Flight Protocols

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Printed in the United States of America

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Treatment Protocol - Overview

All patients must be assessed prior to boarding the airplane. This ideally occurs at the referring hospital unless the flight crew will meet the ambulance at the airport. Any unstable condition MUST be stabilized prior to air evacuation. If there is any doubt regarding the effectiveness or patency of the airway, oxygenation/ventilation status or perfusion, correct the problem prior to transport.

Gather all copies of chart, labs, x-rays, etc. Send patient belongings with family, if possible; otherwise take along with patient. Obtain nursing and medical history as necessary.

Have aeromedical consent form signed by patient or family member.

Prepare patient for transport:

- Ensure two large-bore IV's if patient is unstable or expected to be unstable enroute. Use arm boards or roller gauze as appropriate to secure lines for rigors of transport.
- Ensure adequate airway with supplemental oxygen and adequate ventilation.
- Consider MAST garment to be placed under trauma/hypovolemic patient's uninflated if patient's condition has potential to deteriorate enroute.
- Remove any extraneous bandaging, clothing, sheets, jewelry, etc., to ensure observation of bleeding, swelling, and so forth.
- Secure all patients with appropriate stretcher straps.
- Gather all equipment [equipment should never leave sight of medical flight crew members].

If indicated, contact medical director by phone or radio prior to takeoff. All crewmembers should attempt to contact the medical director or designated physician prior to performing protocols if feasible or as soon as possible after initiation of protocols.

Vital signs should be taken prior to onloading, during climb, at flight altitude, and as often as necessary during transport. For unstable patients, vital signs should be taken AT LEAST every 15 minutes.

Patient should be center of care. Explain and reassure the patient often. Be calm and professional in your approach. Remember that the patient is usually apprehensive about his medical condition and flying. If family members are onboard the aircraft explain all procedures to them and remember that family members may be as apprehensive as the patient regarding air transport.

Overview: Treatment of Cardiac Arrest (Adult)

Definition: Cardiac arrest refers to the cessation of effective cardiac contraction. The two most common causes are:(1) ventricular fibrillation and (2) asystole (cardiac standstill). A third less common cause is electromechanical dissociation (cardiovascular collapse). Rarely, ventricular tachycardia can cause cardiac arrest.

Etiology: The conditions most commonly associated with cardiac arrest are:

- Acute myocardial infarction
- Acute pulmonary embolism
- Various heart blocks
- Valvular heart disease (IHSS, aortic stenosis)
- Cerebrovascular accident/disease
- Toxic doses of drugs (digitalis, potassium, quinidine, etc.)
- Pericardial tamponade
- Tension pneumothorax
- Excessive loss of blood volume

Diagnosis: In general, time should not be wasted in making the diagnosis since irreversible brain damage may occur in 3-4 minutes. Establishing a diagnosis, or etiology, is a secondary concern for the patient in cardiac arrest; the paramount concern is re-establishment of a perfusing cardiac rhythm. If the following signs are present, immediate treatment per protocol should be started:

- Unconsciousness that does not immediately respond with placing the patient in a supine position.
- Absent pulsations in a major artery [carotid, brachial, or femoral].
- Absent or gasping respirations.

If any of the above are present begin BCLS procedures immediately. Proceed into ACLS protocols as soon as feasible but do not delay implementation of basic airway maneuvers and CPR.

Cardiac Arrest - Adult

The senior flight nurse on the flight will act as team leader during all protocols and interventions. There are two scenarios which may occur during flight: An unmonitored arrest situation [basic life support transport]; and a monitored/witnessed event. The former has a much more grave prognosis since the situation was unanticipated. With advanced life support aeromedical transport, the patient will be monitored and have adequate IV access prior to flight.

For unmonitored arrest situations, the flight crew must "begin from scratch" and the situation will require, at minumum, defibrillation after quick look on LifePac 5 and establishing IV line(s) for medications as well as basic and possibly advanced airway maneuvers.

Always consider the possibility that a factor peculiar to altitude flying may be the primary cause of an arrest situation.

- Hypoxia, introduced by falling partial pressures of ambient oxygen is directly related to cabin altitude. Even in pressurized airplanes a cabin of 4,000 feet has 10% less available oxygen than at sea level. Never withhold oxygen if there is any doubt to its need.
- Expansion of trapped gas (Boyle's Law) can occur in the cranium, sinuses, chest cavity, and abdominal cavity. Unlike hypoxia, which can be corrected by giving supplemental oxyen, expansion of trapped gas can only be relieved by repressurization or decreasing altitude. This expansion of trapped gas has a number of complications: brain compression and potential for herniation from trapped intracranial air; pneumothorax or tension pneumothorax from trapped extrapleural air; ruptured viscus or other serious intra-abdominal complication.

Generally, approach cardiac arrest as follows:

- Recognize cardiac arrest: unresponsiveness, absence of respiratory movement, absence of peripheral/central pulses.
- If patient is being monitored, proceed to appropriate protocol.
- If patient is unmonitored, use quick look feature of LifePac 5 to determine initial rhythm and proceed to appropriate algorithm.
- Open airway and administer high flow oxygen, urgently begin a peripheral IV if one is not present and give initial round of drugs. Note: priority setting with a two member crew should be BCLS, establish IV, make initial round of defibrillation and drugs, then proceed to intubation. If an IV is present and patient does not respond to initial defibrillation and drugs then proceed on to advanced airway maneuvers.
- Make sure all connections are secure - take a few extra seconds to make sure electrodes are properly placed [wipe chest with towel for diaphoresis/vomitus] this will save valuable time in the long run and will help to avoid artifacts which may hide underlying cardiac dysrhythmia.
- Continuously evaluate effectiveness of CPR by palpating major arteries and observing for symmetrical chest expansion.
- Consider the possibility of an alternative landing. If the patient is in full arrest and CPR is in progress this is a moot point, land as soon as possible where appropriate medical care at a hospital can be assured. For other problems which occur inflight, such as new onset of chest pain, dysrhythmia, hypotension, etc., the flight nurse must evaluate each situation and determine whether it is better to land immediately or press onward to the intended destination.

There are no clear cut guidelines in this regard and the decisions of the flight nurse will be based on the patient's condition and the merits of landing early or continuing on to the destination.

