.
   - Monitor closely, Narcan has a short duration of action.

**NOTE:** If depressed respirations are associated with chest wall rigidity and patient cannot be successfully ventilated following fentanyl administration, consider the following:

- **Succinylcholine:**
  - 1.5 mg/kg IV and provide controlled ventilation.

- **Narcan HCL (Narcan):**
  - Administer 0.4 mg diluted in 10 ml (0.04 mg/ml) and give in 1-2 ml increments.

MONITORING

1. The incidence of chest wall rigidity can be decreased by using smaller doses of fentanyl and by instilling the medication more slowly.

2. Succinylcholine is considered a paralytic and should only be given to those patients who are intubated, or those who you intend to intubate shortly.

3. Continuous cardiac, hemodynamic and ventilatory monitoring is mandatory with administration of succinylcholine as it has been known to induce malignant hyperthermia in some patients (occurs in 1 in 5,000 – 50,000 cases).

4. Equipment for ventilatory and cardiovascular support must be readily available.

REFERENCES

1. Birnbaum A et al. Randomized double-blind placebo-controlled trial of two intravenous morphine dosages (0.10 mg/kg and 0.15 mg/kg) in emergency department patients with moderate to severe acute pain. Ann Emerg Med 2007 Apr; 49:445-53


3. **PETERSON’S PRINCIPLES OF ORAL AND MAXILLOFACIAL SURGERY, VOLUME 1.** BY MICHAEL MILORO, G. E. GHALLI, PETER LARSEN, PETER WAITE 2004 PP. 88-89
MEDICATION PROTOCOL M11
PROPOFOL

PHARMACOLOGY
Anesthetic-general

INDICATIONS
1. Induction and maintenance of general anesthesia.
2. Intubated patient with refractory status epilepticus (off-label use) (see Clinical Protocol N1 - Seizures).
3. For continuous sedation and for control of the stress responses in intubated, mechanically ventilated, patients in the care of the Saskatchewan Air Ambulance Medical team.

Requires physician’s order prior to administration.

ABSORPTION
1. Onset of action: 30 - 45 sec.
2. Duration of action: 3 - 10 min. (dose-dependent duration).

CONTRAINDICATIONS
1. Hypersensitivity to propofol or its emulsion, which contains soybean oil, glycerol and egg phosphatide.

CAUTIONS/INTERACTONS
1. Elderly, debilitated, patients, patients with hypotension, or severe cardiac disease: may be at greatest risk for hypotension.
2. Cirrhosis: recovery time may be longer.
3. Propofol is devoid of analgesic activity. Pain management requires specific use of analgesic agents.

PREGNANCY/BREAST FEEDING: Contact SHR Pharmacy for most recent information.
**SIDE EFFECTS 1, 2, 3, 4, 5, 6, 7**

1. Hypotension, may be severe, generally dose-and infusion-rate dependent. Responds to IV fluids, and/or vasopressor therapy if required.
2. Bradycardia.
3. Asystole, heart block and other arrhythmias - rare.
4. Transient: convulsions, opisthotonus, myclonus and choreoathetoid movements during emergence from anesthesia.
5. Propofol-infusion syndrome (PRIS) may result if using high-dose propofol or propofol for a long duration in the treatment of patients with refractory status epilepticus.
6. Anaphylaxis.
7. Pain at injection site, minimizing by administering via large vein or central line.
8. Transient green discolouration of the urine.

**DOSE 1**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Direct into IV tubing</th>
<th>Intermittent Infusion</th>
<th>Continuous Infusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Undiluted over 3 - 5 minutes.</td>
<td></td>
<td>1000 mg = 10 mg/ml 100 ml Infuse as mcg/kg/min.</td>
</tr>
</tbody>
</table>

**Sedation in intubated, mechanically ventilated patients: 1, 4**

- Start infusion at 5 mcg/kg/min for 5 minutes then titrate in increments of 5 - 10 mcg/kg/ min to achieve desired level of sedation; allow a minimum of 5 minutes between dose adjustments.
- Maintenance: 5 - 50 mcg/kg/min. Higher doses may be required
  
  Average maintenance dose:
  
  Under 55 years    38 mcg/kg/min
  Over 55 years     20 mcg/kg/min
  
  Bolus administration of 10 to 20 mcg/kg/min should only be used to rapidly increase sedation depth in patients in whom hypotension is not likely to occur.

**In the treatment of patients with refractory status epilepticus: 6**

- Loading dose: 1 - 2 mg/kg with initiation of a continuous infusion.
- Continuous infusion: Initial 20 mcg/kg/min.
- If patient experiences breakthrough status epilepticus while receiving continuous infusion: Increase rate by 5 - 10 mcg/kg/ min. q 5 min.
- Dosage range: 30 - 200 mcg/kg/min.
**Induction of general anesthesia: 1, 7**

- Healthy adults, <55 years: 2 - 2.5 mg/kg IV q 10 seconds until onset of induction.
- Elderly, debilitated: 1 - 1.5 mg/kg IV q 10 sec until onset of induction.

**MONITORING 1**

**REQUIRED**

- Assess level of consciousness as required.
- Continuous cardiac, SpO2 monitoring.
- BP every 5 minutes during bolus dose, the start of infusion and with each dosage increase, then BP q 15 min.

**COMPATABILITY/STABILITY 1**

- Compatible with D5W, D5-1/2S, D5LR, and lactated Ringer’s solution.
- Stable for 12 hours in a syringe.
- For drug-drug compatibility, contact Pharmacy.
REFERENCES


corporation.


5. Al-Mufti, F., Jan Claassen, J. Neurocritical care status

6. Hocker, S., Tatum, W., LaRoche, S. Refractory and super-refractory status
   epilepticus-an update. Current Neurology and Neuroscience Reports
   2014; 14:452.

   http://lifeinthefastlane.com/ccc/rapid-sequence-intubation/.

Approved:    Effective: February, 2016    Medical Director:   

SECTION: Medications   Reviewed January 2016   Page M11-4
MEDICATION PROTOCOL M12
ROCURONIUM

PHARMACOLOGY
Rocuronium is a nondepolarizing neuromuscular blocking agent which has a high affinity for acetylcholine receptor sites. Rocuronium competitively prevents acetylcholine (Ach) molecules from binding to muscarinic acetylcholine receptors on the post-synaptic membrane of the motor endplate. This blocks the action of Ach and prevents activation of the muscle contraction process.

Rocuronium:
1. does not release histamine (therefore does not cause hypotension or bronchospasm).
2. has the fewest cardiovascular side effects of nondepolarizing muscle relaxants.
3. has intermediate onset (45 - 90 seconds).
4. is not renally excreted.
5. has 30 - 70 minute duration depending on the patient and dosing regimen. Does not release histamine (does not cause hypotension or bronchospasm).
6. has the fewest cardiovascular side effects of nondepolarizing muscle relaxants (does not ↑ HR or ↑BP).

INDICATIONS
1. The Flight Nurse or Paramedic may administer rocuronium to facilitate RSI (see Clinical Protocol R4 - Rapid Sequence Induction).
2. To provide long term paralysis for transport in the intubated, ventilated patient.

CONTRAINdications/INTERACTIONS
1. Hypersensitivity to rocuronium.
2. Antibiotics may have an additive effect (aminoglycosides, clindamycin, and vancomycin).
3. May be potentiated by other neuromuscular blockers (succinylcholine) as well as inhaled anesthetics (isoflurane, halothane, and enflurane).
4. Quinidine may cause prolonged recurrent paralysis.
5. Rocuronium is an agent used to provide long-term skeletal muscle paralysis and may not be a good choice as an agent for RSI prior to ETT placement. Ensure you identify the potential difficult airway prior to administering rocuronium for the actual intubation procedure (see Clinical Protocol R1 - Airway Management).
6. Rocuronium may require smaller dosing regimens in patients with neuromuscular disorders such as Myasthenia Gravis.
7. Rocuronium should NOT be administered unless intubation, artificial ventilation, oxygen therapy and reversal agents are immediately available and/or have been initiated.

8. Rocuronium does not possess amnesic, analgesic or anesthetic properties. Patients who are to be continually paralyzed will require additional medications to ensure pain control and sedation (see Clinical Protocol M10 - Pain Management and Clinical Protocol M13 - Sedation Management). Closely monitor patient heart rate and blood pressure for early detection of emergence from sedation.

DOSE
- Long term paralysis: **0.6 – 1.2 mg/kg** (adults and children).
  - Onset: 45 - 90 seconds
  - Duration: 30 - 70 minutes

REVERSAL AGENTS
- Edrophonium
- Neostigmine
- Pyridostigmine

Edrophonium, neostigmine and pyridostigmine are part of a class of drugs referred to as anticholinesterases used to reverse the effect of non-depolarizing paralytics such as rocuronium. Currently Saskatchewan Air Ambulance does not stock these agents although they may be available in the tertiary care centers.

NOTE
Reversal agents must be given with atropine or glycopyrrolate to prevent muscarinic effects such as bradycardia, bronchoconstriction, mucus secretion, etc. Use of reversal agents **MUST** be directed by a physician.

REFERENCES

MEDICATION PROTOCOL M13
SEDATION MANAGEMENT

The Flight Nurse/Paramedic may administer benzodiazepines (midazolam and lorazepam) without expressed consent from a physician in the following situations:

INDICATIONS FOR MIDAZOLAM
1. To provide sedation for patients undergoing air medical transport.
2. To provide continuous sedation in mechanically ventilated patients.
3. To provide sedation for the anxious/combative patient once adequate analgesia is established (see Clinical Protocol G2 - Combative Patient).
4. Generalized tonic-clonic seizures when lorazepam is not available (see Clinical Protocol N1 - Seizures).

Sedation requirements are individual and hence, require individual dosing regimens. The Richmond Agitation Sedation Scale is an objective tool used to measure a patient’s level of awareness. The goal for sedation is a patient who is sedate but still arousable (RASS of -1 to -2). Patients who are critically injured (particularly patients with traumatic brain injury) may benefit from a deeper state of sedation to help blunt the stimulus from the stressors of transport/flight.

INDICATIONS FOR LORAZEPAM
1. Generalized tonic-clonic seizures lasting longer than three to five minutes (see Clinical Protocol N1 - Seizures).
2. Recurrent generalized tonic-clonic seizures where there has not been a return to consciousness between seizures.
3. Symptomatic management of anxiety and tension related to stressful conditions (see Clinical Protocol G2 - Combative Patient).
THE RICHMOND AGITATION SEDATION SCALE

<table>
<thead>
<tr>
<th>Score</th>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>+4</td>
<td>Combative</td>
<td>Overtly combative or violent and an immediate danger to staff</td>
</tr>
<tr>
<td>+3</td>
<td>Very agitated</td>
<td>Pulls on or removes tube(s) or catheter(s) or has aggressive behavior toward staff</td>
</tr>
<tr>
<td>+2</td>
<td>Agitated</td>
<td>Frequent nonpurposeful movement or patient ventilator dyssynchrony</td>
</tr>
<tr>
<td>+1</td>
<td>Restless</td>
<td>Anxious or apprehensive but movements not aggressive or vigorous</td>
</tr>
<tr>
<td>0</td>
<td>Alert and calm</td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td>Drowsy</td>
<td>Not fully alert but has sustained (&gt; 10 seconds) awakenings, with eye contact, to voice</td>
</tr>
<tr>
<td>-2</td>
<td>Light sedation</td>
<td>Briefly (&lt; 10 seconds) awakens with eye contact to voice</td>
</tr>
<tr>
<td>-3</td>
<td>Moderate sedation</td>
<td>Any movement (but no eye contact) to voice</td>
</tr>
<tr>
<td>-4</td>
<td>Deep sedation</td>
<td>No response to voice, but any movement to physical stimuli</td>
</tr>
<tr>
<td>-5</td>
<td>Unarousable</td>
<td>No response to voice or physical stimulation</td>
</tr>
</tbody>
</table>

Source: Crit Care © 2008 BioMed Central, Ltd.

MONITORING

1. Continuous cardiac, hemodynamic and respiratory monitoring is imperative.

2. Equipment for ventilatory and cardiovascular support should be immediately available in cases where the patient does not have an advanced airway placed.

NOTE

1. Patients will also benefit from pain control in conjunction with IV sedation regimes (see Medication Protocol M10 - Pain Management).

2. Where appropriate, consider instituting a continuous IV infusion of midazolam for more consistent sedation with intubated/ventilated patients. iv A Physician's order is required for infusion.
<table>
<thead>
<tr>
<th>DRUG</th>
<th>USUAL ADULT DOSE</th>
<th>DRUG METABOLISM</th>
<th>CAUTIONS/CONTRAINDICATIONS</th>
</tr>
</thead>
</table>
| MIDAZOLAM  | • Initial dose: 1-3 mg over 15 sec; max. 5 mg over 2 min.  
• May repeat q 2-3 min; infuse over > 2 min., maximum of 15 mg.  
• Titrate to response.  
• Additional doses should require only 25% of initial dose to produce effect.  | Onset of Action: 0.5 - 3 min.  
Peak Effect: 1 - 15 min.  
Duration of action: 1 - 4 hrs.  | Cautions:  
• Pulmonary disease, acute pulmonary insufficiency, COPD, CHF.  
• Hepatic or renal dysfunction.  
• Elderly or debilitated.  
• Acute ETOH intoxication.  
Contraindications:  
Known allergy to benzodiazepines.  
Acute narrow angle glaucoma. |
| LORAZEPAM  | Status Epilepticus  
Adult dosage 0.05 – 0.1 mg/kg IV to a max of 4 mg; may repeat once.  
Pediatric dosage 0.05 – 0.1 mg/kg IV/IM to a max of 2 mg; may repeat once.  
Anxiety  
Adult dosage 0.5 – 1.0 mg IV; may repeat once.  | Onset of Action: 1 – 3 min.  
Peak Effect: 60 – 90 min.  | Cautions:  
• May cause respiratory depression and enhanced CNS depression when administered with ethyl alcohol, phenothiazines, barbiturates, MAO inhibitors and other antidepressants.  
• Use lower doses in elderly and debilitated patients and those with organic brain disorders.  
• Use lower doses in patients with known renal, heart or liver failure.  
Contraindications:  
• Known hypersensitivity to the drug.  
• Myasthenia gravis.  
• Acute narrow angle glaucoma.  
• Hypotension. |
REFERENCES


iii It’s Time to Revise the Definition of Status Epilepticus, Daniel H. Lowenstein, Thomas Bleck, and Robert L. Macdonald, Epilepsia Vol 40, No 1 1999.


PHARMACOLOGY
Succinylcholine is a depolarizing skeletal muscle relaxant. As does acetylcholine, it combines with the cholinergic receptors of the motor end plate to produce depolarization. This depolarization may be observed as fasciculations. Subsequent neuromuscular transmission is inhibited so long as adequate concentration of succinylcholine remains at the receptor site. Onset of flaccid paralysis is rapid (less than 1 minute after IV administration), and with single administration, lasts approximately 4 to 6 minutes.

INDICATIONS
In the absence of a physician’s order, the Flight Nurse or Paramedic may administer Succinylcholine to facilitate Rapid Sequence Induction intubation (RSI). (see Clinical Protocol R4 - Rapid Sequence Induction).

CONTRAINDICATIONS
1. Hypersensitivity to succinylcholine.
2. Personal or family history of malignant hyperthermia.
3. Patients with severe hyperkalemia (burns, severe trauma, etc.)
4. Patients with digitalis toxicity.
5. Genetic disorders of plasma pseudocholinesterase, acute narrow-angle glaucoma, recent stroke.

CAUTIONS/INTERACTIONS
1. Succinylcholine should be given with caution and in smaller doses to patients with severe liver impairment, anemia, cancer or severe dehydration.
2. Succinylcholine should be used with caution in patients with pre-existing neuromuscular disorders because of variability of effect; especially those with Muscular Dystrophy.
3. Succinylcholine should be used with caution in patients with cardiovascular and respiratory disease.
4. There have been several reports of acute hyperkalemia with rhabdomyolysis and/or malignant hyperthermia followed by ventricular dysrhythmias and cardiac arrest with the administration of succinylcholine. Use with extreme caution.
5. Most references warn of potential increased IOP and ICP with succinylcholine administration. There is controversy as to whether this is true, however there are few definitive studies to sway practice either direction. Any head-injured patient undergoing RSI should receive copious anesthesia/analgesia to prevent any subsequent increased ICP. The risk of hypoxia associated with an unsecured airway must be balanced with the potential risks of increased ICP associated with the use of succinylcholine in RSI.
6. Drugs which may enhance the neuromuscular blocking action of succinylcholine include: promazine, oxytocin, certain non-penicillin antibiotics, quinidine, β-adrenergic blockers, procainamide, lidocaine, trimethaphan, lithium carbonate, magnesium salts, quinine, chloroquine, diethylether, isoflurane, desflurane, metoclopramide, and terbutaline.

7. The neuromuscular blocking effect of succinylcholine may be enhanced by drugs that reduce plasma cholinesterase activity (e.g., chronically administered oral contraceptives, glucocorticoids, or certain monoamine oxidase inhibitors) or by drugs that irreversibly inhibit plasma cholinesterase.

DOSE

Short term paralysis:  1 – 1.5 mg/kg (adults and children)

Onset: 30 - 60 seconds

Duration: 4 - 6 minutes

NOTE

Succinylcholine does not possess amnesic, analgesic or anesthetic properties. Patients who receive succinylcholine should have already received medication for analgesia and sedation (see Clinical Protocol R4 - Rapid Sequence Induction).