These protocols are guidelines for action when contact with the National Medevac Medical Director or designated Medical Control physician are not immediately available. The flight nurse will make every attempt to contact Medical Control prior to initiating these protocols but due to the inherent delays of immediate air to ground communications do not delay implementation of any protocol in an urgent or emergent situation. Establish contact with Medical Control as soon as feasible via Flight Phone, Cellular telephone, or ARINC phone patch.

Ventricular Fibrillation

Make sure that all connections from patient to cardiac monitor are intact and all electrodes have good contact with skin. Loose leads may mimic asystole or ventricular fibrillation. Be sure to correlate monitor with clinical picture [i.e. pulselessness and apnea].

Witnessed Arrest
↓
if no pulse
↓
precordial thump
↓
if no pulse

Unwitnessed Arrest
↓
if no pulse

↓
check rhythm, if VF or VT
↓
Defibrillate 200 Joules
↓
if still VF or VT
↓
Defibrillate 200-300 Joules
↓
if still VF or VT
↓
Defibrillate up to 360 Joules
↓
Continue CPR if pulseless
↓
Establish IV if not present
↓
Epinephrine 1:10,000 0.5-1.0mg IV push
↓
Continue effective CPR 1-2 minutes
↓
Defibrillate up to 360 Joules
↓
Intubate patient
↓
Lidocaine 1mg/kg IV push
↓
Continue effective CPR 1-2 minutes
↓
Defibillate up to 360 Joules
↓
Repeat Epinephrine 0.5-1.0 mg q5 min
↓
Repeat Lidocaine 0.5mg/kg q8-10 minutes
to total of 3mg/kg
↓
(consider Sodium Bicarbonate)
(consider Bretylium 10mg/kg IV push)

- Flow of algorithm presumes that V-FIB is continuing, if patient converts to another rhythm begin appropriate protocol.
- Although not specifically stated in the protocol, CPR should be continued throughout the sequence without interruption except during defibrillations.
- If at any time during the resuscitation the patient reverts to a normal rhythm, the CONVERSION OF VENTRICULAR FIBRILLATION TO SINUS RHYTHM protocol should be initiated.
- Patients should not be onloaded into aircraft or, if still taxiing, return to airport if cardiac arrest occurs. If cardiac arrest occurs enroute and does not respond to initial round of defibrillation and drugs, pilot should be notified and asked to divert immediately to nearest safe airport with adequate medical facilities. The pilot in command will have final authority in choosing nearest alternate airport.
- Discontinue CPR/ACLS only on order of physician.
- Run frequent rhythm strips to document code sequence and check pulse after each defibrillation attempt

Asystole

Make sure that all connections from patient to cardiac monitor are intact and all electrodes have good contact with skin. Loose leads may mimic asystole or ventricular fibrillation. Be sure to correlate monitor with clinical picture [i.e. pulselessness and apnea].

If rhythm is unclear and possibly ventricular fibrillation defibrillate as per VENTRICULAR FIBRILLATION protocol. If asystole is present:

Continue CPR
↓
Establish IV if none present
↓
Epinephrine 1:10,000, 0.5-1.0mg IV push
↓
Intubate if effective rhythm not restored
↓
Atropine 1.0mg IV push
(repeated in 5 minutes)
↓
Repeat Epinephrine q5 minutes
↓
(consider Sodium Bicarbonate)
↓
External pacing if available

- Flow of algorithm presumes that ASYSTOLE is continuing, if patient converts to another rhythm begin appropriate protocol.
- Although not specifically stated in the protocol, CPR should be continued throughout the sequence without interruption except during defibrillations.
- If at any time during the resuscitation the patient reverts to a normal rhythm, the SINUS RHYTHM IN AN UNSTABLE PATIENT protocol should be initiated.
- Patients should not be onloaded into aircraft or, if still taxiing, return to airport if cardiac arrest occurs. If cardiac arrest occurs enroute and does not respond to initial round of defibrillation and drugs, pilot should be notified and asked to divert immediately to nearest safe airport with adequate medical facilities. The pilot in command will have final authority in choosing nearest alternate airport.
- Discontinue CPR/ACLS only on order of physician.
- Run frequent rhythm strips to document code sequence and check pulse after each defibrillation attempt.

Electromechanical Dissociation

Make sure that all connections from patient to cardiac monitor are intact and all electrodes have good contact with skin. Loose leads may cause artifact an make EKG determination difficult. Be sure to correlate monitor with clinical picture [i.e. pulselessness and apnea].

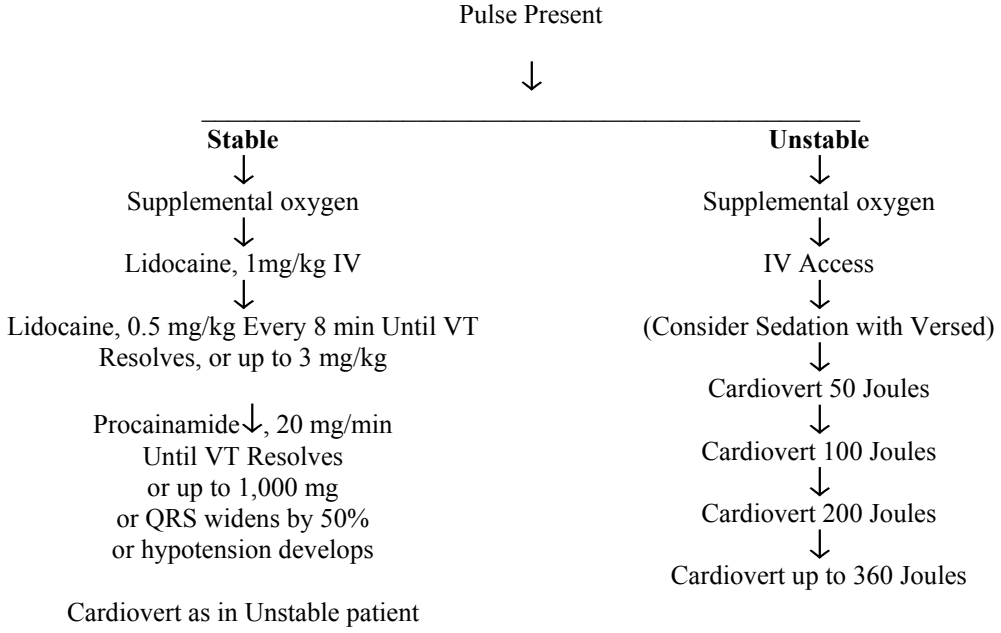
Continue CPR

Establish IV if none present
↓
Epinephrine 1:10,000, 0.5-1.0mg IV push
↓
If EMD associated with bradycardia give
Atropine 0.5-1.0mg IV push
↓
Intubate if effective rhythm not restored
↓
Repeat Epinephrine q5 minutes
↓
(consider Sodium Bicarbonate)
↓
Consider:
Hypovolemia
Cardiac tamponade
Tension pneumothorax
Hypoxemia
Profound acidosis
Pulmonary Embolism

- Flow of algorithm presumes that EMD is continuing, if patient converts to another rhythm begin appropriate protocol.
- Although not specifically stated in the protocol, CPR should be continued throughout the sequence without interruption.
- Patients should not be onloaded into aircraft or, if still taxiing, return to airport if cardiac arrest occurs. If cardiac arrest occurs enroute and does not respond to initial round of defibrillation and drugs, pilot should be notified and asked to divert immediately to nearest safe airport with adequate medical facilities. The pilot in command will have final authority in choosing nearest alternate airport.
- Discontinue CPR/ACLS only on order of physician.
- Run frequent rhythm strips to document code sequence and check for return of central pulses frequently.

Ventircular Tachycardia with a Pulse

The sypmtomatic patient with sustained V-TACH without a pulse requires emergency defibrillation therefore proceed under the VENTRICULAR FIBRILLATION protocol in this instance. The unstable patient with a pulse will present with one or more of the following: chest pain, hypotension, pallor/diaphoresis, changes in mental status, onset of pulmonary edema, dyspnea or respiratory distress.



- If hypotension, pulmonary edema, or unconsciousness is present, unsynchronized cardioversion should be done to avoid delay associated with synchronization, otherwise use synchronized cardioversion.
- A precordial thump is not used because it may change a stable VT into VFIB or Asystole.
- If patient becomes unstable at any time move to "Unstable" arm of algorithm.
- Once VT has resolved, begin continuous infusion of antiarrythmic agent that has aided resolution of VT.
- If pulses become absent proceed to VENTRICULAR FIBRILLATION protocol.
- Provide optimal oxygenation and ventilation. If patient is not already on supplemental oxygen begin with 2 to 6 L/min by nasal cannula. If cyanosis or significant respiratory distress is present, begin high flow oxygen with nonrebreather mask. If patient becomes apneic or if severe respiratory distress is present proceed to RESPIRATORY ARREST protocol.

Bradycardia

Bradycardia is defined as a heart rate below 60/minute. Treat bradycardia only when patient is symptomatic: chest pain, dyspnea, hypotension, changes in mental status, VPC's [escape beats?].

HR < 60/min
↓
Mechanism

Sinus or Nodal	Second Degree AV block Type I	Second Degree AV block Type II	Third Degree AV block

Not symptomatic
↓
Observe and monitor vital signs

Symptomatic
↓
Atropine 0.5 - 1.0 mg IV
↓
Continue symptomatic
↓
Repeat Atropine
↓
Contine symptomatic
↓
Begin Isoprel infusion 2-10ug/min
↓
If external pacemaker is available consider using if patients condition continues to deteriorate

- Hypotension in this situation is primarily rate dependent, that is, the bradycardia causes a low perfusion state. If hypotension remains after correcting bradycardia begin HYPOTENSION protocol.
- Maximum dose of Atropine is 2.0 mg. Doses smaller than 0.5 mg can produce a paradoxical bradycardia due to the central and/or peripheral parasympathomimetic effects of low doses. This can possibly precipitate ventricular fibrillation.
- Provide optimal oxygenation and ventilation. If patient is not already on supplemental oxygen begin with 2-6 L/min by nasal cannula. If cyanosis or significant respiratory distress is present, begin high flow oxygen with nonrebreather mask. If patient becomes apneic or is in severe respiratory distress proceed to RESPIRATORY ARREST protocol.
- Infrequent to occassional nodal or ventricular escape beats may be present and should resolve after bradycardia is corrected. But if significant dysrhythmia is present after bradycardia is correct proceed to SUPPRESSION OF VENTRICULAR DYSRHYTHMIA protocol.

- If Isuprel [Isoproterenol] is begun, use minimum effective dose because of the potential for significant ventricular ectopy and higher oxygen demand on the myocardium. Consider alternative landing where appropriate medical assistance can be found.

Supression of Ventricular Ectopy

This protocol should be used when unifocal ventricular premature complexes [VPC's] occur > 6/min, when occassional to frequent multifocal VPC's or couplets are present, or with unsustained ventricular tachycardia [V-TACH]. Always consider the underlying cause and treat if possible, i.e., hypoxia, hypo/hyper kalemia, bradycardia, certain types of drug overdose, and respiratory failure/arrest.

Assess need for acute antiarrythmic therapy
↓
Supplemental oxygen if not already started
↓
IV access
↓
Lidocaine 1mg/kg IV push

If not suppressed
Repeat Lidocaine, 0.5mg/kg every 2-5 minutes
Until no ectopy or total of 3mg/kg administered
↓
If Lidocaine not effective
↓
Procainamide 20mg/min until
no ectopy or maximum 1000mg administered
↓
If Procainamide not effective
↓
(consider Bretylium)
(5-10mg/kg over 8-10 minutes)

- After initial bolus of Lidocaine begin constant infusion at 1-4 mg/min. Use 1/2 of above doses in patients with liver dysfunction. Use progressively higher infusion to suppress ectopy i.e., 2mg/min-3mg/min - 4mg/min.
- After initial bolus of Procainamide begin constant infusion at 1-4 mg/min as per Lidocaine. When switching from Lidocaine to Procainamide taper Lidocaine infusion off.
- If using Bretylium, begin constant infusion at 2mg/min, taper off other antiarrythmics.
- If ventricular ectopy occurs in acute setting with unstable patient [i.e., chest pain, hypotension, pallor/diaphoresis, dyspnea, etc.] consider alternate landing if appropriate medical care can be assured. The pilot in command will have final decision regarding the aircraft and safety of alternate landing.
- If ventricular ectopy converts to another rhythm, i.e., sustained V-TACH or V-FIB, proceed to appropriate protocol.