REFERENCES

i Rapid Sequence Intubation: A Review of Recent Evidences  Di Filippo, Alessandro; Gonnelli, Chiara Reviews on Recent Clinical Trials, Volume 4, Number 3, September 2009 , pp. 175-178(4)

MEDICATION PROTOCOL M15
TENECTEPLASE (TNKase)

PHARMACOLOGY
Promotes thrombolysis by converting plasminogen to plasmin which degrades fibrin & fibrinogen.1

INDICATIONS
Intravenous use in adults of lysis of suspected occlusive coronary artery thrombi associated with evolving transmural myocardial infarction (MI) to reduce associated mortality.2 Only administer if authorized by a cardiologist or Transport Physician.

CONTRAINDICATIONS 2

Hypersensitivity to tenecteplase or any product component; check vial for most current information.

Absolute contraindications
1. Any prior intracranial hemorrhage.
2. Known structural cerebral vascular lesion (e.g. AV malformation).
3. Known malignant intracranial neoplasm (primary or metastatic).
4. Ischemic stroke within 3 months EXCEPT acute ischemic stroke within 3 hours.
5. Suspected aortic dissection.
6. Active bleeding or bleeding diathesis (excluding menses).
7. Significant closed-head or facial trauma within 3 months.

Relative contraindications
1. History of chronic, severe, poorly controlled hypertension.
2. Severe uncontrolled hypertension on presentation (SBP > 180 mmHg or DBP > 110 mmHg).
3. History of ischemic stroke greater than 3 months, dementia or known intracranial abnormality.
4. Traumatic or prolonged CPR (greater than 10 minutes) or major surgery (less than 3 weeks).
5. Internal bleeding within 2-4 weeks.
7. Pregnancy.
8. Active peptic ulcer.

**CAUTIONS/INTERACTIONS**

1. Avoid I.M. injections for the first few hours following treatment with tenecteplase to minimize the risk of bleeding.
2. Avoid obtaining IV access via non-compressible sites (e.g. subclavian or jugular vein).
3. Avoid unnecessary arterial and venous punctures.
4. Heparin and ASA were used concurrently in the majority of patients in the major clinical studies of tenecteplase.
5. Anticoagulants (e.g. warfarin) or platelet inhibitors (e.g. NSAIDS, clopidogrel, ticlopidine, dipyridamole, GP2b3a inhibitors) may increase risk of bleeding if administered prior to, during or after tenecteplase.
6. Pregnancy/Breastfeeding: contact pharmacy for most recent information.

**ADVERSE EFFECTS**

1. **HEMATOLOGICAL**
   Internal bleeding involving intracranial and retroperitoneal sites or the gastrointestinal, genitourinary, or respiratory tracts. Superficial or surface bleeding observed mainly at vascular puncture and access sites, or sites of recent surgical intervention. When bleeding cannot be controlled with pressure, discontinue any concomitant heparin and antiplatelet agents immediately. Protamine (if receiving heparin; see protamine sulphate IV monograph) and platelet transfusion may assist to reverse anticoagulation.

2. **HYPERSENSITIVITY** (Rare)
   Anaphylaxis has been reported.

3. **OTHER**
   Arrhythmias may be associated with reperfusion, including sinus bradycardia, accelerated idioventricular rhythm, ventricular premature depolarizations, and ventricular tachycardia. These are not different from those often seen in the normal course of MI and are managed with standard anti-arrhythmic measures.
PREPARATION 2

1. Available as 50mg single use vial powder for solution with supplied diluent vial of sterile water for Injection (SWFI). Withdraw 10mL SWFI using the red hub cannula syringe filling device.

2. Inject contents into the TNKase® vial directing the diluent stream into the powder; gently swirl until contents are completely dissolved. **DO NOT SHAKE.** Slight foaming is not unusual; large bubbles will dissipate if the product stands undisturbed for several minutes. The reconstituted solution is a colourless to pale yellow transparent solution of tenecteplase 5mg/ml.

3. After determining the appropriate dose, withdraw this volume (in milliliters) from the reconstituted vial with the syringe. Discard any unused solution. Stand the shield vertically on a flat surface (with green side down) and passively recap the red hub cannula. Remove the entire shield assembly, including the red hub cannula, by twisting counter-clockwise.

COMPATIBILITY / STABILITY 2

1. Vials should be stored at room temperature or in the fridge (2° - 8° C).

2. Unused reconstituted tenecteplase (in the vial) may be stored in the fridge and used within 8 hours.

3. May form a precipitate when administered in an IV line containing dextrose. Dextrose containing lines should be flushed with a saline-containing solution prior to and following single bolus administration of Tenecteplase.

4. For other drug-drug compatibility information contact Pharmacy.

DOSE 2

**ADULT**
The recommended total dose is based on patient weight and should not exceed 50mg.

<table>
<thead>
<tr>
<th>Patient Wt. (kg)</th>
<th>Tenecteplase (mg)</th>
<th>Volume (ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 60</td>
<td>30</td>
<td>6</td>
</tr>
<tr>
<td>60-69</td>
<td>35</td>
<td>7</td>
</tr>
<tr>
<td>70-79</td>
<td>40</td>
<td>8</td>
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<tr>
<td>80-89</td>
<td>45</td>
<td>9</td>
</tr>
<tr>
<td>90 or greater</td>
<td>50</td>
<td>10</td>
</tr>
</tbody>
</table>

Intended for use with heparin and ASA.

**PEDIATRIC 2**
No information.
MONITORING

Required:
1. Observe patient for signs of bleeding.
2. Neurovitals q 1h x 2, then q 4 h x 24h.
3. Vital signs q 15 min.
4. Continuous cardiac monitoring.

Recommended:
1. Baseline CBC and platelet count.
2. Observe for neurological changes.

REFERENCES


TRANEXAMIC ACID (TXA)

PHARMACOLOGY
Hemostatic antifibrinolytic agent.

INDICATIONS
1. Treatment of excessive bleeding from gastrointestinal hemorrhage. 1
2. To reduce postoperative bleeding and blood transfusions after cardiac surgery. 1
3. Trauma associated hemorrhage (off-label use). 2, 3
4. To treat postpartum hemorrhage if other uterotonics fail to stop the bleeding or if it is thought that the bleeding may be partly attributed to trauma. 4

*Should be administered within 3 hours of event.

Requires physician’s order prior to administration.

CONTRAINDICATIONS
1. Hypersensitivity to tranexamic acid.
2. Acquired defective color vision; used as an indicator of toxicity.
3. Active intravascular clotting process; primary fibrinolysis must be differentiated from disseminated intravascular coagulation.
4. Subarachnoid hemorrhage; potential occurrence of cerebral ischemic complications.

CAUTIONS/INTERACTIONS
1. Renal impairment, due to the risk of accumulation.
2. Transurethral prostatectomy; potential for intravesicular clotting.

PREGNANCY/BREAST FEEDING: Category B in pregnancy, exercise caution in breastfeeding.
SIDE EFFECTS

All side effects may subside with reduced dosage or rate of administration.

1. **Hypotension**, primarily when IV injection of the drug is too rapid (i.e., administered at a rate greater than 100 mg/min).

2. Thromboembolic events (e.g. central retinal artery and vein obstruction, pulmonary embolism), a theoretical concern, rarely reported in the literature.

3. Nausea, cramping, diarrhea.

4. **Dizziness**, primarily when intravenous injection of the drug is too rapid (i.e., administered at a rate greater than 100 mg/min).

5. Theoretical risk of thrombophlebitis if given undiluted via a peripheral line.

DOSE

Dosed according to actual body weight, consider using adjusted body weight in obese patients.

ADULT

Hemorrhage:

- **15 mg/kg or 1 g every 6 to 8 hours.** Continue until bleeding stops or lab tests indicate treatment may be stopped.

To reduce postoperative bleeding and blood transfusions after cardiac surgery:

- Optimal dosing regimen is not yet established; considerable variation exists in medical literature.
- Loading or bolus dose: 10 mg/kg (range 2.5 mg/kg to 100 mg/kg), infused over 20-30 minutes.
- Maintenance dose: 1 mg/kg/hr for 10-12 hours (range 0.25 mg/kg/hr to 4 mg/kg/hr over 1 to 12 hours).

ELDERLY

- Lower-end initial and/or reduced doses may be indicated based on the potential for decreased organ function and concomitant disease or drug therapy.

ADMINISTRATION

<table>
<thead>
<tr>
<th>Mode</th>
<th>Direct into IV tubing</th>
<th>Intermittent Infusion</th>
<th>Continuous Infusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult</td>
<td>Admin. each 100 mg or fraction thereof (undiluted) over at least 1 minute.</td>
<td>Dilute dose in 50-250 ml. infusion bag. Infuse over 20-30 minutes.</td>
<td>Dilute in 250 ml infusion bag. Infuse as directed.</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
MONITORING
- Vital signs at least every 15 min., continuous cardiac and SpO2 monitoring.

COMPATABILITY/STABILITY
- Compatible in dextrose, normal saline, dextrose-saline combinations and Ringer's solution.

RECOMMENDED
- In repeated treatment or if treatment will last more than several (2 to 3) days, a complete ophthalmologic examination (visual acuity, color vision, eye ground, visual fields) should be done before and at regular intervals during treatment, therefore, ensure receiving facility is notified if patient has received repeated infusions of TXA.

REFERENCES


**MEDICATION PROTOCOL M17**

**MISCELLANEOUS:**

**Acetylcysteine:**

**N-acetylcysteine dose and infusion rate calculation chart  ADULTS**

Do not remove fluid from infusion bag prior to adding N-acetylcysteine (NAC)

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>Loading Dose (mg)</th>
<th>Volume of NAC required - add to 250 mL bag (mg)</th>
<th>Final volume (mL</th>
<th>Infusion rate (mL/h)</th>
<th>Second dose (50 mg/kg)</th>
<th>Volume of NAC required - add to 500 mL bag (mg)</th>
<th>Final volume (mL</th>
<th>Infusion rate (mL/h)</th>
<th>Third dose (100 mg/kg)</th>
<th>Volume of NAC required - add to 1000 mL bag (mg)</th>
<th>Final volume (mL</th>
<th>Infusion rate (mL/h)</th>
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</thead>
<tbody>
<tr>
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<td>2500</td>
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</tbody>
</table>

Values have been rounded off

Copy of NAC dose calculation charts adult Mar 2010
Epinephrine Infusion:

### EPINEPHRINE INFUSION

**3 mg**  
250 ml NS  
**CONCENTRATION = 12 mcg/ml**

<table>
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<th>MCg/kg/min</th>
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<td>130</td>
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<tr>
<td>135</td>
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</tbody>
</table>
Fentanyl Infusion:

**FENTANYL INFUSION**

400 mcg
80 ml NS

Remove 20 mls from 100 ml bag of N/S, add Fentanyl 400 mcg

**CONCENTRATION** = 5.0 mcg/ml

Usual dosage range 50-200 mcg/hr

<table>
<thead>
<tr>
<th>DOSAGE mcg/hr</th>
<th>RATE ml/hr</th>
<th>DOSAGE mcg/hr</th>
<th>RATE ml/hr</th>
<th>DOSAGE mcg/hr</th>
<th>RATE ml/hr</th>
<th>DOSAGE mcg/hr</th>
<th>RATE ml/hr</th>
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</table>
Heparin Infusion:

<table>
<thead>
<tr>
<th>DOSAGE (units/hr)</th>
<th>RATE (ml/hr)</th>
<th>DOSAGE (units/hr)</th>
<th>RATE (ml/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>8</td>
<td>1150</td>
<td>23</td>
</tr>
<tr>
<td>450</td>
<td>9</td>
<td>1200</td>
<td>24</td>
</tr>
<tr>
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<td>10</td>
<td>1250</td>
<td>25</td>
</tr>
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<td>1300</td>
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<td>12</td>
<td>1350</td>
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</tr>
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<td>650</td>
<td>13</td>
<td>1400</td>
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</tr>
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<td>700</td>
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<tr>
<td>750</td>
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<tr>
<td>1100</td>
<td>22</td>
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</table>
### Insulin Infusion:

**INSULIN INFUSION**

50 units regular insulin

250 ml NS

**CONCENTRATION:** 0.2 units/ml

<table>
<thead>
<tr>
<th>DOSAGE (units/hour)</th>
<th>RATE (mls/hour)</th>
<th>DOSAGE (units/hour)</th>
<th>RATE (mls/hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>6.5</td>
<td>32.5</td>
</tr>
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<td>7.5</td>
<td>7</td>
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</tr>
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<td>10</td>
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**Midazolam Infusion:**

<table>
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<th>Rate (ml/hr)</th>
<th>Dosage (mg/hr)</th>
<th>Rate (ml/hr)</th>
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<td>50</td>
</tr>
</tbody>
</table>

**MIDAZOLAM INFUSION**  
20mg  
100ml NS  
Concentration = 0.2 mg/ml  
Usual dosage range 1-10mg/hr
Morphine Infusion:

<table>
<thead>
<tr>
<th>DOSAGE (mg/hr)</th>
<th>RATE (ml/hr)</th>
</tr>
</thead>
<tbody>
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<td>4.5</td>
<td>23</td>
</tr>
<tr>
<td>5.0</td>
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</tr>
</tbody>
</table>

MORPHINE INFUSION

20mg

100ml NS

CONCENTRATION=0.2 mg/ml
Usual dosage range 2-5 mg/hr.
No upper limit to dose as long as pt. free of toxicity.
Oxytocin (Syntocinon)

<table>
<thead>
<tr>
<th>OXYTOCIN (SYNTOCINON)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 units</td>
</tr>
<tr>
<td>1000 mL NS or RL</td>
</tr>
<tr>
<td>40 milliunits/mL</td>
</tr>
</tbody>
</table>

**PPH, POST ABORTION HEMORRHAGE, INCOMPLETE ABORTION, ATONY:**
Infuse at 200-250 mL/hr at a rate sufficient to control uterine atony or as ordered to control uterine response. Infusion should not be stopped abruptly; rate should be tapered.
Phenylephrine Infusion:

<table>
<thead>
<tr>
<th>WT (kg)</th>
<th>0.5</th>
<th>0.6</th>
<th>0.7</th>
<th>0.8</th>
<th>0.9</th>
<th>1.0</th>
<th>1.1</th>
<th>1.2</th>
<th>1.3</th>
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<th>1.5</th>
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<td>149</td>
<td>162</td>
<td>176</td>
<td>189</td>
<td>203</td>
</tr>
</tbody>
</table>
Vasopressin (Pitressin):

**VASOPRESSIN (PITRESSIN)**
10 unit  
100 ml NS  
0.1 unit/ml

<table>
<thead>
<tr>
<th>UNITS/MIN</th>
<th>INFUSION RATE ML/HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01</td>
<td>6</td>
</tr>
<tr>
<td>0.02</td>
<td>12</td>
</tr>
<tr>
<td>0.03</td>
<td>18</td>
</tr>
<tr>
<td>0.04</td>
<td>24</td>
</tr>
</tbody>
</table>
Salbutamol (Ventolin) Infusion:

<table>
<thead>
<tr>
<th>DOSAGE (mcg/min)</th>
<th>RATE (ml/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>15</td>
<td>90</td>
</tr>
<tr>
<td>20</td>
<td>120</td>
</tr>
</tbody>
</table>

**SALBUTAMOL (VENTOLIN) INFUSION**

5mg
500ml NS
10 mcg/ml

Approval: Effective February, 2016

Medical Director: [Signature]
MEDICATION PROTOCOL
SHR Standardized Drug Mixtures (May 2014):

Key Points:
1. Prepare the admixtures as directed by the table
2. All admixtures are in NS unless otherwise stated. ** All mixtures are stable 24hrs unless otherwise stated
3. Use admission weight for weight based infusions and document weight used on MAR