Sinus Rhythm in an Unstable Patient

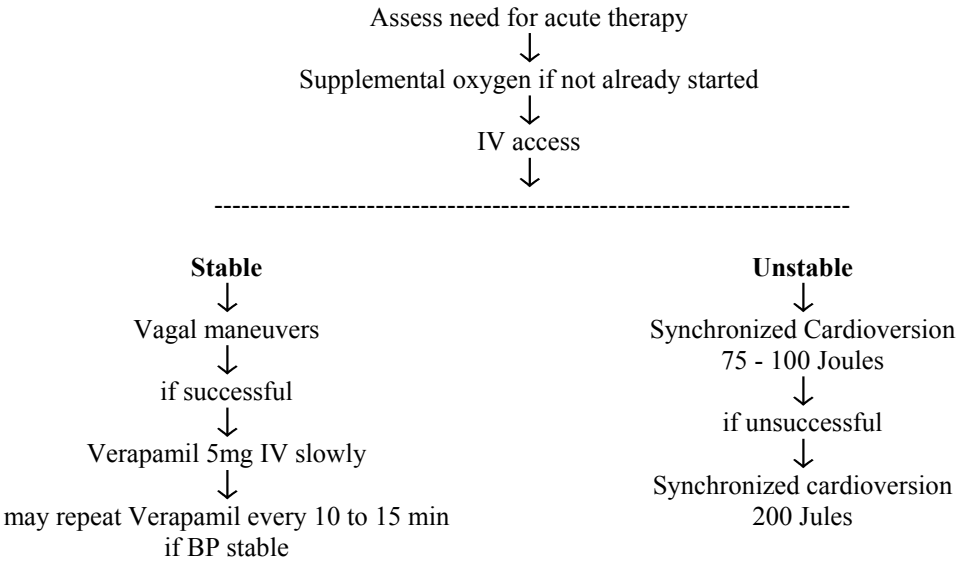
(Following conversion from asystole or EMD, or with suspected MI.)

- Provide optimal airway, oxygenation and ventilation. Assure good positioning of airway, provide supplemental oxygen as needed, suction as needed, if intubated be sure to securely tape tracheal tube. Monitor EKG and document rhythm changes with strip. Vital signs should be taken a MINIMUM q15 minutes.
- If an IV has not been established do so.A second IV is indicated if a peripheral line can be started. Use an external jugular IV only as a last resort.
- For Ventricular tachycardia with a pulse or frequent ventricular premature complexes [VPC's] see VENTRICULAR TACHYCARDIA WITH A PULSE or SUPPRESSION OF VENTRICULAR ECTOPY protocols.
- For bradycardia [HR < 60/min] see BRADYCARDIA protocol.
- For hypotension [systolic pressure < 90] after correcting bradycardia see HYPOTENSION protocol.
- Continue close monitoring of vital signs, mental status, and infusions throughout transport. Refer to appropriate protocol if alternative rhythm intervenes.
- Unstable patients should not be evacuated unless there is a compelling reason [i.e., local medical care is nonexistent].

Supraventricular Tachycardia

Supraventricular tachycardia [SVT] requires urgent treatment when:

- it causes or exacerbates cardiovascular dysfunction (i.e., induces or exacerbates chest pain, dyspnea, hypotension, or pulmonary edema).:
- it occurs in a setting where deleterious effects due to the tachycardia are likely, i.e. patients with acute ischemic heart disease such as acute myocardial infarction.



- Verapamil may cause hypotension due to its vasodilation effects. Use Verapamil with caution if patient is on oral beta blockers, do not give Verapamil if IV beta blocker, i.e. Propranalol, have been given recently. Do not give Verapamil in wide QRS tachycardia.
- Administer sedation with IV Versed or Valium 2-5mg prior to cardioversion if possible but do not delay cardioversion in an emergent situation.
- Call Medical Control by Flight Phone, Cellular Phone, or ARINC for follow up orders. Expect to administer digoxin if patient not already digitalized. Routine digoxin orders [after contact with Medical Control]:
- Digoxin 0.5mg IV stat
- Digoxin 0.25mg IV in two hours.
- If a wide complex tachycardia is present and there is doubt whether this is supraventricular tachycardia [SVT] or ventricular tachycardia [VT] treat as ventricular tachycardia using appropriate protocol.
- Use appropriate protocol if other rhythm(s) develop.

Prehospital Treatment of Cardiac Arrest (Pediatric)

The same basic definitions and guidelines that are pertinent to adult arrests are pertinent to pediatric arrests, with the exceptions outlined below.

In general, children tend to suffer a respiratory arrest first, followed by cardiac arrest. There are a large variety of situations and illnesses which may predispose a pediatric patient to cardiorespiratory arrest; in the vast majority of these, early recognition of the emergent nature of the problem and appropriate interventions will enable the patient and medical crew to circumvent cardiorespiratory arrest. So, as with adults, the ABC's of pediatric advanced life support begin with the AIRWAY.

It is often difficult to obtain stable intravenous access in a pediatric patient. Excessive time should NOT be spent in attempting to start an IV. Remember, the most generally accessible veins in children are usually the antecubital vein, the external jugular, and dorsomedial foot veins. No more than five minutes should be spent trying to gain venous access. Applying the pediatric MAST trousers may help distend upper extremity veins to aid IV placement in an urgent situation but is not recommended for routine use for starting IV's.

It is generally felt that an IV with D5W will predispose a pediatric patient, especially a small infant, to water intoxication. Thus, D5W is rarely used in pediatric patients. Rather, Normal Saline or D51/4NS are used for KVO lifelines and Ringer's Lactate or Normal Saline for volume replacement.

Nearly all pediatric drug doseages are given according to weight in kilograms.If a weight is not available use the following formula: weight [kg] = age of child x 2 + 8.

Table 1: Pediatric Drug Dosing

Medication	Dose	Maximum dose
Sodium Bicarbonate	0 mEq/kg	as needed
Calcium Chloride	7 mg/kg	repeat x 1
Epinephrine	01-.03 mg/kg	repeat q5 - 10 min.
Narcan	1 mg/kg 0.02 mg/kg	
Atropine	1 mg/kg	1.0mg
Lidocaine	5-20 ug/kg/min	50 ug/kg/min
Dopamine	5-10 ug/kg/min	20 ug/kg/min
Dobutamine	0.5-1.0 g/kg as D25W	20 ug/kg/min
Glucose	0.1-0.2 ug/kg/min	
Isoproterenol (Isuprel)	0.5-1.0 J/kg	adjust prn
Cardioversion		2.0 J/kg

Overview: Respiratory Arrest

Definition: Primary respiratory arrest may lead to cardiac arrest within minutes if the ensuing hypoxia persists [similarly, primary cardiac arrest leads to respiratory arrest but in a shorter period of time]. Primary respiratory arrest is the most common cause of cardiac arrest in children.

Etiology: In adults the conditions most often associated with respiratory arrest are:

- Acute airway obstruction.
- Aspiration.
- Stroke.
- Drowning.
- Electric shock.
- Hypothermia.
- Overdose of sedatives, etc.
- Acute hypoxia of any cause.

Diagnosis: History pertinent to the arrest state [OD, aspiration, etc.] may be attainable. Time is critical and airway m3anagement and ventilation should not be delayed. Remember that the ABC's start with AIRWAY. If any of the following signs are present, the protocol should be immediately implemented:

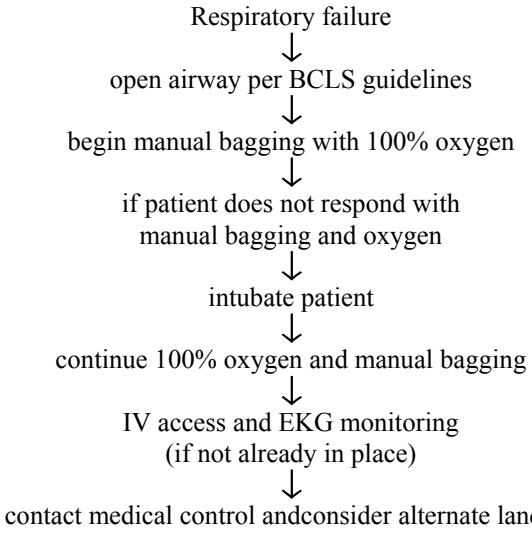
- Absent or gasping respirations.
- Unconsciousness associated with absent or labored respirations.
- Cyanosis and absent or gasping respirations.

During fixed-wing aeromedical evacuation it is unlikely that intubation will be necessary other than during cardiac arrest. Yet be aware of the effects of flying at altitude: hypoxia induced by falling partial pressures of oxygen; expansion of trapped gases [Boyle's Law] could cause catastrophic problems such as tension pneumothorax, brain herniation and coma/arrest, or ruptured abdominal organs.

Always search for the underlying cause of primary respiratory arrest and treat if possible, i.e., chest decompression for tension pneumothorax. Needless to say, inflight respiratory failure/arrest is an acute emergency and contingency landing should be strongly considered.

Respiratory Arrest

This protocol should be implemented whenever severe respiratory distress, especially with cyanosis, or respiratory arrest has occured.



- It is important to treat underlying cause of respiratory failure. If patient has significant hypotension, dysrhythmia, seizures, or pneumothorax, treat with appropriate protocol.
- This protocol is integrated into the general cardiac arrest protocols but may be used independently when needed.
- If the event is primary respiratory in origin, consider hypoxia, aspiration, or tension pneumothorax - all of these are possible in the aeromedical environment.
- Patients with pneumonia should be carefully evaluated prior to flight since the aeromedical environment can potentially aggravate the underlying problem of infection and hypoxia.
- Medical control should be contacted prior to intubation if possible but do not delay treating an urgent situation if communications can not be immediately established.
- Have suction immediately available and use as necessary. If foreign body is seen, attempt to sweep out but do not force it deeper into the oropharynx. Consider using the Magill forceps if appropriate.

Endotracheal Intubation

Background: The ultimate standard for airway protection and effectiveness of ventilation for a critically ill or injured person is tracheal intubation. This will ensure adequate ventilation and oxygenation, minimize the potential for aspiration, and facilitate the exodus of airway secretions. The most commonly employed means of tracheal intubation is via an endotracheal or nasotracheal tube.

Indications: An unresponsive, or nearly so, patient with depressed protective airway reflexes, inadequate ventilation, peripheral signs of decreased tissue oxygenation, and/or a difficult airway secretion management problem.

Contraindications: Significant cervical, laryngeal or maxillofacial injuries; an alert patient; ability to satisfactorily stabilize the airway via less invasive means; or potential for aggravating foreign body upper airway obstruction by pushing object further into trachea.

- Preoxygenate and ventilate by second crewmember while preparing equipment. Have suction at hand and be prepared to use it.
- Choose proper sized tracheal tube - see chart. Check cuff for leakage [inflate with 10cc].
- Assemble laryngoscope handle and blade; check to see that light works and is secure. Place stylet in tube [if desired] and lubricate end of tracheal tube with Lidocaine jelly.
- Hold laryngoscope handle in left hand with blade extended; slide blade into right corner of patient's mouth with patient's head mildly hyperextended. Slide the tongue to the left with the blade's flange. .Advance blade posteriorly along tongue in midline until the tip of the curved blade is in the vallecula [so that epiglottis and vocal cords are visualized] or the tip of the straight blade has lifted the epiglottis [so that the vocal cords are visualized]. This may require gentle upward traction in the direction that the laryngoscope handle is pointing; this must be a pulling action, not a levering action to avoid breaking teeth.
- Once the vocal cords are seen, maintain this position with your left hand and slide the endotracheal tube into the mouth and past the cords with your right hand [remove stylet] while you visualize the cords.
- Inflate the cuff on the tube with 5-10cc of air until gentle resistance is met. Adjust cuff during climb and descent to account for effects of altitude.
- Auscultate the chest bilaterally and the stomach to check tube placement as the patient is ventilated with bag mask. If decreased or absent breath sounds are heard on the right [suspected right mainstem intubation], retract the tube 1-2cm after deflating the cuff, and reinflate. If no breath sounds are heard [possible esophagus intubation], deflate the cuff, remove tracheal tube, and repeat steps above. Use manual techniques in interim.
- Tape endotracheal tube securely and insert oropharayngeal airway. Provide artificial ventilation and oxygenation as appropriate.
- Take no more than 15-20 seconds to perform procedure. If unsuccessful, provide bag mask ventilation with 100% oxygen; suction and reposition airway as needed. [note: a useful tip is to hold your breath during actual intubation - if you can't hold your breath any longer it is certainly time to stop intubation attempt and revert to manual techniques].
- Establish IV access and begin continuous EKG monitoring if not already done.