<table>
<thead>
<tr>
<th>Medication</th>
<th>Amount of Drug Volume of Solution</th>
<th>Concentration</th>
<th>Usual dosage range</th>
<th>Special Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abciximab (Reopro) 10 mg / 5mL</td>
<td>9 mg (4.5 mL) 250 mL</td>
<td>36 mcg/mL</td>
<td>mL/hr</td>
<td>Filter prior to adding to bag Infusion length not to exceed 12 hrs Maximum 17mL/hr</td>
</tr>
<tr>
<td>Amiodarone</td>
<td>450 mg 250 mL D5W</td>
<td>1.8 mg/mL</td>
<td>mg/min</td>
<td>In-line filter Non-PVC bag</td>
</tr>
<tr>
<td>* Cisatracurium (Nimbex) 20 mg/10 mL</td>
<td>100 mg (50 mL) 250 mL (Remove 50 mL from 250 mL bag, add 50 mL drug)</td>
<td>400 mcg/mL</td>
<td>1-3 mcg/kg/min</td>
<td>Paralyzing agent</td>
</tr>
<tr>
<td>*Dexmedetomidine (Precedex)</td>
<td>200 mcg (2 mL) 50 mL</td>
<td>4 mcg/mL</td>
<td>0.2 - 1.1 mcg/kg/hr</td>
<td>A dose higher than 1.4 mcg/kg/hr should not be used</td>
</tr>
<tr>
<td>Dilaudid (HYDROMorphone)</td>
<td>50 mg 500 mL</td>
<td>0.1 mg/mL</td>
<td>0.25 - 5 mg/hr</td>
<td>5 mg/hr of Dilaudid is equal to 25 mg/hr of Morphine</td>
</tr>
<tr>
<td>Diltiazem (Cardizem) 50 mg/10 mL</td>
<td>125 mg 125 mL (25 mL drug +100 mL diluent)</td>
<td>1 mg/mL</td>
<td>5-15 mg/hr</td>
<td></td>
</tr>
<tr>
<td>*DOBUTamine (Dobutrex)</td>
<td>250 mg 250 mL</td>
<td>1000 mcg/mL</td>
<td>2-15 mcg/kg/min</td>
<td></td>
</tr>
<tr>
<td>*DOPamime</td>
<td>400 mg 250 mL</td>
<td>1600 mcg/mL</td>
<td>2.5-20 mcg/kg/min</td>
<td></td>
</tr>
<tr>
<td>*EPINEPHrine</td>
<td>3 mg 250 mL</td>
<td>12 mcg/mL</td>
<td>0.01 - 0.1 mcg/kg/min</td>
<td>Dosing dependent on indication</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>3000 mcg (60 mL) 300 mL (240 mL (Remove 10 mL from a 250 mL bag, add 60 mL drug)</td>
<td>10 mcg/mL</td>
<td>50-200 mcg/hr</td>
<td>Substantial dosage reductions required if used with other sedation</td>
</tr>
<tr>
<td>Medication</td>
<td>Amount of Drug Volume of Solution</td>
<td>Concentration</td>
<td>Usual dosage range</td>
<td>Special Precautions</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------------------------------</td>
<td>---------------</td>
<td>--------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Insulin (Humulin R)</td>
<td>50 units 250 mL</td>
<td>0.2 units/mL</td>
<td>1-10 units/hr</td>
<td>Let sit 30mins before infusing.</td>
</tr>
<tr>
<td>*Isoproterenol (Isuprel)</td>
<td>3 mg 250 mL</td>
<td>12 mcg/mL</td>
<td>0.375 – 5 mcg/min</td>
<td></td>
</tr>
<tr>
<td>*Ketamine 100 mg/2 mL</td>
<td>200 mg (4 mL) 100 mL</td>
<td>2 mg/mL</td>
<td>5-20 mcg/kg/min</td>
<td></td>
</tr>
<tr>
<td>Labetolol</td>
<td>1000 mg (200 mL) 250 mL (Remove 200 mL from 250 mL bag, add 200 mL drug)</td>
<td>4 mg/mL</td>
<td>1-4 mg/min</td>
<td>Infusion may be run undiluted in rare circumstances</td>
</tr>
<tr>
<td>*Lidocaine</td>
<td>2 gm 500 mL</td>
<td>4 mg/mL</td>
<td>1-4 mg/min</td>
<td></td>
</tr>
<tr>
<td>Lorazepam (Ativan)</td>
<td>10 mg 100 mL D5W</td>
<td>0.1 mg/mL</td>
<td>0.25 - 2 mg/hr</td>
<td>In-line filter Do not mix concentrations of 0.5-1 mg/mL, as drug precipitates easily.</td>
</tr>
<tr>
<td></td>
<td>100 mg (25 mL) 50 mL D5W (25 mL drug plus 25mL D5W)</td>
<td>2 mg/mL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midazolam (Versed)</td>
<td>50 mg 250 mL</td>
<td>0.2 mg/ mL</td>
<td>1-10 mg/hr</td>
<td></td>
</tr>
<tr>
<td>*Morphine</td>
<td>50 mg 250 mL</td>
<td>0.2 mg/mL</td>
<td>2 - 5 mg/hr</td>
<td>No upper limit to dose as long as patient is free of toxicity</td>
</tr>
<tr>
<td>Nitroglycerin</td>
<td>50 mg 500 mL</td>
<td>100 mcg/mL</td>
<td>5 - 100 mcg/min</td>
<td>Protect from light Monitor cyanide level if over 2 mcg/kg/min</td>
</tr>
<tr>
<td>*Nitroprusside</td>
<td>50 mg 250 mL D5W</td>
<td>200 mcg/mL</td>
<td>0.25 - 5 mcg/kg/min</td>
<td></td>
</tr>
<tr>
<td>*Norepinephrine (Levophed)</td>
<td>16 mg 250 mL D5W</td>
<td>64 mcg/mL</td>
<td>0.03 - 1.5 mcg/kg/min</td>
<td></td>
</tr>
<tr>
<td>Medication</td>
<td>Amount of Drug Volume of Solution</td>
<td>Concentration</td>
<td>Usual dosage range</td>
<td>Special Precautions</td>
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</tr>
<tr>
<td><strong>Phenylephrine</strong> <em>(NeoSympathom)</em></td>
<td>30 mg (3 mL) 500 mL</td>
<td>60 mcg/mL</td>
<td>0.3 - 1.5 mcg/kg/min</td>
<td></td>
</tr>
<tr>
<td><strong>Procainamide</strong> <em>(Pronestyl)</em></td>
<td>2 gm 500 mL NS</td>
<td>4 mg/mL</td>
<td>1 - 4 mg/min</td>
<td></td>
</tr>
<tr>
<td><strong>Propofol</strong></td>
<td>1000 mg 100 mL</td>
<td>10 mg/mL</td>
<td>5 - 50 mcg/kg/min</td>
<td>Higher doses may be required</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td>Premixed Change tubing q12hr</td>
</tr>
<tr>
<td><strong>Rocuronium</strong> <em>(Zemuron)</em></td>
<td>250 mg 250 mL</td>
<td>1 mg/mL</td>
<td>10-12 mcg/kg/min</td>
<td>Paralyzing agent</td>
</tr>
<tr>
<td><strong>Vasopressin</strong> <em>(Pitressin)</em></td>
<td>Septic Shock 10 unit 100 mL</td>
<td>0.1 unit/mL</td>
<td>0.01-0.04 unit/min</td>
<td></td>
</tr>
</tbody>
</table>
NEUROLOGICAL PROTOCOL N1
SEIZURES

- If possible, do not transport a patient who is actively seizing.
- Request maximum cabin altitude of 2,000 feet ASL.
- **During seizure:**
  a) remove hazards from immediate surroundings.
  b) turn patient on side with head flat, maintain airway.
  c) administer oxygen.
  d) check blood glucose level; treat appropriately.
  e) keep external stimulation to a minimum (i.e. window shades to reduce stimuli).
  f) **DO NOT FORCIBLY RESTRAIN PATIENT’S EXTREMITIES DURING A SEIZURE.**

**Medication Administration for Ongoing Seizures:**

1. **Adults:** Administer **lorazepam**: 0.1 mg/kg IV at a rate of 1 - 2 mg/min (maximum dose of 4 mg). Onset of action is 1 - 3 minutes.
   Pediatrics: Administer **lorazepam**: 0.1 mg/kg IV at a rate of 1 mg/min (may be administered rectally if IV site is not available).

2. **IF LORAZEPAM IS NOT AVAILABLE:**
   Adult: Administer **midazolam**ii 0.2 mg/kg IV up to a maximum single dose of 10mg.
   Pediatrics: Administer **midazolam**: 0.2 mg/kg IV up to a maximum single dose of 7mg. If an IV cannot be established, midazolam has been shown to be safe/effective when given rectally or IM as welliiii.

If seizure activity continues, contact the Transport Physician or pediatric Intensivist for consultation and further orders.

3. Consider the administration of **phenytoin** (Dilantin) under medical direction as follows:
   Adults: (& patients over 50 kg): **phenytoin**: 20 mg/kg IV at a rate of 25 mg per minute. Onset of action is 10-30 minutes.
   Pediatrics: **phenytoin** 20 mg/kg IV at a rate of 1 mg/kg/min. Onset of action is 15-30 minutes.

**Note:**
Phenytoin is compatible ONLY in normal saline IV solutions. Monitor ECG continuously during phenytoin administration; stop or slow infusion if hypotension, Q-T interval widening or dysrhythmias develop. If phenytoin is administered by infusion, a 0.22 micron filter must be used proximal to the venous site.
Patients with continuous seizure activity despite treatment may require endotracheal intubation and assisted ventilation for airway protection (See Clinical Protocols R1 – Airway Management & R4 – Rapid Sequence Induction). Cerebral basal metabolic rate is substantially elevated in status epilepticus. The compensatory increase in cerebral blood flow diminishes after 30 minutes, creating severe cerebral hypoxia even in the presence of normal SpO\textsubscript{2} readings.

4. **Refractory status epilepticus** patients, who are intubated and mechanically ventilated may benefit from a **propofol loading dose & infusion**: requires a physician’s order prior to administration: \(^4\) (see Medication Protocol M11 – Propofol).

- Loading dose: **propofol**: 1-2 mg/kg IV with initiation of a continuous infusion.
- Continuous infusion: Initial dose propofol 20 mcg/kg/min.
- If patient experiences breakthrough status epilepticus while receiving continuous infusion: Increase propofol rate by 5-10 mcg/kg/min. q 5 min.
- Dosage range: propofol 30-200 mcg/kg/min.

**STATUS EPILEPTICUS CLINICAL PRACTICE GUIDELINES ANTICONVULSANTS**

**NEONATES**

Phenytoin 20 mg/kg IV  
Lorazepam 0.10 mg/kg IV

**NOTE:** Neonatal anticonvulsant guidelines are included FOR INFORMATION PURPOSES and can be implemented ONLY upon physician’s order.

**PEDIATRICS**

Lorazepam 0.10 mg/kg IV  
Phenytoin 20 mg/kg IV

**ADULTS**

Lorazepam 0.10 mg/kg IV  
Phenytoin 20 mg/kg IV
• **Post seizure:**
  
a) primary survey.
b) continue to administer oxygen until the patient is alert.
c) secondary survey.
d) obtain pertinent medical history:
   • known seizure disorder
   • medications, what and when
   • medical identification
   • suspected alcohol or drug abuse
   • recent trauma
   • note fever, particularly in children under five years of age (see Clinical Protocol T6 - Heat Injury)
e) Treat injuries (see specific protocols).
f) Transport the patient on their side to help facilitate airway maintenance if not contraindicated.

**References**

1. Intramuscular midazolam vs. intravenous diazepam for acute seizures. *Indian Journal of Pediatrics* Volume 72, Number 8, 667-670. DOI: 10.1007/BF02724074


NEUROLOGICAL PROTOCOL N2
STROKE

- Request cabin altitude of 2000 ft. ASL.
- Prior to departure, ensure the patient has a patent airway and adequate respirations. Suction secretions as necessary. If the patient is unconscious or is having difficulty in maintaining an adequate airway, intubate. (See Clinical Protocol R1 - Airway Management).
- In the non-intubated stroke patient, it may be beneficial to position patient on their side to provide good clearance of airway secretions in transit.
- Provide supplemental oxygen as necessary for transport.
- Initiate and provide continuous cardiac monitoring.
- Establish IV/IO access.
- Perform a blood glucose measurement.
- In cases of a known or presumed hemorrhagic stroke, hypotension has shown to have a dramatically negative impact upon patient outcome. Efforts should be made to maintain the MAP above 70 mmHg. Consult Transport Physician for advice.
- If possible (and not contra-indicated) raise the head of the stretcher to a 30 degree angle with the head in-line to optimize venous drainage from the skull.
- In consultation with the Transport Physician: airway management may be preceded by a dose of lidocaine IV (1.5mg/kg IV) or topical to blunt any unwanted stimulus of the gag reflex. This includes insertion of an OG or NG in the unconscious patient.

References
NEUROLOGICAL PROTOCOL N3
UNCONSCIOUSNESS OF UNKNOWN ETIOLOGY

- Confirm unconsciousness, establish and maintain an airway, determine presence of a pulse and respiration. (see Clinical Protocol R1 - Airway Management).
- Maintain cabin altitude of 2,000 feet ASL.
- If pulseless, proceed to the appropriate protocols.
- If breathing and pulse are present, administer oxygen to maintain adequate O₂ saturations.
- If not already done, start an IV of normal saline and maintain systolic blood pressure at 100 mg/Hg.
- Rule out hypoglycemia as a cause of the unconsciousness.
- If hypoglycemia is present, administer glucose IV:
  a) **Adults**
     50% DW - 50 ml IV over 2-3 minutes
  b) **Children**
     250 mg/kg (1 ml/kg of 25% DW) IV over 2 - 3 minutes
  c) **Neonates**
     200 mg/kg (2 ml/kg of 10% DW) IV over 2 - 3 minutes

**Prior to infusing the dextrose, ensure the IV is patent.**
- If evidence of respiratory depression, administer:
  a) **Adults**: narcan: 0.4 - 2 mg IV (preferably before you insert an advanced airway). May be repeated as required.
  b) **Children**: narcan: 0.01 mg/kg IV.
- If no response, provide supportive care and transport.
- For hypotension, start a second IV line and infuse crystalloid to maintain an adequate blood pressure.
- Insert nasogastric tube and decompress stomach as indicated.

**References**
OBSTETRICAL PROTOCOL OB1  
BREECH PRESENTATION DELIVERY

- Continuous consultation with the on-call Obstetrician at the receiving centre is required for all in-flight breech deliveries (RUH: 306-655-1000 or RGH: 306-766-4444).
- Administer 100% O₂ by non-rebreather mask.
- Establish 2 large bore IV’s.
- If unable to establish traditional peripheral IV access, consider intraosseous or external jugular cannulation.
- Allow bearing down ONLY if the buttocks are crowning.

**NON-INTERFERENCE IS THE RULE!**

- If delivery is inevitable, support the buttocks and trunk during the delivery.
- Do not bring out the legs. Allow them to deliver spontaneously - supporting the heels as they deliver to prevent tearing of the perineum.
- If the anterior scapula is visible but the arms appear stuck and do not deliver spontaneously, with a gentle movement rotate the fetal body 180° with the back towards the maternal front. The posterior arm will rotate anteriorly bringing it under the pubic bone. This will aid delivery.
- As the head delivers, the body should be extended by lifting it up over the mother’s abdomen. Continue extending over the abdomen until the head delivers. **YOU ARE AIDING AND FACILITATING** delivery of the head, **DO NOT** actively pull on the baby.
- If the baby delivers, follow the Clinical Protocol OB2 - Childbirth.
- If the head does not deliver in 4 to 6 minutes, insert a gloved hand into the vagina to create an airway to the baby, ensuring that you do not compress the umbilical cord. **TRANSPORT IMMEDIATELY - DO NOT REMOVE HAND.**
- The following information is provided as reference material regarding breech presentations and delivery:
Types of Breech Presentations: Frank         Complete         Incomplete

There are three general methods of breech delivery through the vagina:

1. Spontaneous breech delivery. The fetus is expelled entirely spontaneously without any traction or manipulation other than support of the newborn.
2. Partial breech extraction. The fetus is delivered spontaneously as far as the umbilicus, but the remainder of the body is extracted or delivered with operator traction and assisted maneuvers, with or without maternal expulsive efforts.
3. Total breech extraction. The entire body of the fetus is extracted by the obstetrician.

The hips of the frank breech are delivering over the perineum. The anterior hip usually is delivered first.
Delivery of the body. The hands are applied, but not above the pelvic girdle. With thumbs over the sacrum, gentle downward traction is accomplished until the scapulae are clearly visible.

- Clockwise rotation of the fetal pelvis and abdomen 90 degrees brings the sacrum from anterior to left sacrum transverse (LST). Simultaneously, the application of gentle downward traction effects delivery of the scapula (A) and arm (B–D).
If trunk rotation is unsuccessful using above method, perform the following:

counterclockwise rotation from right sacrum anterior (RSA) to right sacrum transverse (RST) along with gentle downward traction effects delivery of the right scapula. With this maneuver, the posterior shoulder is delivered first. For this, the feet are grasped in one hand and drawn upward over the inner thigh of the mother, toward which the ventral surface of the fetus is directed (see figure below). In this manner, leverage is exerted on the posterior shoulder, which slides out over the perineal margin, usually followed by the arm and hand. Then, by depressing the body of the fetus, the anterior shoulder emerges beneath the pubic arch, and the arm and hand usually follow spontaneously.
Reduction of nuchal arm being accomplished by rotating the fetus through half a circle counterclockwise so that the friction exerted by the birth canal will draw the elbow toward the face.

**BACK OF FETUS FAILS TO ROTATE TO THE ANTERIOR:**

**MODIFIED PRAGUE MANEUVER**

Rarely, the back of the fetus fails to rotate to the anterior. In this situation, rotation of the back to the anterior may be achieved by using stronger traction on the fetal legs or bony pelvis. If the back still remains oriented posteriorly, extraction may be accomplished using the Mauriceau maneuver, described next, and delivering the fetus back down. If this is impossible, the fetus still may be delivered using the modified Prague maneuver, which consists of two fingers of one hand grasping the shoulders of the back-down fetus from below while the other hand draws the feet up and over the maternal abdomen (see figure below).
DELIVERY OF THE AFTERCOMING HEAD:

MAURICEAU MANEUVER

Normally, the fetal head may be extracted with forceps or by one of several maneuvers. With the Mauriceau maneuver, the index and middle finger of one hand are applied over the maxilla, to flex the head, while the fetal body rests on the palm of the hand and forearm (see figure below). The operator’s forearm is straddled by the fetal legs. Two fingers of the other hand then are hooked over the fetal neck, and grasping the shoulders, downward traction is concurrently applied until the sub-occipital region appears under the symphysis. Gentle suprapubic pressure simultaneously applied by an assistant helps keep the head flexed. The body then is elevated toward the maternal abdomen, and the mouth, nose, brow, and eventually the occiput emerge successively over the perineum. With this maneuver, the operator uses both hands simultaneously and in tandem to exert continuous downward gentle traction simultaneously on the fetal neck and on the maxilla. At the same time, appropriate suprapubic pressure is applied by an assistant (see figure below).

Delivery of the aftercoming head using the Mauriceau maneuver. A. Note that as the fetal head is being delivered, flexion of the head is maintained by suprapubic pressure provided by an assistant. B. Pressure on the maxilla is applied simultaneously by the operator as upward and outward traction is exerted.
TOTAL EXTRACTION OF COMPLETE OR INCOMPLETE BREECH

The ankles are held with the second finger lying between them. With gentle traction, the feet are brought through the introitus. If difficulty is experienced in grasping both feet, first one foot should be drawn into the vagina but not through the introitus, and then the other foot is advanced in a similar fashion. Now both feet are grasped and pulled through the vulva simultaneously (see figure below).

Complete breech extraction begins with traction on the feet and ankles.

As the legs begin to emerge through the vulva, downward gentle traction is continued. As the legs emerge, successively higher portions are grasped, first the calves and then the thighs. When the breech appears at the
vaginal outlet, gentle traction is applied until the hips are delivered. As the buttocks emerge, the back of the fetus usually rotates to the anterior. The thumbs are then placed over the sacrum and the fingers over the hips, and breech extraction is completed, as described for partial breech extraction (Nuchal Arm-see figure below).

During complete extraction of a frank breech, moderate traction is exerted by a finger in each groin and aided by a generous episiotomy (see figure below). Once the breech is pulled through the introitus, the steps described for partial breech extractions are then completed (Nuchal Arm).

Extraction of frank breech using fingers in groins. B. Once the hips are delivered, each hip and knee is flexed to deliver them from the vagina.
NOTE: All gravid women 18 weeks gestation or greater must be transported in the left (preferably) or right lateral recumbent position to avoid the supine-hypotension syndrome of pregnancy (the gravid uterus may compress the vena cava, leading to decreased venous return, decreased cardiac output, and compromised blood flow to the uterus and other organs).

CHILDBIRTH

- Initiate preparations for emergency childbirth.
- Administer 100% oxygen by non-rebreather mask.
- Establish IV access if not already established.
- Perform newborn resuscitation care, if required. Otherwise, perform and record 1 and 5 minute APGAR scores.
  - A – Appearance (color)
  - P – Pulse (HR)
  - G – Grimace (reflex/ irritable)
  - A – Activity (muscle tone)
  - R - Respirations
- If there is vaginal hemorrhage, assist with delivery of the placenta followed by uterine massage.
- Administer oxytocin: 10 U IM or 5 U IV, with delivery of the anterior shoulder, or as soon as possible post-delivery.
- Should postpartum hemorrhage develop, or the mother become hypotensive, please see Clinical Protocol OB4 - Obstetrical Hemorrhage.

MULTIPLE BIRTHS

- Continuous consultation with the on call Obstetrician at the receiving centre is required for all in flight multiple birth deliveries (RUH: 306-655-1000; RGH: 306-766-4444).
- Administer 100% O₂ by non-rebreather mask.
- Establish 2 large bore IV’s.
- If unable to establish traditional peripheral IV access, consider intraosseous or external jugular cannulation.
- If breech presentation, refer to Clinical Protocol OB1 - Breech Presentation Delivery.
NOTE:

1. Watch closely for signs of post-partum hemorrhage and shock (increased risk with multiple births due to the overextended uterus).

2. Babies are frequently premature; follow NRP/STABLE guidelines as applicable.

References


OBSTETRICAL PROTOCOL OB3
CORD PROLAPSE

- Administer 100% O₂ by non-rebreather mask.
- Establish 2 large bore IV’s.
- If unable to establish traditional peripheral IV access, consider intraosseous or external jugular cannulation.
- Ensure that you **DO NOT** palpate the cord for a pulse as you may cause the vessels to go into spasm and compromise blood flow to the fetus.
- Insert a gloved hand into the vagina and push the baby’s head off the cord. Try not to compress the cord and **KEEP YOUR HAND IN POSITION UNTIL RELIEVED AT A HEALTH CARE FACILITY.**

References

NOTE: All gravid women 18 weeks gestation or greater must be transported in the left (preferably) or right lateral recumbent position to avoid the supine-hypotension syndrome of pregnancy (the gravid uterus may compress the vena cava, leading to decreased venous return, decreased cardiac output, and compromised blood flow to the uterus and other organs).

ANTEPARTUM HEMORRHAGE

- Request cabin altitude of 2,000’ ASL.
- Consider taking SAA blood box and fluid warming device on transport.
- Administer 100% O₂ by non-rebreather mask.
- Establish 2 large bore IV’s.
- If unable to establish traditional peripheral IV access, consider intraosseous or external jugular cannulation.
- Resuscitate with normal saline.
- Consider contacting medical control for tranexamic acid order (see Medication Protocol M16 – Tranexamic Acid) and/or PRBC order.
- Frequent maternal vital signs (q 10-15 min with FHT q 15 min).

POST PARTUM HEMORRHAGE (PPH)

- Early consultation with the Transport Physician or the Obstetrician on call at the receiving centre is advised (RUH: 306-655-1000; RGH: 306-766-4444).
- Potential causes of PPH include:
  - Retained placenta
  - Cervical laceration
  - Coagulation defects
  - Uterine atony
  - Uterine inversion
  - Uterine rupture
  - Vulvovaginal hematomas
- Administer 100% O₂ by non-rebreather mask.
OBSTETRICAL HEMORRHAGE

- Ensure uterine contraction by massaging the fundus of the uterus firmly. One hand must support base of uterus while fundus is being massaged to prevent prolapse of uterus.
- Establish 2 large bore IV’s.
- If unable to establish traditional peripheral IV access, consider intraosseous or external jugular cannulation.
- Resuscitate with normal saline.
- Administer oxytocin, if not already given (see Clinical Protocol OB2 - Childbirth).
- If the placenta is still in situ, it needs to be delivered. Encourage spontaneous delivery and ask the mother to bear down. If the babe is present, encourage the mother to initiate breast feeding. **DO NOT** jerk or pull the placenta. After delivery of the placenta, perform FUNDAL MASSAGE as required to halt the bleeding.
- If heavy bleeding continues (>500 ml post vaginal delivery or >1000 ml post C/section) administer oxytocin: 40 U in 1 liter of normal saline @ 200-250 ml/hr.
- Consider contacting medical control for tranexamic acid order (see Medication Protocol M16 – Tranexamic Acid) and/or PRBC order.
- Estimate blood loss (e.g. number and type of pads soaked).

References


Approval: Effective Date: February, 2016

Medical Director: 

Section: Obstetrical Reviewed January 2016 Page OB4-2
OBSTETRICAL PROTOCOL OB5
SHOULDER DYSTOCIA

Recognizing shoulder dystocia:

- difficulty in the delivery of the face and chin.
- once the head delivers, head appears to retract and sink back into the perineum (turtling).
- maternal effort does not cause further progress towards expulsion of the infant.
- as maternal delivery efforts are more vigorously encouraged, vascular congestion of the fetal head will become pronounced and the danger to the infant increases if delivery cannot be accomplished promptly.

Contact the Obstetrician at the receiving centre if shoulder dystocia is suspected (RUH: 306-655-1000; RGH: 306-766-4444).  


Assisting patient with shoulder dystocia

- **Avoid** the three P’s - Panic, Pulling and Pressure and request that patient stop pushing.

- Delivery of the posterior shoulder for relief of shoulder dystocia. **A.** Operator’s hand is introduced into the vagina along the fetal posterior humerus. **B.** Splint arm & sweep across the chest, keep the arm flexed at the elbow. **C.** Grasp the fetal hand & extend the arm along the side of the face. The posterior arm is delivered from the vagina.

Attempt delivery with McRobert’s maneuver (see diagram below):

- Lift the buttocks, and raise the legs of the mother.
- Flex the maternal legs onto her abdomen as far as they will go (allows the hips to rotate and flattens out the lumbar curve, bringing the symphysis pubis anteriorly, which hopefully will decrease impaction of the anterior shoulder).
- Apply **suprapubic** pressure with a flat hand while in this position getting the mother to bear down. **DO NOT PUT PRESSURE ON THE FUNDUS!**
The McRobert’s maneuver. The maneuver consists of sharply flexing the thighs up onto the abdomen. The assistant is also providing suprapubic pressure simultaneously (arrow).

- **Attempt the Wood’s manoeuver**: the hand is placed behind the posterior shoulder of the fetus. The shoulder is then rotated progressively 180 degrees in a corkscrew manner so that the impacted anterior shoulder is released.

- First, the fetal shoulders are rocked from side to side by applying force to the maternal abdomen. If this is not successful, attempt the second Rubin maneuver. **A.** The shoulder-to-shoulder diameter is aligned vertically. **B.** The more easily accessible fetal shoulder (the anterior is shown here) is pushed toward the anterior chest wall of the fetus (arrow). Most often, this results in abduction of both shoulders, which reduces the shoulder-to-shoulder diameter and frees the impacted anterior shoulder.
• If this is unsuccessful & if safety permits, attempt rolling the mother over into a knee-chest position, with her back and buttocks up; this allows for similar pelvic rotation, decreasing impaction and may even permit spontaneous fetal rotation into one of the oblique pelvic diameters, facilitating easier delivery.

• Repeat the above manoeuvres until successful while in constant contact with the Obstetrician on call.

• Alert receiving health care facility en-route re patient condition.

References

NOTE: All gravid women 18 weeks gestation or greater must be transported in the left (preferably) or right lateral recumbent position to avoid the supine-hypotension syndrome of pregnancy (the gravid uterus may compress the vena cava, leading to decreased venous return, decreased cardiac output, and compromised blood flow to the uterus and other organs).

- The referring physician, RN or NP must examine the woman in labour or with prematurely ruptured membranes to determine the status of cervical dilation and effacement within 15 minutes to transfer of care to the air medical crew.
- A complete, well-documented pre-flight assessment must be performed by the referring clinician, including:
  - fetal heart rate
  - onset, frequency, strength and length of contractions
  - membrane status and if ruptured, a description of the amniotic fluid
  - detailed obstetrical history including (but not limited to…) EDC, para/gravida, previous pregnancies, previous labours, pre-existing medical conditions
- Consider administering a pre-flight anti-emetic, particularly to women who have had a meal in the previous 8 hours.
- All women with ruptured membranes must be on a Lifeport stretcher for all aspects of the transport.
- If the patient is in established labour with contractions less than 10 minutes apart and the cervix is dilated more than 3-4 cm, a physician escort will be a joint decision made by the attending flight nurse, the referring physician and the transport physician.
- Establish/request at least one large bore IV, may be saline locked.
- If unable to establish traditional peripheral IV access, consider intraosseous or external jugular cannulation.
- If the patient is at risk for PPH, consider taking SAA blood box and fluid warming device on transport.
- The flight nurse is encouraged to consult the receiving, or on-call Obstetrician for troubleshooting advice at either Royal University Hospital (655-1000) or the Regina General Hospital (766-4444).
- Neonatal resuscitation equipment should be on board the aircraft and readily available should the delivery proceed in-flight.
- Assess & record fetal heart tones upon receiving the patient and at least every ½ hour thereafter during flight. Should the labour progress with more frequent contractions, the fetal heart tones should be monitored every 15 minutes. Auscultate for the presence of accelerations and decelerations,
particularly following any contractions. A baby with a lagging heart rate following uterine contractions may have compromised blood flow to the umbilical cord.

References
OTHER PROTOCOL 01
DIABETIC EMERGENCIES

- Protect the airway and provide supplemental oxygen.
- If not recently done, perform a blood glucose test.
- Establishment of two large bore IV’s, initiate 0.9% NaCl.
- If unable to establish traditional peripheral IV access, consider intraosseous or external jugular cannulation.

HYPOGLYCEMIA
- If the patient is conscious, cooperative with an intact gag reflex and the blood glucose is <4.0 mmol/L, administer an Instant glucose tab.
- If the patient is unconscious or is unable to swallow, initiate an IV and administer:
  - 50% dextrose: 1 gram/kg IV up to a maximum of 50mls (initially).
  - ENSURE THE IV IS PATENT PRIOR TO ADMINISTERING THE D50W.
- The pediatric dosage for the intravenous administration of glucose is 5-10 ml/kg of D10W.
- Repeat blood glucose testing in 15 minutes.

HYPERGLYCEMIA
- Protect the airway and provide supplemental oxygen.
- If recent lab values are not available, or if the patient is being transferred from a site that does not have lab facilities, perform point of care testing to identify any blood gas or electrolyte abnormalities.
- Patients with extreme dehydration may require potassium replacement, particularly as they are rehydrated with crystalloid. Consult the Transport Physician for guidance regarding fluid and potassium replacement therapy.
- After the rehydration process has started, consider administering insulin (Humulin R) under the guidance of the transport physician. **DO NOT** administer insulin to patients with a serum potassium less than 2.5 mmol/L as it will further lower the serum K+.
- Periodically reassess serum glucose levels during transport.
References


OTHER PROTOCOL O2
EPISTAXIS

- Request antiemetic pre-flight.
- Request maximum cabin altitude of 2000 feet ASL.
- Assess patency of patient's airway.
- Establish two large bore IV’s.
- If unable to establish traditional peripheral IV access, consider intraosseous or external jugular cannulation.
- Consider volume resuscitation with normal saline as required.
- Consider taking SAA blood box and fluid warmer on transport.
- If catastrophic bleeding, consider calling Transport Physician for tranexamic acid order (see Medication Protocol M16 – Tranexamic Acid).
- Load patient head to the nose of the aircraft.
- Elevate head of the stretcher, unless patient is in shock.
- If posterior nasal packing is in place via foley catheter ensure bulb is filled with sterile water.
- If anterior bleeding is present, provide anterior digital pressure; utilize a nasal clamp, as necessary.
- Observe patient carefully for evidence of bleeding.

References
**OTHER PROTOCOL O3**

**SEPSIS**

- Every patient with a suspected infection shall be screened for sepsis, severe sepsis and septic shock during triage.

- Patients demonstrating **any TWO** of the following:
  - Temperature (oral) greater than 38 °C or less than 36 °C
  - Heart rate greater than 90 beats per minute
  - Respiratory rate greater than 20 breaths per minute
  - WBC greater than 12,000 or less than 4000 OR greater than 10% immature neutrophils

  Plus at least **ONE** of the following:
  - Hypotension: SBP less than 90 mm Hg or MAP less than 70 mmHg
  - Hypoxemia: PaO2 less than 70 mmHg or SpO2 less than 90%
  - Oliguria: urine output less than 0.5 ml/kg/hr
  - Coagulopathy: INR greater than 1.5, APTT greater than 60 seconds or platelets less than 100
  - Mottled skin, capillary refill greater than 3 seconds
  - Serum lactate over 2.0 mmol/L
  - Altered mental state
  - Immunocompromised

  **Should be considered to have SEVERE SEPSIS / SEPTIC SHOCK WITH A CTAS LEVEL 2 MINIMUM**

**Initiate Treatment Protocol**

Take all necessary steps to initiate the earliest treatment including:
• request sending facility collect cultures of the blood, sputum, wound and urine to transport with patient to receiving centre.

• request sending facility performs ABG, CXR and 12 lead ECG if possible.

• deliver oxygen to achieve a target SpO2 greater than/equal to 92%.

• insert foley catheter and monitor urine output hourly.

• establish 2 large bore IV’s.

• if unable to establish traditional peripheral IV access, consider intraosseous or external jugular cannulation.

• initiate IV fluid bolus of Normal Saline 500mls repeated every 10 minutes until:
  o MAP is greater than 65 mmHg or systolic BP over 90 mmHg
  o Urine output greater than 0.5 ml/kg/hr

• titrate fluid maintenance to keep urine output of 0.5 ml/kg/hr.

• monitor heart rate, BP and auscultate lungs sounds frequently.

• initiate IV antibiotics in consultation with Transport Physician or infectious disease consultant.

**Antibiotics**

• Under physician direction, initiate antibiotic therapy:
  
  o **ceftriaxone**: 2 grams IV over 5 minutes
  o **ciprofloxacin**: 400 mg IV over 30 minutes
  o **moxifloxacin**: 400mg IV over 60 minutes
  o **vancomycin**: 25mg/kg IV over 60 – 90 minutes (maximum 3.5 gram loading dose)

**Vasopressors**

• In consultation with the Transport Physician: start vasopressors if appropriate fluid challenge (usually 3000 mls or greater) fails to rapidly restore adequate blood pressure and perfusion or if hypotension is life threatening during the process of fluid resuscitation.
  
  o **Norepinephrine** will increase peripheral vascular resistance and have less effect on heart rate and stroke volume. Initiate when the patient is tachycardic – Initial dose rate at 0.5 mcg/kg/min and titrate to keep MAP greater than 70 mm Hg.
  o **Dopamine** will not only provide beta 1 stimulation (increased HR & force of contraction) as well as alpha 1 stimulation in higher doses. Initiate dopamine at 5 mcg/kg/min and titrate to keep the MAP greater than 70 mm Hg.
**General Considerations**

- Request cabin altitude of 2000 ft ASL.
- Monitor CVP if available. Fluid resuscitation goals are aimed at maintaining a CVP of 8 – 12 mmHg.
- Utilize I Stat point of care testing to monitor pH, blood gases, saturation and electrolytes, preferably while in transit.
- Titrate oxygen delivery to maintain saturation > 92%.
- Do not delay antibiotic therapy.
- Transport culture specimens to the lab at the receiving facility.
- Patients with sepsis routinely require a large amount of fluid resuscitation and often receive over 4-6 liters of fluid in the initial few hours after presentation.