Complications: Broken teeth; esophageal intubation; right mainstem bronchus intubation; mucosal or pharyngeal trauma.

Table 2: Airway and Suction Catheter Sizes vs. Patient Age

Age	**Tube size [mm]**	**Suction catheter size**
Newborn	3.0 uncuffed	6fr
6 months	3.5 uncuffed	8fr
18 months	4.0 uncuffed	8fr
3 yr.	4.5 uncuffed	8fr
5 yr.	5.0 uncuffed	10fr
6 yr.	5.5 uncuffed	10fr
8 yr.	6.0 uncuffed	10fr
12 yr.	6.5 cuffed	10fr
16 yr.	7.0 cuffed	10fr
Adult female	8.0-8.5 cuffed	12fr
Adult male	8.5-9.0 cuffed	14fr

Nasotracheal Intubation

Background: As discussed under endotracheal intubation, assurance of a stable artificial airway is the standard for critical patients with compromised respiratory status. Many patients with acute respiratory failure may not be sufficiently obtunded initially to allow endotracheal intubation, but would significantly benefit from the provision of an artificial airway. Nasotracheal intubation can be done on alert, breathing patients, or on apneic individuals, although the latter may often require use of McGill forceps to allow tracheal placement of a nasal tube.

Indications: A patient who is alert but in impending respiratory failure; or a patient who is not breathing in whom endotracheal intubation is not possible.

Contraindication: Violent, uncontrollable patients; or persons with significant maxillofacial trauma.

- Preoxygenate and ventilate by second crewmember while preparing equipment. Have suction at hand and be prepared to use it.
- Choose proper sized tracheal tube - see chart under endotracheal tube protocol. Check cuff for leakage [inflate with 10cc] then lubricate tube with Lidocaine jelly. Maintain sterile technique as much as possible. If time permits, use Neosynephrine spray to shrink nasal mucosa.
- Pass the tracheal end of the tube through the nostril with the tube parallel to the floor of the nose. Firm pressure may be needed. Use extra care not to damage turbinate or the posterior pharynx.
- When the tube no longer meets resistance, it is probably in the pharynx; the tube may require a quarter twist at this time to slide further down into the pharynx.
- Place the patient's head in a neutral position [slight flexion or hyperextension may be needed to pass the tube into the trachea].
- Listen to the patient's breathing pattern and gently slide the tube in during the beginning of an inspiration. If the tube advances into the trachea, the patient will likely cough; if the tube advances into the esophagus, the patient will still breathe through the mouth. The tracheal tube will usually fog and air movement will be felt at the flange.
- When the trachea is entered, inflate the cuff with 5-10cc of air until gentle resistance is met. Adjust the cuff during climb and descent to account for the effects of altitude.
- Auscultate the chest bilaterally and the stomach to check tube placement as the patient is ventilated with bag mask. If decreased or absent breath sounds are heard on the right [suspected right mainstem intubation], retract the tube 1-2cm after deflating the cuff, and reinflate. If no breath sounds are heard [possible eshophagus intubation], deflate the cuff, remove tracheal tube, and repeat steps above. Use manual techniques in interim. Tape nasotracheal tube securely.Provide artificial ventilation and oxygenation as appropriate.
- Take no more than 15-20 seconds to perform procedure. unsuccessful, provide bag mask ventilation with 100% oxygen; suction and reposition airway as needed. [note: a useful tip is to hold your breath during actual intubation - if you can not hold your breath any longer it is certainly time to stop intubation attempt and revert to manual techniques].
- Establish IV access and begin continuous cardiac monitoring if not already done.

Hypotension

Hypotension has a number of etiologies. From a medical standpoint it may result from sepsis, anaphylaxis, myocardial damage, and vasodilation due to spinal cord damage. From a trauma standpoint it may result from acute volume/blood lose due to trauma, rupture of a major blood vessel [i.e., disecting aortic aneurysm], or fluid loss from a major burn injury. Low perfusion states may present with: pallor, cool extremities/core, diaphoresis, listlessness or other mental status changes, weak thready pulse, cyanosis, obtundation, and eventually loss of pulses and cardiac arrest.

The mainstay of the treatment of hypotension is assessment and treatment of its underlying cause. Generally, hypotension is related to poor cardiac output due to myocardial damage/depression, vasodilation, or decreased circulating volume. Vasopressors will be used to increase inotropic action of heart or cause peripheral vasoconstriction. Volume expanders as crystalloid or colloid will be used where loss of circulating volume is primary cause of hypotension. When hypotension is due to trauma, the definitive treatment is surgery, therefore volume replacement is only a "stopgap measure".

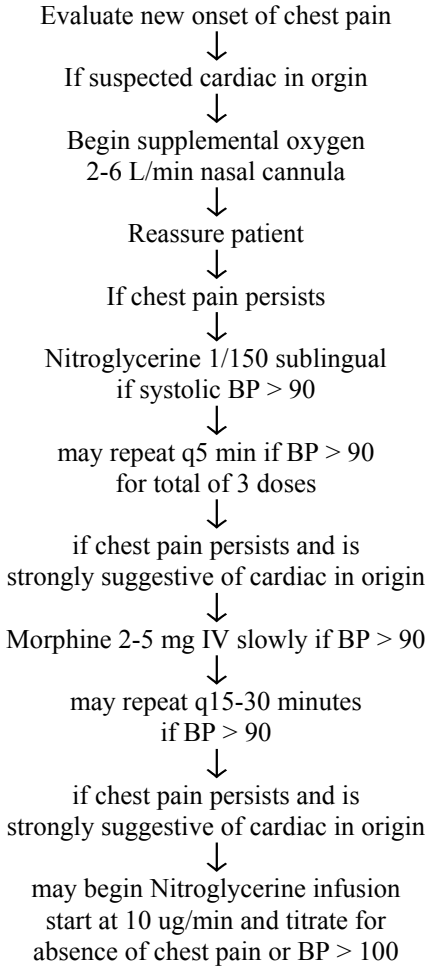
Assess symptomatic hypotension
[BP < 90]
↓
Primary etiology
↓

Sepsis, Myocardial Infarction Neurogenic shock ↓ Dopamine begin @ 5ug/kg/min and titrate upward for BP > 90	Volume/Blood loss ↓ NaCl or Ringers Lactate 100-200cc bolus over 5 min. ↓ Repeat as needed to maintain BP > 90 ↓ Inflate MAST trousers as appropriate

- Maintain optimal oxygenation and ventilation. If patient is not already on supplemental oxygen begin with nasal cannula at 2 to 6 L/min. If cyanosis or respiratory distress is present begin high flow oxygen with nonrebreather mask. Assess respiratory status and if deteriorating proceed to RESPIRATORY ARREST protocol.
- Maximum dose of dopamine is 20 ug/kg/min. If this dose is not effective for maintaining an adequate pressure consider underlying hypovolemia and give NaCl/RL 100-200cc bolus.Do not give fluid challenge with significant pulmonary edema.
- When hypovolemia is primary etiology, maintenance fluids should be given to maintain systolic BP > 90 and urine output > 30 cc/hr.
- If significant dysrhyrhmia occurs, proceed to appropriate protocol.