**References**


POISONING – OD – METABOLIC PROTOCOL P1
POISONING - GENERAL

- Primary survey.
- Secondary survey.
- If not already initiated, contact Poison Control Centre for treatment recommendations at 1-866-454-1212.
- Establishment of two large bore IV’s.
- If unable to establish traditional peripheral IV access, consider intraosseous or external jugular cannulation.
- Request maximum cabin altitude of 2,000 to 4,000 feet ASL.
- If it is safe to do so, you may bring the product or substance and container to hospital with the patient.
- Treat the patient, not the poison.
- Administer appropriate antidote, if available as per poison control recommendations.
- Support cardiac or respiratory systems as needed.
- Maintain airway and administer oxygen as required to maintain oxygen saturations of 95% or above.
- Conscious, alert patient:
  a) **Swallowed poisons**
     - Identify substance ingested.
     - Estimate quantity ingested.
     - Treat as per Poison Control Centre recommendations.
  b) **Inhaled poisons**
     - Administer oxygen.
     - Identify substance inhaled.
     - Estimate duration of exposure.
     - Treat as per Poison Control Centre recommendations.
  c) **Chemical contaminant**
     - Wear gloves, gown and appropriate mask when dealing with pesticide poisoning or when type or chemical on the skin is unknown.
     - Ensure contaminated clothing has been removed and that skin has been flushed with water for ten minutes and washed gently with soap and water and rinsed prior to transport.
     - Identify contaminant.
     - Ensure that air transport is appropriate.
• Treat as per Poison Control Centre recommendations.
• Once at the receiving health care facility, remove gloves, mask and gown and place into a double plastic bag which is then sealed and identified by the receiving staff.

d) **Chemical contaminant the eye**
• Prior to transport, request that referral centre: flood the eye with normal saline continuously for at least fifteen minutes. Have patient blink frequently during irrigation.
• Identify contaminant.
• Treat as per Poison Control recommendation.

**References**
POISONING – OD – METABOLIC PROTOCOL P2
TRICYCLIC ANTIDEPRESSANT OVERDOSE

- Initiate cardiac monitoring.
- Request initiation or initiate IV/IO with normal saline.
- If the QRS interval appears widened on the monitor:
  a) obtain a strip; and
  b) measure the QRS interval.
- Contact Transport Physician re assessment and receive advice including:
- If QRS interval > 0.10 seconds:
  a) administer sodium bicarbonate: 1 meq/kg IV.
- Seizure activity:
  a) administer benzodiazepines as per Clinical Protocol N1 - Seizures.
  b) Administer sodium bicarbonate: 1 meq/kg IV to all patients with active or recent seizure activity.
- Hypotension:
  a) Administer sodium bicarbonate: 1 meq/kg IV while rapidly infusing normal saline.
- Ventricular arrhythmias:
  a) Ventricular Tachycardia: If hemodynamically stable, administer sodium bicarbonate: 1 meq/kg IV. If unsuccessful start lidocaine.
  c) Unstable Ventricular Tachycardia and Ventricular Defibrillation: defibrillate immediately, followed by the administration of sodium bicarbonate: 1 meq/kg as soon as an IV is established.
- Hemodynamically unstable bradyarrhythmias:
  a) Treat with transcutaneous pacing (refer to Clinical Protocol C8 – Transcutaneous Pacing).
  b) If the patient is intubated, hyperventilate at forty per minute in children and thirty per minute in adults in conjunction with the intravenous administration of Sodium Bicarbonate.

SPECIAL CONSIDERATIONS:
1. Amiodarone is NOT indicated for treatment of V-tach in the patient with a TCA overdose as it causes sodium channel inhibition.
2. Sodium bicarbonate is not indicated in non-cyclic antidepressant overdoses.
3. Sodium bicarbonate cannot be given via an endotracheal tube.
4. Asymptomatic patients with normal QRS width and no ventricular arrhythmias do not require sodium bicarbonate IV.
References

Hyperkalemia is defined as a potassium level >5.5 mmol/L. Causes of hyperkalemia include:

- acidemia.
- cell death from rhabdomyolysis, tumour lysis, burns, hemolysis.
- drugs such as potassium sparing diuretics, ACE inhibitors, succinylcholine, NSAIDS, trimethoprim-sulfamethxazole, etc.
- excessive intake.
- hypoaldosteronism.
- renal dysfunction.

Hyperkalemia can cause the following clinical manifestations:

1. Cardiac:
   - arrhythmias.
   - bradycardia.
   - diminished conduction and contraction.
   - ECG abnormalities including peaked t waves, PR interval progression, QRS widening, diminished P waves, sine waves.
   - heart block.
   - muscle weakness.

2. Neurological:
   - paralysis.
   - paraesthesias.
   - hypoactive reflexes.

**Transport Management**

- Consult medical control for orders, which may include:
  1. If significant ECG changes such as widened QRS and sine waves are present:
     - calcium chloride 10% solution: 5-10 ml IV over 5-10 minutes.
  2. For redistribution of potassium:
     - 10-20 units of regular insulin with 25-50 g of 50% dextrose over 5-10 minutes intravenously.
     - sodium bicarbonate: 1 mmol/kg IV over 5-10 minutes.
     - Inhaled ventolin: 10-20 mg.
3. For removal of potassium:
   - **furosemide**: 1-2 mg/kg and isotonic fluids. Doses of 120 mg or less - over 1-2 min, doses greater than 120 mg – by intermittent infusion.
   - ensure patent airway and administer oxygen via nasal prongs or NRB to maintain SpO₂ above 94%.
   - establishment of two large bore IV’s.
   - if unable to establish traditional peripheral IV access, consider intraosseous or external jugular cannulation.
   - perform IStat testing every 30-60 minutes to monitor treatment effectiveness.
   - monitor output via urinary catheter.

**References**


RESPIRATORY PROTOCOL R1
AIRWAY MANAGEMENT

INDICATIONS FOR ENDOTRACHEAL INTUBATION

1. Patient in cardiopulmonary or respiratory arrest or unresponsive, near death (“crash” airway).
2. Failure of airway maintenance or protection:
   - decreased level of consciousness, GCS ≤ 8 with airway compromise.
   - patient unable to protect their airway from aspiration.
3. Respiratory failure requiring ventilation; (hypoxemia or ventilatory failure).
   - inadequate ventilation with increased CO₂ levels causing respiratory acidosis and decreased level of consciousness.
   - inadequate oxygenation (<90%) despite supplemental oxygen delivery or progressive oxygenation failure that requires positive pressure ventilation through an endotracheal tube.
4. Catastrophic illness or injury with anticipated deterioration.
   - anatomical distortion from direct trauma, edema, multiple trauma with shock.
5. Need for therapeutic interventions including delivery of oxygen, anaesthetic agents, medications and tracheal toilet.
7. Administration of Propofol in the patient with refractory status epilepticus. (See Clinical Protocol N1 - Seizures).

ASSESSMENT OF THE AIRWAY (LEMON assessment)

1. Look externally (short neck, facial disruption, dental shape).
2. Evaluate mouth opening, length of the mandible, thyromental distance.
3. Mallampati score.
4. Obstruction (muffled voice, difficulty swallowing secretions, stridor).

If a difficult intubation is anticipated, unless patient is a “crash airway”, consult the Transport Physician.

Preparation:
- perform GCS (see indications for RSI).
- evaluate for difficult intubation.
- select appropriate laryngoscope, blade and tube size.
- all required equipment should be assembled and ready for use.
• position patient supine on stretcher or table.
• place 4 inch pillow or towel between the shoulder blades to align patient’s oral, pharyngeal and laryngeal axis. (May not be feasible in emergent situations; contraindicated in patient with known or suspected cervical spine injury).
• ensure adequate preoxygenation and ventilation.
• initiate RSI procedure (IF RSI INDICATIONS ARE MET), (see Clinical Protocol R4 – Rapid Sequence Induction).

**Procedure:**

• place endotracheal tube, inflate cuff with sterile water.
• verify placement:
  • ETCO₂
  • Gastric/breath sounds
  • Bag compliance during ventilation
  • Tube fogging/tube depth
  • Observe chest rise; palpate chest rise
  • SpO₂
• secure tube with commercial bite block device.
• if ET placement unsuccessful oxygenate and ventilate patient, re-attempt ET placement. Patients already intubated or who have had their endotracheal tube cut short may benefit from a larger sized endotracheal tube. A tube changer device is included in the airway kit to facilitate easy swapping of endotracheal tubes.
• **NOTE:**
  • in children up to the age of eight years, the use of a straight laryngoscope blade is preferred for intubation and an appropriately sized “noncuffed” endotracheal tube must be used. A Broselow tape is useful for determining the size of endotracheal tube to be used in a child.

**FAILED INTUBATION/VENTILATION**

In the event that the endotracheal intubation fails:

• ventilate using bag-valve-mask (BVM) and 100% O₂ with oropharyngeal airway (OPA) insitu.
• reassess patient positioning if possible.
• reattempt intubation under direct laryngoscopy (consider use of the King Vision video laryngoscope, a different laryngoscope blade, and/or a smaller size of intubation tube).
• if unsuccessful, ventilate using BVM and 100% oxygen.
• consider insertion of laryngeal mask airway (LMA) for transport.
• confirm placement and ventilate to desired SpO₂ and ETCO₂ parameters.
• if still unable to ventilate remove LMA, insert OPA & oxygenate with 100% via BVM.
• if unable to ventilate using BVM, trouble-shoot the cause.
• DOPE pneumonic may be useful:
Consult medical control for advice. Be prepared for a surgical airway.

CRICOIDTHYROTOMY (SURGICAL AND PORTEX CRICOTHYROIDOTOMY KIT)

**Indications:**
- inability to ventilate despite attempted ventilation with BVM endotracheal tube placement, and LMA.
- completely obstructing upper airway foreign body, edema, anatomic variation, trauma, hemorrhage or infection.

**Contraindications:**
- children under the age of 12 years.
- uncertainty in identifying the anatomical landmarks.

**Preparation:**
- prepare equipment.
- locate cricoid cartilage.
- palpate cricothyroid membrane anteriorly between cricoid cartilage and thyroid cartilage.
- prepare skin with betadine swab.

**SURGICAL CRICOTHYROTOMY (ADULT PATIENTS ONLY)**
- stabilize thyroid cartilage with non-dominant hand.
- make an incision over the lower half of the cricothyroid membrane (1-1 ½ inches).
- carefully incise through membrane.
- insert scalpel handle and rotate 90 degrees. Do not use blade of scalpel.
- insert an appropriately sized, cuffed ETT into the incision, using the natural curve of the tube (size 5.0 or 6.0 mm tube).
- insert ET to just above cuff.
- inflate cuff with water and ventilate patient.
- assess adequacy of ventilation.
- secure tube (DO NOT CUT).
- monitor SpO₂ and ETCO₂.
PORTEX CRICOHYROIDOTOMY KIT (ADULT PATIENTS ONLY)

- Ensure that the integrity of the cricothyroidotomy tube cuff has not been compromised by inflating the bulb.
- Fully deflate the cuff to prevent rupture during insertion.
- Position the patient supine with the neck hyperextended if there is no spinal injury or potential for a spinal injury.
- Stabilize the trachea between the thumb and forefinger. Locate the cricothyroid membrane by palpating the depression immediately below the prominence of the thyroid cartilage.
- Make a 2 cm long horizontal incision through the skin over the cricothyroid membrane.
- Hold the device with your thumb on the needle hub and forefingers underneath the tube flange.
- With the trachea stabilized, place the needle tip centrally over the cricothyroid membrane, perpendicular to the skin.
- Insert the device while constantly observing the red indicator flag located in the needle hub. This will confirm contact of the blunt stylet/needle with the tissue.
- Advance the device until a loss of resistance is felt and the red indicator flag in the needle hub disappears. This confirms entry into the trachea.
- If there is any doubt as to proper placement of the device, aspirate air with the syringe provided in the kit.
- Continue to insert the device until the red flag is observed to move again in the needle hub. This will indicate contact of the blunt stylet with the posterior cricothyroid cartilage. **DO NOT INSERT THE DEVICE ANY FURTHER.**
- Angle the device in a caudal (downwards) direction and advance it 1-2 cm into the trachea.
- Remove the needle portion (clear hub) of the device while holding the dilator (both the white and blue portions of the handle)
- Slide the cricothyroidotomy tube off of the dilator into the trachea until the flange is resting against the neck. A slight twisting motion of the dilator may help facilitate its removal from the tube.
- Inflate the tube cuff with the minimum volume of water to form a seal.
- Secure the tube with twill tape or the straps included with the device.

For detailed photos of the insertion procedure, see the instructions enclosed with the device.
References


RESPIRATORY PROTOCOL R2
ANAPHYLAXIS

- Request cabin altitude restriction of 2000 feet ASL.
- Primary survey.
- Administer high concentrations of oxygen.
- Note the presence of, and extent of, related signs indicating the severity of reaction; respiratory status, skin color, swelling, urticaria, abdominal cramps, nausea/vomiting and vital signs. Patients may appear anxious, agitated, flushed or pale and may express a feeling of impending doom.
- If patient has 2 out 3 body system involvement, i.e. urticaria with respiratory distress; respiratory distress with nausea/vomiting, throat swelling, etc., immediately administer IM epinephrine: 0.5 ml of 1:1,000 in lateral thigh (pediatric dosage is 0.1 mg/kg or 0.1 ml/kg of epinephrine 1:1,000) IM via the deltoid or vastus lateralis of the leg. May administer maximum of 3 doses of epinephrine every 5 minutes for persistent respiratory compromise/hemodynamic instability.
- Initiate cardiac monitoring.
- Establish 2 large bore IV’s.
- If unable to establish traditional peripheral IV access, consider intraosseous or external jugular cannulation.
- For patients in severe respiratory distress or for patients in a peri-arrest state, take control of the airway as necessary (see Clinical Protocol R4 – Rapid Sequence Induction). Ketamine used as an induction agent may be of benefit as it has bronchodilation properties.
- If patient is hypotensive, provide fluid resuscitation.
- For persistent hypotension, administer epinephrine: 1 ml of 1:10,000 IV push slowly over several minutes in an adult. May be repeated once after five minutes if necessary. Call the Transport Physician.
- If bronchospasm is present, administer salbutamol (see Clinical Protocol R5 – Respiratory Emergencies).
- Administer diphenhydramine: 1 mg/kg IV (up to a maximum of 50mg).
- Administer methylprednisolone: 1-2 mg/kg IV (up to a maximum of 125mg, including pediatric patients), if the patient has not received same at the referral centre.
- Administer ranitidine: 1 mg/kg IV to a maximum of 50 mg. (including pediatric patients).

SPECIAL CONSIDERATIONS
Epinephrine, via an endotracheal tube, must be given in a volume of at least 10 ml in an adult, 5 to 10 ml between the ages of two and twelve, and 1 to 2 ml under the age of two.
References


CMAJ, Diagnosis & Management of Anaphylaxis, August 19, 2003; 169(4).
RESPIRATORY PROTOCOL R3
MECHANICAL / NON-INVASIVE VENTILATION

MECHANICAL VENTILATION (LTV 1200)

Preparation

- Confirm correct endotracheal tube placement (ETCO2, auscultation) and ensure ETT tube is well-secured prior to transport.
- Obtain baseline vital signs, cardiac rhythm strip and capnograph.
- Perform and record respiratory assessment.
- Review most recent CXR and ABG if available.
- Estimate lean body weight for patient (see appendix).
- Determine if patient has normal lungs, COPD/asthma or ARDS/lung injury to determine the initial ventilator parameters.
- Perform leak test on ventilator circuit.
- Place patient on ventilator early while preparing for transport; ensure ventilator function and patient tolerance to settings prior to flight.
- Refer to the LTV 1200 Ventilator Quick Reference or to the LTV 1200 Ventilator Operator’s Manual for further information.

Initiation of Ventilation

- If ventilating well at referring facility, consider maintaining the patient’s current settings if appropriate.

- Ensure the ventilator is attached to supplemental oxygen and that the “Low Flow” oxygen light is illuminated on the ventilator.

- **If initiating mechanical ventilation, presets in place for an adult are:**
  - Assist control – volume regulated mode
  - Tidal volume: 500 ml
  - Respiratory rate: 12
  - PEEP: 0 cm H2O
  - I time: 1.0
  - Pressure control: 15 cm H2O
  - Pressure support: 10 cm H2O
• Sensitivity: 3 Lpm

• Depending on patient condition, consider:
  • Starting with FiO₂ of 1.0, titrate down to minimum value required to maintain adequate O₂ saturations.
  • PEEP ≥ 5 cm H2O, increase if warranted.
  • Adjust sensitivity to trigger with respiratory effort prn.

• Alarms presets for adult setting:
  • High f alarm, breaths per minute (bpm): 40 bpm, 30 sec
  • High pressure limit: 40 cm H₂O
  • Low pressure limit: 10 cm H₂O
  • Low minute volume: 3.0 ml
  • High PEEP alarm: PEEP +5cm H₂O
  • Low PEEP alarm: PEEP -3cm H₂O

• Adjust ventilator alarms after 5 minutes of ventilation, including:
  • High pressure alarms to 10-15 cm H₂O above the displayed peak inspiratory pressure (PIP).
  • Low pressure alarms to 5-10 cm H₂O less than the displayed PIP.
  • Low volume alarm to approximately 75% of the displayed minute volume (VE).

• Transport in low Fowler’s position (at least 30 ° rise) whenever possible. Keep head of stretcher down for take-off and landing.

• Insert oral gastric tube and connect to low intermittent suction.

• Keep bag-valve-mask (BVM) available during the transport.

• Apply 20-30 mm Hg suction to the Hi-LO Evac ET tube when suction available during the transport; otherwise cap the port.

Monitoring

• Establish continuous cardiac, SpO₂ and EtCO₂ monitoring.

• Monitor vital signs and ventilator settings including: mode, sensitivity, RR (vent/spont), Vt/Vte, FiO₂, PEEP, PS, I Time, and I:E ratio, airway pressures (PIP, MAP) q 15 minutes. Document any change to settings and ventilation therapies provided.

• Airway pressures:
  o Peak Inspiratory pressure (PIP) measures the airway resistance of the major airways.

  o Mean airway pressure (MAP) measures the average airway pressure over a ventilator cycle and reflects mean alveolar volume.
• Record alarm parameters set.