Chest Pain

Chest pain has a number of implications.When it occurs during flight, especially in a patient with underlying cardiovascular disease, it must be evaluated and treated. The important etiologies, some which are peculiar to aeromedical evacuation include: hypoxia, dysrhythmia, anxiety [especially with flying], abdominal/chest gas expansion, low perfusion states, and myocardial ischemia/infarction.



- For new onset of chest pain during flight unrelieved with sublingual Nitroglycerine consider significant myocardial ischemia or infarction. Consider alternative landing if chest pain persists.
- If significant dysrhythmia occurs refer to appropriate protocol.
- Maximum dose of NTG infusion is 200 ug/kg/min. The flight nurse will call Medical Control as soon as feasible before or after initiating NTG infusion or Morphine.

Seizures

Seizures may occur in flight. A single isolated seizure is self limiting and may require no medical intervention but sustained seizures require immediate intervention. For frequent or sustained seizures the flight medical crew will act as follows:

Assess frequent seizures
↓
Assure adequate airway
Give high flow oxygen
↓
IV access
↓
For continued tonic/clonic seizures
Valium 2-5mg IV slowly
↓
may repeat q15-30 minutes if
BP > 90 and no respiratory depression

- For patients with known seizure history assess the underlying cause. In an aeromedical environment, cyclic vibrations of the aircraft, looking at propellers, and looking at aircraft strobe lights have the potential for causing seizures.
- High fever, especially in children, can precipitate seizures. The flight nurse's attention should be directed towards reducing body temperature in this instance.
- Valium has the potential for causing respiratory depression. Be prepared to assist ventilation or intubate if respiratory arrest occurs, refer to appropriate module as needed.
- Seizure in a patient with an intracranial lesion, such as brain tumor or hematoma has a grave prognosis. Assess the patient's neuro status frequently. If the patient's condition is deteriorating, consider alternative landing where neurosurgery facilities can be found.

Narcotic Overdose

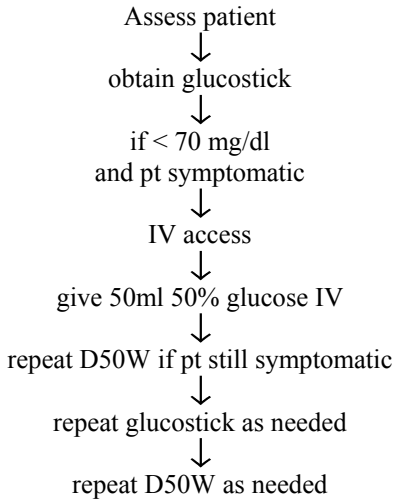
Administration of intravenous or intramuscular narcotics may cause respiratory depression and hypotension. Narcan can counteract these effects. This protocol is specifically designed to address these problems.

Respiratory depression or significant hypotension
in patient who has received a narcotic
↓
maintain airway
give oxygen 2 to 6 L/min cannula or
high flow oxygen is cyanosis present
↓
IV access
↓
Give Narcan 0.4-0.8 mg IV push
↓
repeat q5-10 min as needed

- When giving narcotics always prepare for respiratory depression, apnea or hypotension. Do not administer a narcotic if Narcan is not available.
- If respiratory depression occurs and is not corrected by initial dose of Narcan refer to RESPIRATORY ARREST protocol.
- Place on Lifepack 5 if available, and continue monitoring vital signs.

Hypogylcemia

Hypoglycemia may occur in insulin dependent diabetics during flight or may occur in patients receiving high glucose loads and insulin (i.e., TPN, or tube feedings). Hypoglycemia is possible when insulin dependent diabetics take routing insulin and food intake is inadequate [i.e. long flight with turbulence and patient is having motion sickness]. Tube feedings at times may be discontinued due to the hazards of regurgitation and aspiration during turbulent flight. Therefore there is also a potential for hypoglycemia in these patients. This protocol is used to address the problem of hypoglycemia during flight.



- Recognize signs and symptoms of hypoglycemia: changes in sensorium, or bizarre and psychotic behavior; tachycardia, diaphoresis, decreased levels of consciousness, seizures.
- Maintain a stable airway with supplemental oxygen and adequate ventilation.
- Monitor cardiac rhythm and check vital signs closely.
- If unable to start an IV, give Glucose solution by mouth if patient is awake and not in danger of aspiration or give sugar sublingual if patient has altered level of consciousness.

Tension Pneumothorax

On of the unique aspects of aeromedical transport is the problem of volume expansion of trapped gases [Boyle's Law]. One of the most serious problems is expansion of a small pneumothorax into a tension pneumothorax. This may occur in pressurized as well as nonpressurized aircraft.

- Recognize tension pneumothorax: respiratory distress, cyanosis, distended neck veins, tracheal deviation, unilateral absence of breath sounds, narrowed arterial pulse pressure, and asymmetrical chest expansion.
- Contact physician on Flight Phone if able and relay assessment but do not delay procedure in an urgent situation.
- Perform needle decompression as follows:

- Provide a secure airway and 100% oxygen.
- Prep the second intercostal space, midclavicular line on the side of the tension pneumothorax with Betadine.
- Connect a 14 or 16 gauge angiocatheter to a 10cc syringe and remove piston of syringe.
- Insert the needle just above the rib in the second intercostal space, midclavicular line on the side of the tension pneumothorax until a "pop" is felt. Expect a rush of air as tension is relieved.
- Thread catheter and remove needle and syringe. Secure with tape to chest wall.
- Securely tape an exam glove over the barrel of the syringe so that no air may enter the syringe; cut off the very tip of one finger of the glove to create a one-way valve, to prevent re-accumulation of intrapleural air.
- Continue optimal oxygenation and ventilation, begin EKG monitoring if not already started.. Begin IV access if not already done.
- Continuously assess patient and move to appropriate protocol if apnea/severe dyspnea, dysrhythmia, etc., occur.
- Hypotension in this setting is primarily caused by high intrathoracic pressures compromising circulation. Persistent hypotension after relieving tension pneumothorax should be investigated and treated under HYPOTENSION protocol.