**EtCO₂ Monitoring**

• Monitor trends in EtCO₂. For normal lungs, goal EtCO₂ 30-35 mm Hg. For hemodynamically unstable patients, goal EtCO₂ 25-30 mm Hg.

• Evaluate clinical status including breath sounds, skin color, cap refill, ease of ventilation and synchrony.

**COPD/Asthma Ventilation Strategies**

• Severe airway obstruction may not allow complete expiration prior to the next delivered breath. Intrinsic or autoPEEP develops, leading to worsening hypoxia, hypercapnea and hypotension.

• Monitor for presence of autoPEEP. Suspect autoPEEP when air flow persists to the very end of exhalation (auscultate at the trachea when on the ground). To measure press “INS/EXP Hold” button twice to choose EXP HOLD; while holding button down, inspiration is delayed and the end expiratory airway pressure or autoPEEP is measured and displayed.

• To prevent or treat autoPEEP:
  o Keep Vt low (6 ml/kg lean body weight or less if required when airway obstruction is extreme).
  o Adjust I time to increase inspiratory flow (<1 second).
  o Decrease breath frequency to maximize the I:E ratio (1:4 or greater) allowing for long expiratory time. Ensure adequate minute volumes.

• Monitor EtCO₂ trends;
  o Sloped expiratory rise on the capnograph is an indication of airflow obstruction. Consider bronchodilators.
  o Avoid hyperventilation.

• Markedly increased PIP may indicate pneumothorax, bronchospasm or airway obstruction.

• Target SpO₂ between 88-90 %.

**ARDS Ventilation Strategies**

• Inflamed lungs with decreased compliance and increased dead space are prone to atelectasis, barotrauma and volutrauma.

• Initial Vt: 6-8mL/kg ideal body weight (IBW).
• Initial f: 10-12. Adjust respiratory rate to maintain adequate minute volumes, and near normal blood pH (7.30-7.45) if available or EtCO2 near 30 mm Hg if arterial gases unavailable.

• Goal SpO₂ 90% or greater; or PaO₂ of 55-80 mm Hg.

• Initiate ventilation with FiO₂ of 1.0 and PEEP of 5-8 cm H₂O.

• If refractory hypoxias despite FiO₂ of 1.0 and increased PEEP, call medical control to discuss further ventilation strategies.

• Department of Respiratory Therapy @ RUH (switchboard 306-655-1000) is available as required for consultation.

Troubleshooting

If the ventilator is alarming and the patient exhibits signs and symptoms of respiratory distress or condition has deteriorated unexpectedly, disconnect patient from the ventilator and bag with 100 % oxygen.

• Persistent hypoxia despite FiO₂ 1.0, consider:
  o Check equipment and ETT displacement
  o Pneumothorax
  o Intrapulmonary shunt requiring increased PEEP

• PIP > 35, consider:
  o Tidal volume too high
  o Need for suctioning or bronchodilator
  o Check equipment and ETT placement
  o Pneumothorax
  o Increased patient agitation/ asynchrony with ventilator. Sedate as per clinical protocol.
  o Decreasing lung compliance d/t ARDS

• Low PIP alarm, consider:
  o Circuit disconnect
  o Check alarm settings

• Low volume alarm, consider:
  o Circuit disconnect
  o Improper settings – VE, RR, Vt

• Mismatch between Vt and Vte, consider:
  o Circuit leak/ open tubing ports
  o Insufficient ETT cuff seal
• Turbulence from swivel adapter will increase Vte; add short connector tubing between adapter and circuit.

• Hemodynamic compromise as evidenced by low BP, increased HR, consider:
  o PEEP intolerance – try slowly decreasing PEEP
  o Vt too high - decrease Vt and increase RR to maintain minute volume
  o Administering fluids

• F alarm, consider:
  o Spontaneous breath rate over the default alarm rate
  o Decreasing sensitivity to disallow inappropriate triggering
  o Changing to SIMV mode to allow spontaneous breath rate; support with PS if required
  o Sedation to suppress hyperventilation

**Contact Medical Control If:**

• Hypoxia remains as evidenced by SpO2 sat < 88-90% despite high FiO2 and increased PEEP.

• PEEP requirements beyond 12cm H2O are required to maintain oxygenation.
Appendix: Estimation of Lean Body Weight

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NON-INVASIVE VENTILATION (LTV 1200)

Indications for non invasive ventilation

- COPD with respiratory acidosis (pH 7.25-7.35).

- Hypercapneic respiratory failure due to chest wall deformity or neuromuscular disease.

- Heart failure in acute exacerbation.
Contraindications

- Refusal or inability of patient to cooperate with NIV.
- Impaired consciousness, confusion or agitation (patient unable to protect airway).
- Life threatening hypoxia.
- Hemodynamic instability / severe comorbidity.
- Copious respiratory secretions.
- Consolidation on chest X-ray.
- Head gear or mask cannot be fitted to face due to burn, facial trauma, beard etc.
- Airway obstruction.
- Vomiting, GI obstruction, recent abdominal or esophageal surgery.

PROCEDURE

- Create an alternative management plan prior to initiating treatment.
- Perform a circuit leak test.
- Push the Assist/Control, SIMV/CPAP mode button until the NPPV LED flashes.
- Press the button once more to confirm. The NPPV LED will continue to flash.
- SET IPAP will be displayed. The Pres. Support control display will be bright; all other controls dim.
- Turn the Set Value knob to adjust the IPAP value (displayed in Pres. Support LED window). Press the Pres. Support button to confirm, SET EPAP will display. The PEEP control display will be bright and all other controls will dim.
- Turn the Set Value knob to adjust the EPAP value (shown in the PEEP LED window). Press the PEEP button to confirm.
- The PEEP button will confirm NPPV operation and LED then turns solid.
- Set O2%.
- Set the High Pres. Limit alarm.

Initial settings

**Volume ventilation:** Set VT to patients VT

**Rate:** RR set at 0 (---)

**Mode:** SIMV/CPAP

**Pressure Support:** 10 - 15
Sensitivity: 3

PEEP: 5

I-Time: 1 - 1.5 seconds

FiO₂: Adjust to maintain SpO₂ of 88-92% (use the low flow source)

High Pressure Alarm: 10-15 cm H₂O > displayed PIP

Low Pressure Alarm: 5-10 cm H₂O > displayed PIP

Low Volume Alarm: 75% of the displayed minute volume

Monitor

- Heart rate, respiratory rate, SpO₂, EtCO₂ (EtCO₂ nasal prongs may prevent adequate mask seal).

- Chest wall movement.

- Coordination of respiratory effort.

- Patient comfort and tolerance of NIV.

- Leaks around the mask or through open mouth.

- Airway pressure.

- Low minute volume.

Adjusting parameters

- Maintain SpO₂ between 88 and 92%; consider increasing PEEP to improve oxygenation.

- Adjust sensitivity to synchronize with patient respirations (↑sensitivity to ↑ effort; ↓ sensitivity to ↓ effort required to trigger the pressure support).

- If work of breathing is not lessening, decrease the I Time to ↑ the inspiratory flow rate.

- Monitor the tidal volume; adjust the pressure support to attain adequate volume ventilation (6-8 ml/kg). Set the back up volume close to the patient generated tidal volumes.
**Troubleshooting**

- Assess for complications of therapy such as pneumothorax.
- Ensure appropriate mask fit, monitor for leaks and pressure points.
- Ensure the circuit is free from leaks and connections are secure.
- Adjust oxygen to maintain SpO₂ between 88-92%.
- Department of Respiratory Therapy @ RUH (switchboard 306-655-1000) is available as required for consultation.

**Withdrawal of NIV will be required if the patient deteriorates, failure to improve on NIV is an indication for intubation and invasive positive pressure ventilation.**

**References**

RESPIRATORY PROTOCOL R4
RAPID SEQUENCE INDUCTION

PATIENT SELECTION
Rapid sequence induction (RSI) is a technique for inducing anesthesia and establishing oral endotracheal intubation in an emergent situation. It typically involves the sequential application of:

- oxygen
- sedation
- “BURP”, prn
- short-acting paralytic agent
- oral endotracheal intubation
- continued sedation and paralysis

RSI is used to secure the airway in the following patients (ENSURE PATENT AIRWAY AND ADEQUATE OXYGENATION):

1. Inability to tolerate laryngoscopy and,
   - GCS ≤ 8 with a resp. rate < 8 or >35
   - GCS ≤ 8 with SpO2 < 90% on NRB mask

2. RSI may also be indicated in the following situations:
   - GCS < 8 and clenched jaw or inability to suction airway
   - Extremely agitated or combative patient; particularly with associated head injury (regardless of GCS)
   - Respiratory extremis (tachypnea with air hunger, use of accessory muscles and SpO2 < 90% on NRB)

NOTE:
- RSI is not necessary for immediate airway control in patients in cardiopulmonary arrest.
- RSI is indicated in the patients with a full stomach and at risk for aspiration.
- Always consider an awake intubation (i.e. with use of lidocaine spray) prior to proceeding with RSI, if patient can tolerate this.
- The Air Medical Team may assist/implement the following protocol for rapid sequence induction in the above circumstances. **Medical control must be obtained prior to intubating an infant or child and if medications are used other than those described in the protocol.**
Contraindications to RSI

1. When the airway is assessed as difficult and the ability to ventilate with a bag valve mask (BVM) device is considered unlikely (see Clinical Protocol R1 - Airway Management for assessment criteria).
2. Patient is unresponsive and near death or in respiratory or cardiac arrest.
3. Considerations and Contraindications to succinylcholine:
   - open eye injuries (succinylcholine will increase intra-ocular pressure).
   - burns and/or spinal cord injuries >48 hrs. (risk of hyperkalemia).
   - myopathic patients – (muscular dystrophy, MS, rhabdomyolysis, crush injuries) – (risk of hyperkalemia).
   - denervation injuries (stroke, Guillain-Barre syndrome, polio, spinal cord trauma, myasthenia gravis). May cause hyperkalemia 4-5 days post injury but can be used in the initial 1-4 days post injury.
   - chronic renal failure – avoid succinylcholine due to risk of hyperkalemia.
   - history of malignant hyperthermia – Do not use succinylcholine with patients with a personal or family history of sensitivity.

When considering RSI in children, the pediatric intensivist and/or the transport physician must be contacted prior to procedure.

PROTOCOL AND PROCEDURE

1. Ensure the following equipment is assembled and ready for use:
   - bag valve mask device connected to 100% oxygen.
   - working suction unit and suction catheters.
   - cardiac monitor, pulse oximetry, end tidal CO\textsubscript{2} monitor.
   - working laryngoscope with selection of blades.
   - oral airway kit/Magill forceps.
   - endotracheal tubes with stylet and cuff inflation syringe (adult).
   - sterile water for cuff inflation (adult).
   - patent large bore IV line.
   - RSI drug kit (prepare required drugs prior to commencing RSI).
   - endotracheal tube securement device.
2. Preoxygenate the patient with 100% oxygen.
   - breathe 100% O\textsubscript{2} for 5 minutes (or at least 5 deep breaths).
3. Pretreat with:
   - CHILDREN: atropine: 0.02 mg/kg IV, in patients with an increased risk of bradycardia.
   - ADULTS: lidocaine: 1.5 mg/kg IV.
   - CHILDREN: lidocaine: 1.5 mg/kg IV.

   NOTE: If the patient has suspected increased intracranial pressure, pre-treat with:
   - ADULTS: lidocaine: 1.5 mg/kg IV.

   Wait two to three minutes (if possible); continue oxygenation as required to maintain SpO\textsubscript{2} > 96%.
4. Sedate/induce with **one or more** of the following:

**ADULTS:**
- **fentanyl:** 0.5-2 mcg/kg IV, for sedation.
- **fentanyl:** 1-3 mcg/kg IV, for induction, every 2-3 minutes.
- **ketamine:** 1-2 mg/kg IV, decrease dose in shock states. May cause increased salivation, consider if patient has asthma (only after non-invasive measures have failed) or respiratory failure.
- **midazolam:** 0.05-0.1 mg/kg IV, (maximum 5 mg if normotensive).
- **propofol:** <55 years: 2-2.5mg/kg IV, (~40 mg every 10 seconds).
- **propofol:** >55 years: 1-1.5 mg/kg IV.

**CHILDREN:**
- **midazolam:** 0.1 to 0.2 mg/kg IV, (maximum of 5 mg).

5. Continue oxygenation allowing sufficient time for sedation to take effect.

6. Apply cricoid pressure; maintain until intubation is complete. Caution: cricoid pressure may induce vomiting.

7. Paralyze (optional if patient may be intubated with sedation alone)
   - **ADULTS:** **succinylcholine:** 1-1.5 mg/kg IV.
   - **CHILDREN:** **succinylcholine:** > 12 kg: 1 mg/kg IV.
   - < 12 kg: 2 mg/kg IV.

8. Intubate.

9. Verify ETT placement; release cricoid pressure; secure ETT.

10. Consider long term paralysis for transport:
    **ADULTS:**
    - **rocuronium bromide:** 0.5 mg/kg at 30-60 minute intervals as necessary.
    **CHILDREN:**
    - **rocuronium bromide:** 0.5 mg/kg-1 mg/kg, repeat at 30-60 minute intervals as necessary.

11. Consider adequate sedation.

12. For failed intubation or ventilation refer to Clinical Protocol R1 - Airway Management.
RAPID SEQUENCE INDUCTION CHART

Assemble Equipment
0-10 minutes

Preoxygenation
0-5 minutes

Premedication
Lidocaine IV vs. topical spray if indicated
Atropine in children, if indicated
0-3 minutes

Sedation/Induction using
1 or more:
Midazolam
Ketamine
Fentanyl
Propofol
0 minutes

BURP, prn
0 mins + 30 seconds

Paralyze, prn
Succinylcholine
0 mins + 30 seconds

Intubate
0 mins + 60 seconds

Maintenance Sedation/Paralysis
Midazolam/Rocuronium
## RSI Kit Reference Card

### Rapid Sequence Induction

*Medications & dosages are guidelines only. TP/Pediatric intensivist must be contacted prior to PEDIATRIC RSI*

1. Preoxygenate x 2-5min

2. Consider topical Lidocaine (10-20 sprays)

3. Consider premedication:

   **Lidocaine (1.5mg/kg)** [Head injury/Reactive Airway]
   - 75mg
   - 90mg
   - 105mg
   - 120mg
   - 135mg
   - 150mg

   **20 mg/ml 2% (pre-load)**
   - 3.75ml
   - 4.5ml
   - 5.25ml
   - 6ml
   - 6.75ml
   - 7.5ml

   **Atropine (0.02mg/kg)** in peds with ↑risk of bradycardia

4. **Induction / Sedation** - Administer 1 or more

   - **Ketamine (1-2mg/kg)**
     - 50-100mg
     - 60-120mg
     - 70-140mg
     - 80-160mg
     - 90-180mg
     - 100-200mg
     - [May increase salivation, Decrease dose in shock states]

   - **Midazolam (0.05-0.1mg/kg)** Max. 5mg, if normotensive
     - 2.5-5mg
     - 3.0-5mg
     - 3.5-5mg
     - 4-5mg
     - 4.5-4mg
     - 5mg

   - **Propofol** <55yrs (2-2.5mg/kg) [-40mg q10sec]
     - 100-125mg
     - 120-150mg
     - 140-154mg
     - 160-176mg
     - 180-198mg
     - 200-220mg

     >55yrs (1-1.5mg/kg)
     - 50-75mg
     - 60-90mg
     - 70-105mg
     - 80-120mg
     - 90-135mg
     - 100-150mg

   - **Fentanyl - Sedation (0.5-2mcg/kg)**
     - 25-100mcg
     - 30-120mcg
     - 35-140mcg
     - 40-160mcg
     - 45-180mcg
     - 50-200mcg

     - Induction (1-3mcg/kg) [q2-3min]
     - 50-150mcg
     - 60-180mcg
     - 70-210mcg
     - 80-240mcg
     - 90-270mcg
     - 100-300mcg

5. **Apply BURP, prn. Give NMB as required**

   - **Succinylcholine (1-1.5mg/kg)** [duration 4-6min]
     - 50-75mg
     - 60-90mg
     - 70-105mg
     - 80-120mg
     - 90-135mg
     - 100-150mg

6. **Intubate. Consider long-term NMB and sedation**

   - **Rocuronium (0.5mg/kg)** [duration 30-45min]
     - 25mg
     - 30mg
     - 35mg
     - 40mg
     - 45mg
     - 50mg
Considerations and Contraindications to Succinylcholine

Hypersensitivity to Succinylcholine, Personal or Familial Hx of Malignant Hyperthermia, Eye injuries, Hyperkalemia

Neuromuscular disorders, Burns >5% BSA (>48hrs), Massive Trauma

The Sequence of RSI

0 minus 10 min - Prep of equipment & medication, Check contraindications of Succinylcholine,
Assess for difficult airway, Create plan for failed intubation, Full monitoring, IV access, Suction,
Universal precautions

0 minus 5 min - Preoxygenation

0 minus 3 min - Premedication

0 min - Induction & Neuromuscular Blockade, only if required

0 plus 30 sec - Apply cricoid pressure, position for laryngoscopy

0 plus 45 sec - Assess mandible for flaccidly and perform intubation, Confirm placement with etCO2

0 plus 60 sec - Post intubation management, secure tube, ventilation, monitoring, VS, sedation, NMB
References


RESPIRATORY PROTOCOL R5
RESPIRATORY EMERGENCIES

- Request a cabin altitude of 2,000 ft. ASL.
- Draw lab samples for point of care testing & blood gas analysis prior to, or during transport.
- Allow your patients to seek position of comfort for transport. Patients who are too fatigued to maintain their own body posture or those who are becoming combative are in respiratory failure. Stabilization of the patient on the ground with NPPV or intubation may be indicated.
- Early consultation with the Transport Physician is mandatory if patient is in respiratory distress/failure.

CHRONIC OBSTRUCTIVE PULMONARY DISEASE
- Administer oxygen via nasal prongs or NRB to maintain SpO₂ above 92%, or to provide relief of symptoms.
- Ensure IV/IO access.
- If the patient is showing signs of bronchospasm (wheezing or poor air entry):
  - Administer salbutamol: 2.5-5 mg diluted in 3 mls N/S nebulized q 15-20 min or until symptoms have been relieved,
  - or salbutamol: 2-8 puffs (100mcg/spray) via metered dose inhaler (MDI).
  - Intubated patients may receive sprays with an in-line MDI adaptor.
  - Administer ipratropium bromide: 250-500 mcg nebulized in conjunction with salbutamol. May be repeated, to a maximum of 1500 mcg.
  - Administer budesonide: 1-2 mg diluted with 1-2 mls N/S nebulized X 1.
  - Consider methylprednisolone: 1-2 mg/kg to a maximum of 125 mg. Administer over 3-5 min.

ASTHMA
- Administer oxygen as required to maintain SpO₂ at 92% or above.
- If the patient is showing signs of bronchospasm (wheezing or poor air entry):

Salbutamol:
- *Adult* dosage:
  - salbutamol: 2.5-5 mg diluted in 3 mls N/S nebulized q 15-20 min or until symptoms have been relieved.
  - Or salbutamol: 2 to 8 puffs (100mcg/spray) via metered dose inhaler. Intubated patients may receive sprays with an in-line MDI adaptor.
**Pediatric** dosage:
- **salbutamol**: 1.25-2.5 mg diluted in 2-3 mls N/S nebulized q 15-20 min or until symptoms have relieved.

**Iopatropium bromide**:
- **Adult** dosage:
  - Administer **iopatropium bromide**: 250-500 mcg administered in conjunction with salbutamol. May be repeated, maximum of 1500 mcg.
- **Pediatric** dosage:
  - Age >5: **iopatropium bromide**: 125-250 mcg nebulized in conjunction with salbutamol.

**Budesonide**:
- **Adult** dosage:
  - Administer **budesonide**: 1-2 mg diluted with 1-2 mls N/S nebulized x 1.
- **Pediatric** dosage:
  - Age 3 months-12 years: **budesonide**: 0.25-0.5 mg diluted with 3-4 mls N/S nebulized x 1.

Consider **methylprednisolone**: 1-2 mg/kg IV to a maximum of 125 mg.

Consider nebulized **epinephrine**: 5 mls of 1:1000 solution; over 3-5 min.

Asthma patients in extremis who are in a peri-arrest state who have little to no gas exchange may benefit from IV magnesium to provide smooth muscle relaxation. Contact medical control for orders for the following:
- **magnesium sulphate**: 2 g IV over 20 min.

  Caution should be exercised in patients receiving magnesium sulphate as there have been documented incidences of “rebound” bronchospasm hours after the initial presentation and have a high likelihood of needing intubation and mechanical ventilation.

**PULMONARY EDEMA**
- Administer O₂ to maintain SpO₂ at 92% or above.
- Consider NIPPV.
- Establish IV/IO access.
- Administer **furosemide**: 0.5 mg/kg IV (if the patient is not hypotensive) initially. May be repeated in 15-20 min. Patients on chronic furosemide therapy should receive an IV dose that is twice their daily oral dose up to a maximum of 200 mg IV.
- Administer **morphine**: 2-4 mg IV q 15 min (maximum of 20 mg).
- Administer **nitroglycerin**: 0.4 mg SL q 5-10 min provided the patient has an adequate blood pressure. If effective, and particularly if the patient is hypertensive, following consultation with the Transport Physician, initiate a **nitroglycerin infusion** beginning at 5 mcg/min IV and titrating to effect.
- If initial SBP is < 70-100 mm of Hg in patients with acute pulmonary edema, in consultation with the Transport Physician, initiate **dopamine**: 2.5 mcg/kg/min IV and titrate to goal SBP > 100 mm Hg.
- Perform 12 lead ECG.
- Request pre-flight foley catheter insertion.

**CROUP AND EPIGLOTTITIS**

- **Early consultation with the Transport Physician is mandatory if stridor present or any symptoms of respiratory distress/failure.**
- Allow patient to maintain position of comfort.
- Administer a high concentration of oxygen via any route tolerated. Maintain SpO₂ greater than 92%, if possible.
- Elevate the head of the stretcher to high fowler's position.
- Keep the child calm and do not agitate.
- Encourage the parent to accompany the child.
- **Croup:**
  a) If signs of respiratory distress present (audible stridor and moderate to severe intercostal indrawing), administer nebulized **epinephrine**: 5 mls of 1:1000 solution. May repeat in thirty minutes if necessary. **NOTE**: nebulized epinephrine may cause "rebound swelling". Therefore careful observation, including cardiac monitoring is required. Do not administer epinephrine if the heart rate is >200 bpm.
  b) **dexamethasone**: 0.6 mg/kg be administered (X1) IM or po up to a maximum dose of 12 mg.
  c) Sedation should not be used.
- **Epiglottitis:**
  a) Suction should be readily available (most common cause of respiratory arrest is fatigue associated with thick secretions).
  b) "Fly like the wind" (definitive treatment is intubation with ENT standby for possible tracheostomy). See Clinical Protocol R1 - Airway Management for surgical airway guidelines.
References


RESPIRATORY PROTOCOL R6
OBSTRUCTED AIRWAY

- Perform manual techniques for removing a foreign body airway obstruction until removed or patient becomes unconscious.
- If patient becomes unconscious and is still obstructed, repeat manual attempts to clear airway through two complete cycles.
- If patient begins breathing spontaneously, administer supplemental oxygen by mask.
- If patient does not begin spontaneous breathing, ventilate with bag-valve-mask and supplemental oxygen.
- If manual attempts are unsuccessful, use laryngoscope and Magill forceps to grasp and remove obstructions.
- If the airway obstruction cannot be relieved by chest thrusts or with Magill forceps, a surgical airway may be required. See Clinical Protocol R1 - Airway Management.
- If patient remains unconscious, insert an endotracheal tube.
TRAUMA PROTOCOL T1
ABDOMINAL TRAUMA

- Request or insert pre-flight oro or nasogastric tube.
- Request maximum cabin altitude of 2000 ASL.
- Consider taking SAA blood box and fluid warming device on transport.
- If conscious, place patient in a position of comfort whenever possible.
- Abdominal wounds or eviscerations should be covered with sterile saline dressings followed by an outer, occlusive dressing.
- The patient with a traumatic evisceration should be placed in a position which prevents possible strangulation of the exposed viscera by muscle tension around the wound. Depending on the nature of the injury, this may be accomplished by raising the lower extremities or bending the knees.
- Establish 2 large bore IV’s.
- If unable to establish traditional peripheral IV access, consider intraosseous or external jugular cannulation.
- If systolic blood pressure is above 100 mmHg, but guarding, rigidity, tenderness or ecchymosis of the abdomen is noted, start a 1 litre bolus of normal saline. Infuse @ 250 ml/hr.
- The following reference charts may be beneficial in determining the severity of the bleeding and/or the fluid replacement required:

Estimated Blood Loss Based on Patient’s Initial Presentation (For a 70-kg man)

<table>
<thead>
<tr>
<th>Class of Hemorrhage</th>
<th>Class I</th>
<th>Class II</th>
<th>Class III</th>
<th>Class IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Loss (ml)</td>
<td>Up to 750</td>
<td>750-1500</td>
<td>1500-2000</td>
<td>&gt;2000</td>
</tr>
<tr>
<td>Blood Loss (% blood vol.)</td>
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<td>15-30 %</td>
<td>30-40 %</td>
<td>&gt;40 %</td>
</tr>
<tr>
<td>Pulse Rate (BPM)</td>
<td>&lt;100</td>
<td>100-120</td>
<td>120-140</td>
<td>&gt;140</td>
</tr>
<tr>
<td>Systolic Blood Pressure</td>
<td>Normal</td>
<td>Normal</td>
<td>Decreased</td>
<td>Decreased</td>
</tr>
<tr>
<td>Pulse Pressure (mmHg)</td>
<td>Normal/increased</td>
<td>Decreased</td>
<td>Decreased</td>
<td>Decreased</td>
</tr>
<tr>
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<td>14-20</td>
<td>20-30</td>
<td>30-40</td>
<td>&gt; 35</td>
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<tr>
<td>Urine Output (mL/hr)</td>
<td>&gt;30</td>
<td>20-30</td>
<td>5-15</td>
<td>Negligible</td>
</tr>
<tr>
<td>CNS/Mental status</td>
<td>Slightly anxious</td>
<td>Mildly anxious</td>
<td>Anxious, confused</td>
<td>Confused, lethargic</td>
</tr>
<tr>
<td>Initial fluid replacement</td>
<td>Crystalloid</td>
<td>Crystalloid</td>
<td>Crystalloid &amp; blood</td>
<td>Crystalloid &amp; blood</td>
</tr>
</tbody>
</table>
References


TRAUMA PROTOCOL T2
BURNS

Establishing airway control, stopping the burning process and gaining intravenous access are life saving measures for patients with burn injuries.

PRIMARY SURVEY

- **AIRWAY:** As a consequence from exposure to heat, the airway is extremely susceptible to obstruction; signs of obstruction may initially be subtle until the patient is in crisis. Clinical indications of inhalation injury which suggest the need for intubation with the largest endotracheal tube possible, include:
  - Face and/or neck burns
  - Singeing of the eyebrows and nasal vibrissae
  - Carbon deposits in the mouth and/or nose and carbonaceous sputum
  - Acute inflammatory changes in the oropharynx, including erythema
  - Hoarseness
  - History of impaired mentation and/or confinement in a burning environment
  - Explosion with burns to head and torso
  - Carboxyhemoglobin level greater than 10% in a patient who was involved in a fire
  - Circumferential burns of the neck
  - Stridor (late sign, requires immediate intubation)

*C spine precautions are required if trauma is associated with the burn injury.

- **BREATHING:** Supplemental oxygen via non rebreather mask is indicated whenever intubation is not. Ventilate as necessary; PEEP and low tidal volumes may be of benefit for those with lower airway injury and edema.

- **CIRCULATION:** Once circulation has been assessed (and established if necessary) begin fluid resuscitation. Total body surface area is estimated by the “rule of nines” (see below).
Patients with $\geq 2^{nd}$ degree 10-20% TBSA burns should have fluid resuscitation initiated.

**FLUID RESUSCITATION**

- Ensure that two large bore IV’s have been inserted and that fluid resuscitation with crystalloid has been initiated by utilizing the Parkland Burn Formula.

**Parkland Burn Formula:**

- $4 \text{ ml/kg/percent BSA burn}$.
- Administer half of this volume in the first eight hours.
- Administer the remainder over the next sixteen hours.

This is calculated from the time of injury, not from the time the patient is first evaluated by medical personnel.

**PAIN MANAGEMENT**

- Management of pain is a prime consideration; consider medication with fentanyl or morphine as necessary (see Medication Protocol M10 – Pain Management).

**SECONDARY SURVEY**

- Patients with $> 20$% TBSA, are more prone to gastric dilatation due to ileus; an N/G or O/G tube should be inserted prior to transport.
- Urine output is a key parameter in assessing fluid administration. Adequate hourly urine output is 0.5-1 ml/kg for adults and 1 ml/kg for children.
- Remove any jewellery.
- Cover burned area with dry, sterile dressings or drape for transport. Do not apply any ointment to the burn.
- If referral center has dressed burns, do not disturb dressing; reinforce prn.
- Obtain and record history of incident.
- Obtain and record vital signs every 5-15 minutes, depending on extent of injury.
- Treat any other injuries according to protocols (e.g. fractures, underlying conditions, etc.)
- Elevate and pad affected limbs.
- Maintain normothermic temperature (this may require increasing cabin heat).
- Request cabin altitude restriction of 2000’ ASL.
- Nausea can be treated by administering Gravol 1 mg/kg slow IV push to a maximum single dose of 50 mg for adults and children.

NOTE:
1. Escharotomies may be considered if swelling for circumferential burns has constricted the chest causing ventilatory problems or limbs causing restriction to arterial flow. Contact Transport Physician for direction.
2. Patients who have suffered electrical burns may not necessarily show the extent of the burns on their skin. Fluid resuscitation should be initiated and urine output must be monitored to ensure proper hydration. Cardiac monitoring must be initiated for arrhythmia surveillance.

Classification of Burn Severity:
- First-degree burn:
  - Characterized by erythema, pain, absence of blisters.
- Partial thickness, second-degree burn:
  - Characterized by a red or mottled appearance with associated swelling and blister formation, possible weeping, wet appearance.
  - Painfully hypersensitive, even to air current.
- Full-thickness, third degree burn:
  - Appear dark and leathery/translucent or waxy white, may be red but does not blanch with pressure.
  - Painless, dry surface.
  - Minimal swelling of burned tissue, surrounding tissue may swell significantly.

NOTE:
Depending on the type and severity of the burn, concomitant trauma, pre-existing illness, etc., some patients may require direct transfer from the rural referral centre to an out-of-province burn unit.
References

TRAUMA PROTOCOL T3
COLD EMERGENCIES

FROSTBITE

- Primary survey.
- Secondary survey.
- Protect injured areas from pressure, trauma, and friction. Remove all coverings from injured parts. Do not rub. Do not break blisters.
- Maintain core temperature by keeping the patient warm with blankets.
- Refer to Medication Protocol M10 – Pain Management.

SYSTEMIC HYPOTHERMIA

- Request maximum cabin altitude of 2000 feet ASL.
- Primary survey.
- Secondary survey.
- Protect against heat loss.
- Administer oxygen to maintain SpO₂ at 96% or above.
- Establish cardiac monitoring, particularly for the surveillance of any dysrhythmias.
- Establish IV/IO access.
- If ETA is less than one hour, do not attempt rewarming the patient, simply warm aircraft cabin.
- If ETA is greater than one hour, initiate controlled rewarming of patient during transport.
  a) Place insulated hot packs or warmed bags of saline, not exceeding 43.3°C, over the carotid arteries, head, lateral thorax, and femoral arteries.
  b) Warm aircraft cabin to 30°C or more, if possible.
  c) Do not attempt to warm the extremities. Elevate, pad and protect the limbs.
  d) Administer warm normal saline (43°C). Utilize fluid warming device.

NOTE:

1. Shivering occurs between 32°C to 36.6°C but not below. This is a fair indicator of the severity of hypothermia in the patient. If possible, core temperature should be recorded with low temperature, rectal thermometer.

2. The absence of a palpable pulse in patients is not necessarily an accurate indicator of functional cardiac activity. To avoid the possibility of causing ventricular fibrillation of a cold but functioning heart, functional heart activity is only considered to be absent if:
a) the victim loses a palpable pulse during evacuation; or
b) ventricular fibrillation or asystole is present on the cardiac monitor; and

c) no clinical signs of life are present, including:
   • spontaneous ventilation.
   • response to positive pressure ventilation.
   • spontaneous movement or sound.
   • organized rhythm on a cardiac monitor.
   • audible heart sounds on auscultation.

3. Ventricular fibrillation/Ventricular tachycardia patient without a pulse should be defibrillated only once until the core temperature is $\geq 30^\circ C$. If unsuccessful, continue rewarming measures and start CPR until core temperature is $\geq 30^\circ C$, then continue as per appropriate dysrhythmia protocol.

References


TRAUMA PROTOCOL T4
CHEST TRAUMA

- Request maximum cabin altitude of 2,000 feet ASL.
- Place patient in a position that provides greatest respiratory effect with least effort.
- Provide supplementary oxygen at high flow rates for patients breathing spontaneously.
- Initiate 2 large bore IV’s of Ringer’s Lactate or normal saline maintained at a rate to maintain systolic blood pressure between 90 - 100 mm/Hg.

NEEDLE THORACOSTOMY FOR TENSION PNEUMOTHORAX

1. The flight nurse/paramedic who has been instructed and certified competent may relieve a tension pneumothorax during flight when the following indications are present:
   Presence of at least SIX of the following signs and symptoms in an acutely deteriorating patient, acute onset with rapid progression must be evident:
   a) Chest pain
   b) Respiratory distress and air hunger
   c) Tachycardia
   d) Hypotension
   e) Unilateral absence of breath sounds (auscultation may be of limited value in the aircraft)
   f) Elevated hemi-thorax without respiratory movement
   g) Hyperresonant percussion note (percussion of limited value in the aircraft)
   h) Contralateral tracheal deviation
   i) Distended neck veins
   j) Cyanosis (late sign)

2. The blood pressure must be below the following values on two separate occasions, time permitting.
   a) Adults: 80 systolic
   b) Children up to the age of ten years: 65 systolic
   c) Infants up to twelve months: 50 systolic

3. Contact the Transport Physician to report your findings. Do not delay treatment if unable to contact the Transport Physician.

4. A Heimlich flutter valve must be attached to the catheter used in the needle thoracostomy as soon as possible after the procedure.
CHEST TUBES/HEIMLICH VALVE
1. When transporting a patient with chest tubes, the flight nurse/paramedic must ensure that:
   a) A Heimlich valve is inserted between the chest tube and chest drainage device prior to any ground or air transport.
      - All connections should be securely taped to prevent accidental dislodging.
      - Each separate chest tube requires a separate Heimlich drain valve.
      - Frequent “stripping” of a chest tube draining blood or pleural fluid may be necessary to prevent “plugging” of the Heimlich valve.
   b) Two Kelly clamps per chest tube are readily visible and available.
   c) All drainage sets are secured within the aircraft.