- Patients with indwelleing chest tubes should have Heimlich Valves placed in line before transport. Patients with pneumothorax without chest tubes or pleural decompression are not to be transported by air.

Burns

In the fixed wing environment, transport of acute burn patients will always occur from a local facility to a regional burn center. This protocol is used in these circumstances.

Assess patient
estimate % of burned surface
↓
administer oxygen 2-6 L/min cannula or
high flows if significant dyspnea or cyanosis
↓
intubate if indicated
↓
cardiac monitoring
↓
establish 2 large bore IV's
↓
give Ringers's Lactate or Nacl
to maintain BP > 100 and urine > 30cc/hr
↓
place urinary catheter
↓
prevent hypothermia
↓
maintain sterility of burn
↓
(consider morphine for pain relief)

- Priority setting for acute burn patients is still AIRWAY, BREATHING [ventilation], and CIRCULATION [perfusion].
- A guide for initial fluid resuscitation with Ringer's Lactate or Normal Saline is the Parkland Formula: 4 cc's x % burn x weight in kg; 1/2 of total fluid requirements in first 8 hours then 1/4 of total next 8 hours then 1/4 last 8 hours. This is an estimate and hypotention [BP < 100] or urine output below 30 cc/hr [or 1ml/kg/hr in children] should be treated with higher fluid rates.
- When placing IV's, attempt to use unburned areas first but if none are available then it is appropriate to use a site in a burned area. Use 16 or 14 gauge catheters to permit high flows of fluid if needed.
- Wrap burn area in sterile dressings or use sterile burn pack. Keep dressings as dry as possible. Do not subject the patient to hypothermia. Use Mylar blanket to preserve body heat and keep the cabin of the aircraft warm.
- Give Morphine 2-10mg IV q15-30 minutes prn for pain or restlessness only when there is no respiratory compromise, hypotension, or indication of head injury.

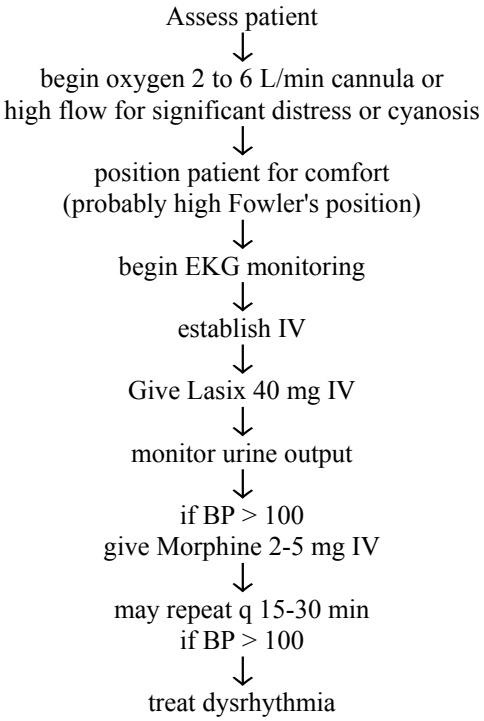
External Jugular IV

During cardial arrest or for other reasons, the peripheral circulation of the arms and legs may be difficult to cannulate. The flight nurse may use the external jugular vein as an alternative for IV access if other means are unavailable.

- Choose appropriate catheter.
- Prep site with betadine.
- Turn patient's head as appropriate to give access to the external vein, occlude distal end of vein to engourge it.
- Puncture vein at 45 degree angle and watch for blood flash back. Thread plastic cannula over needle.
- Attach IV and tubing, hold IV bag below level of heart to make sure that line is patent and blood flows back up the tubing.
- Run IV at appropriate rate.
- Flight nurse may suture catheter with 000 silk if needed to assure security of catheter.
- Cover site with sterile dressing.
- Continuously monitor site for hematoma, bleeding, or air embolus.

Pulmonary Edema

Acute pulmonary edema when it occurs or is exacerbated during flight requires aggressive treatment. Always search for an underlying treatable cause. If pulmonary congestion is progressive and is causing respiratory compromise [i.e., dyspnea, frothy sputum production, cyanosis, diaphoresis, dysrhythmia] begin this protocol. Always attempt to contact the medical control physician but do not delay implementation of this protocol in an urgent situation.



- The aggressiveness of treatment will depend on the situation, for example, a patient with mild to moderate distress and pulmonary congesion may benefit from just Lasix but in more severe conditions Morphine may be needed.
- Place urinary catheter if indicated.
- Consider alternative landing if situation is deteriorating.

Anaphylactic Shock

Anaphylaxis is possible anytime a foreign drug or substance is introduced into the body. This protocol will be initiated in the rare event that a drug or treatment causes severe systemic sypmtoms. Life threatening respiratory compromise is possible, therefore any suspected reaction should be treated on an urgent basis.

Suspected mild reaction
(urticaria, pruitis)
↓
Benadryl 12.5 to 50 mg IM
↓
Monitor patient and vital signs

Severe reaction
(wheezing, respiratory
distress or severe urticaria)
↓
Epinephrine 1:1,000
0.3ml SQ
↓
may repeat Q10-15 min for
maximum of three doses
↓
for airway compromise or
impending arrest
↓
Epinephrine 1:10,000
0.5 - 1.0 mg IV push

- Use other protocols as appropriate.
- Always know patient's previous drug reactions or known allergies prior to administering any drug or treatment.
- Mild reactions are generally self limiting and Benadryl is used to make the patent comfortable until further medical workup can be accomplished.
- Continuously assess the situation. Begin oxygen and cardiac monitoring if indicated. Withhold suspected allergen [drug].
- Contact Medical Control as soon as feasible but do not delay implementation of this protocol in an urgent situation.