PERICARDIOCENTESIS

Pericardial tamponade is a life threatening emergency with a poor outcome unless immediate aspiration of fluid from the pericardial sac is performed.

Indications:
The flight nurse/paramedic may assist or implement the following protocol for pericardiocentesis for stated indications. Medical control MUST be obtained prior to the performing the procedure.

Patients requiring pericardiocentesis are identified based on the progressive appearance of five of the following signs and symptoms with a strong index of suspicion in chest trauma (especially penetrating chest injuries):
- Distended neck veins (with equal breath sounds)
- Pulsus paradoxus
- Rapid weak pulse
- Low blood pressure
- Muffled heart sounds
- Narrowing pulse pressure
- Patient in extremis

Procedure:
1. Ensure the following equipment is assembled and ready for use:
   - IV sedation medication (i.e. midazolam)
   - Equipment/medications for ventilatory and cardiovascular support available
   - Sterile surgical gloves
   - SHR approved skin prep (such as Solu-prep)
   - Pericardiocentesis needle
   - Several sterile 60 ml luer lock syringes
CHEST TRAUMA

STERILE THREE-WAY STOPCOCK

2. Continuous cardiac, hemodynamic and ventilatory monitoring is imperative.
3. Surgically prep the xiphoid and substernum area, if time allows.
4. Using the pericardiocentesis needle, attach a sterile syringe and a three-way stopcock.
5. Puncture the skin 1 to 2 cm inferior to the left of the xiphoid junction at a 45 degree angle to the skin.
6. Carefully advance the needle cephalad and aim towards the tip of the left scapula (shoulder level mid-clavicular) while applying slight negative pressure on the syringe and watching the monitor and your patient throughout.
7. When the needle tip enters the blood-filled pericardial sac, withdraw as much blood as possible.
   **Note:** Free flow of continuous blood indicates the needle is in the ventricle.
8. When aspiration is complete, close the stopcock and remove the syringe.
9. Tape the catheter in place.
10. Record the procedure and patient’s response to same.

**Complications:**

- Aspiration of ventricular blood instead of pericardial blood.
- Laceration of ventricular epicardium/myocardium.
- Laceration of coronary artery or vein
- New hemopericardium
- VF/VT
- Pneumothorax
- Puncture of great vessels
- Puncture of esophagus
- Puncture of peritoneum

**References**


**Approval:** Effective Date: February, 2016  Medical Director:
TRAUMA PROTOCOL T5
HEAD INJURY and INTRACEREBRAL HEMORRHAGE

- Request antiemetic pre-flight (see Clinical Protocol M2 – Anti-emetics).
- Request maximum cabin altitude of 2,000 feet ASL (sea level if pneumocephalus is suspected).
- Ensure adequate cervical spine immobilization has been performed, as indicated for patients with head injuries.
- Load the patient's head to the nose of the aircraft.
- Elevate patient's head, neck and back thirty degrees if possible. The patient's head and neck must be kept in alignment to prevent venous outflow obstruction.
- Administer oxygen as necessary.
- If intubated, adjust ventilations to maintain an ETCO2 of 35 mmHg.
- Assess neurological status every 30 minutes and VS every 15 minutes.
- Keep external stimulation to a minimum (i.e.: close blinds).
- For all patients exhibiting signs of increased intracranial pressure (increased blood pressure, widened pulse pressure, decreased heart rate, decreased level of consciousness, change in pupil size, symmetry and/or reaction to light) consider the use of mannitol: 1 gram/kg IV over five minutes. **Only administer if authorized by the Transport Physician or a neurosurgeon**.
- If nausea and/or vomiting occur, administer an anti-emetic as necessary (see Medication Protocol M2 – Anti-emetics). It is especially important that the immobilized patient receive anti-emetics, even if it could potentially cause unwanted sedation.
- If a CSF leak is suspected on patients with head injuries, place sterile gauze over the site. The flight nurse and paramedic should wear a mask when a CSF leak is suspected.
- Insert orogastric tube and foley catheter if patient is unresponsive. Patients with traumatic injuries to the head/face have an increased risk of having a basal skull fracture and therefore **SHOULD NOT** have a nasogastric tube inserted. If you arrive at the sending facility and there is one in place, confirm placement preferably by CXR or aspiration. Insufflation of air into an improperly placed NG could potentially cause a pneumocephalus.
- Patients with a suspected head injury who are intubated require sedation during flight. The stressors of flight (motion, noise, vibration, etc.) can be very stimulating and thus, detrimental to the head injury patient. The vital signs (particularly the heart rate) may provide feedback with managing sedation.
- Use paralytics carefully in patients with a suspected head injury as they may mask the presence of a seizure.
- In cases of a known intracranial hemorrhage, hypotension has shown to have a dramatically negative impact upon patient outcome. Efforts should be made to maintain the MAP **above 70 mmHg**. Ensure accompanying injuries have been properly addressed with adequate boluses of crystalloid and/or blood before proceeding as follows:

  As necessary to maintain MAP > 70 mmHg, administer:
norepinephrine: 0.05 mcg/kg/min and titrate to effect (refer to Medication Protocol M8 - Norepinephrine). This should be done in consultation with the Transport Physician.

- Consider a dose of lidocaine: 1-1.5mg/kg IV or topical to blunt any unwanted stimulus of the gag reflex. This includes insertion of an OG in the unconscious patient. Consult Transport Physician for advice.

References


Saskatoon Health Region Intravenous Medication Reference Manual 2015
TRAUMA PROTOCOL T6
HEAT STROKE

- Request a cabin altitude of 2000 ft. ASL.
- Establish and/or maintain a patent airway.
- For heat exhaustion, loosen clothing and cool gradually.
- For heat stroke, remove clothing and cool gradually with cool sponging, if possible.
- Establish IV/IO access. Goal SBP >100 mm Hg.
- Establish cardiac monitoring.
- Anticipate potential for seizure activity.
- Keep aircraft cabin vents open.
- Request pilots keep aircraft cabin temperature ≤20 degrees C.

References

TRAUMA PROTOCOL T7
LIFE THREATENING HEMORRHAGE

Request pre-flight stabilization of:

a) **Airway** - intubate as necessary, c - spine control as indicated.

b) **Breathing** - ventilate and/or administer high concentration of O₂.

c) **Control of Bleeding**
   - establishment of two large bore IV’s.
   - if unable to establish traditional peripheral IV access, consider intraosseous or external jugular cannulation.
   - administration of volume resuscitation with normal saline or Ringer’s Lactate.
   - an infusion cuff should be used to increase IV flow rate.
   - insertion of nasogastric tube.
   - insertion of foley catheter.
   - monitor cardiac rhythm.

- Consider taking SAA blood box and fluid warming device on transport.
- If within 3 hours & catastrophic bleeding, consider calling Transport Physician for tranexamic acid order (see Medication Protocol M18 – Tranexamic Acid).

- Apply direct pressure to wound if applicable. If necessary, consider use of a tourniquet.
- Request maximum cabin altitude of 2,000 feet ASL and gradual ascent and descent.
- Administer O₂ via NRB mask or via bag-valve-mask with 100% O₂ at a rate of sixteen to twenty per minute, or as required to maintain SpO₂ at 96% or above.
- Initial fluid bolus: Administer (preferably warmed) normal saline or lactated Ringer’s bolus, 1-2 litres for adults and 20 ml/kg for pediatric patients. Remember that this initial fluid bolus includes any fluid given prior to transport.
- In pediatric patients with crystalloid-refractory hemorrhagic shock, administer PRBCs 10 ml/kg, in consultation with Transport Physician or pediatric Intensivist.
- The following reference charts may be beneficial in determining the severity of the bleeding and/or the fluid replacement required:
**Estimated Blood Loss Based on Patient’s Initial Presentation (For a 70-kg man)**

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<td>Crystalloid &amp; blood</td>
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</tr>
</tbody>
</table>

**Systemic Responses to Blood Loss in Pediatric Patients**

<table>
<thead>
<tr>
<th>System</th>
<th>Mild Blood Volume Loss (&lt;30%)</th>
<th>Moderate Blood Volume Loss (30-45%)</th>
<th>Severe Blood Volume Loss (&gt;45%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular</td>
<td>Increased heart rate; weak, thread peripheral pulses; normal systolic blood pressure (80-90 + 2 x age in years); normal pulse pressure</td>
<td>Markedly increased heart rate; weak thread central pulses; absent peripheral pulses; low normal systolic blood pressure (70-80 + 2 x age in years); narrowed pulse pressure</td>
<td>Tachycardia followed by bradycardia; very weak or absent peripheral pulses; hypotension (&lt;70 + 2 x age in years); undetectable diastolic blood pressure (or widened pulse pressure)</td>
</tr>
<tr>
<td>Central nervous system</td>
<td>Anxious; irritable; confused</td>
<td>Lethargic; dulled response to pain</td>
<td>Comatose</td>
</tr>
<tr>
<td>Skin</td>
<td>Cool; mottled; prolonged cap refill</td>
<td>Cyanotic; markedly prolonged cap refill</td>
<td>Pale and cold</td>
</tr>
<tr>
<td>Urine output</td>
<td>Low to very low</td>
<td>Minimal</td>
<td>None</td>
</tr>
</tbody>
</table>
The following chart may be beneficial in determining the patient’s response to fluid resuscitation:

**Responses to Initial Fluid Resuscitation (2000 ml in adults; 20 ml/kg in children)**

<table>
<thead>
<tr>
<th></th>
<th>Rapid Response</th>
<th>Transient Response</th>
<th>Minimal or No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vital signs</td>
<td>Return to normal</td>
<td>Transient improvement, recurrence of decrease</td>
<td>Remain abnormal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>blood pressure and increased heart rate</td>
<td></td>
</tr>
<tr>
<td>Estimated blood loss</td>
<td>Minimal (10-20%)</td>
<td>Moderate and ongoing (20-40%)</td>
<td>Severe (&gt;40%)</td>
</tr>
<tr>
<td>Need for more crystalloid</td>
<td>Low</td>
<td>Low to moderate</td>
<td>Moderate as a bridge to transfusion</td>
</tr>
<tr>
<td>Need for blood</td>
<td>Low</td>
<td>Moderate to high</td>
<td>Immediate</td>
</tr>
</tbody>
</table>

**References**


TRAUMA PROTOCOL T8
MUSCULOSKELETAL INJURIES

- Request cabin altitude restriction of 2000 – 4000 feet ASL if patient is otherwise stable.
- Protect injury site from excessive movement by ensuring that the extremity is adequately splinted prior to transport. Use additional straps/padding as necessary to prevent any further injury.
- Elevate the injured limb, if possible. Apply cold packs to injury site when practical.
- All patients with fractures to the pelvis or femur will have IV access.
- All open fractures should be treated with IV antibiotics as soon as possible. Contact Transport Physician for guidance.
- Patients in discomfort may receive pain control as required.

AMPUTATIONS

- Ensure adequate hemostasis is obtained (refer to Clinical Protocol T7 – Life-Threatening Hemorrhage if necessary). Consider use of tourniquet, if necessary. Contact medical control if required.
- Wrap and package amputated part(s) for transport, using sterile dressings, wraps and cooling as required.
- Ensure an IV of Ringer’s Lactate or normal saline is in place. Treat if clinical signs of shock are present.

NOTE
1. Make sure the OBVIOUS injury is also the ONLY injury.
2. Monitor neurologic function and circulation distal to the fracture site.
3. Absence of pulse distal to major fractures and dislocations is regarded as an orthopedic emergency and should be transported immediately.
4. Care should be given in handling and splinting of patients with suspected fractures or dislocations that may be close to or include joints.

References
TRAUMA PROTOCOL T9
OPHTHALMIC EMERGENCIES

- Request pre-flight antiemetic.
- Request that affected eye be patched with a light dressing. If the eye trauma is blunt or penetrating, consider applying a saline dressing to both eyes to prevent further conjugate movement. If you do patch both eyes, ensure that your patient is well informed of what to expect with the flight in regards to noise and motion.
- Request maximum cabin altitude of 2000 feet ASL for severe eye conditions (i.e. glaucoma, hyphema).
- Load patient head to the nose of the aircraft.
- Elevate the head of the stretcher, and stabilize the patient's head.
- Administer O₂ as required to maintain O₂ Sat of 96% or above.
- For acute eye pain, administer analgesia as necessary.

References
TRAUMA PROTOCOL T10
SPINE INJURIES and NEUROGENIC SHOCK

Spine Injuries

- Request cabin altitude restriction of 2000 feet ASL.
- Primary survey. **DO NOT HYPEREXTEND THE NECK.**
- Administer oxygen as appropriate.
- Secondary Survey. (Note presence of cerebrospinal fluid from nose, ears, mouth). Obtain detailed history surrounding the mechanism of the injury.
- Prior to transport, to safely maintain spinal motion restriction, ensure that the patient is wearing an **appropriately fitted** cervical collar and is safely secured to the air ambulance stretcher.
- If vital signs are stable, search for and treat other injuries.
- Ensure that the patient has adequate IV access during or prior to flight. Particularly, those patients who may need transfusion therapy or those who will require surgery.
- Prevent aspiration by monitoring for signs of nausea/emesis. Some patients may require pre-treatment with anti-emetics prior to transport, even in the presence of other CNS depressants (see Medication Protocol M2 – Anti-emetics).
- In the event that the patient vomits, they **must** be rolled quickly to prevent aspiration. Protection of the airway always takes precedence over spinal motion restriction. After the patient has been suctioned, return them to a supine position and make any necessary adjustments.
- Remember that C-spine cannot be cleared clinically when the patient is under the influence of drugs or alcohol, despite the presence of normal radiographic findings.
- Suction secretions as necessary.
Neurogenic Shock

Neurogenic shock occurs when the descending sympathetic pathways in the cervical or upper thoracic cord are impaired resulting in loss of vasomotor tone and sympathetic innervation to the heart. Suspect neurogenic shock in trauma patients with:

2. Bradycardia or the absence of tachycardia in response to hypovolemia.
3. Hypotension that is not corrected with fluid boluses.
4. Development of fluid overload and pulmonary edema following fluid resuscitation.
5. Normal pulse pressure.
6. Decreased urinary output.
7. Pink, warm, dry skin.
8. Impaired thermoregulation and poikilothermia.

Transport Management

- Prior to transport, to safely maintain spinal motion restriction, ensure that the patient is wearing an appropriately fitted cervical collar and is safely secured to the air ambulance stretcher.
- Maintain a patent airway; endotracheal intubation and mechanical ventilation may be required.
- Administer normal saline fluid boluses, target MAP >70 mmHg and/or systolic BP >90 mmHg.
- If fluid resuscitation does not resolve hypotension, consider administering vasopressors under the direction of medical control to maintain target blood pressure:
  - norepinephrine: Initial infusion rate varies considerably: 0.01 – 0.5 mcg/kg/min.
  - Maintenance: 0.03 – 1.5 mcg/kg/min.
  - Doses as high as 3.3 mcg/kg/min. have been used.
  - And/or
    - dopamine: "inotropic-dose" 2.5 - 5 mcg/kg/min, then titrate as required for BP control.
    - Increase dose by increments of 1 - 4 mcg/kg/min.
    - Usual maintenance range: 5 - 20 mcg/kg/min.

- Maintain the heart rate by:
  - Administering atropine: 0.5 – 1 mg every 3-5 minutes to a total dose of 0.04 mg/kg or 3 mg.
  - Consider transcutaneous pacing.
- Monitor output via urinary catheter.
References


TRAUMA PROTOCOL T11
SUBMERSION INJURY

NEAR DROWNING
If decompression illness or gas embolus is not suspected:
- Request a maximum cabin altitude of 2,000 ft. ASL.
- Establish patent airway.
- Administer O₂, aim for SpO₂ of 95% or above.
- In cases where there is a potential for c-spine injury, ensure adequate cervical spine immobilization has been performed.
- Establish cardiac monitoring.
- Establish IV access.
- Insert a nasogastric tube and decompress the stomach.
- If patient is hypothermic, treat as per Clinical Protocol T3 - Cold Emergencies.

DIVING ACCIDENT
The patient who has had a diving accident may present with hypoxemia, air embolism, decompression illness, pain and agitation, hypothermia, and motion sickness.

Decompression Illness
Type I
- "Bends" - pain in and about joint, muscles, bones
- Paresthesias - itching, tingling, cold or warm sensations in the skin
- Lymphatic obstruction
- Skin manifestations

Type II
- Specific skin manifestation such as mottling
- CNS manifestations - signs and symptoms depend on location of bubble formation (i.e. visual effects, paralysis, sensory and/or motor deficits)
- Inner ear manifestations (i.e. nausea and vomiting)
- “Chokes” - bubble formation in pulmonary circulation
- Vasomotor collapse
- Shock
Management

- Establish patent airway.
- Administer O₂, aim for SpO₂ of 95% or above.
- Establish cardiac monitoring.
- Establish IV/IO access.
- Describe symptoms to Transport Physician; suggest referral to the Divers Alert Network at 1(919) 684-8111, for consultation and further management options.

ARTERIAL GAS EMBOLISM

- Request anti-emetic pre-flight.
- Request sea level cabin altitude to maximum of 500 feet ASL.
- Load patient head to front to the aircraft.
- Position patient with his/her left side down.
- Administer O₂ via NRB mask or 100% O₂ via bag-valve-mask.
- For nausea, administer dimenhydrinate: 1 mg/kg IM or slow IV to a maximum single dose of 50 mg q4h for adults and children.

References
