If a cervical spine injury is suspected, open the airway using a jaw thrust without head extension (Class IIb). If this maneuver does not open the airway, use a head tilt–chin lift technique because opening the airway is a priority for the unresponsive trauma victim (Class I).

When breaths are given they should be approximately 1 second each. (Class IIa) Your tidal volume administered to the patient should just cause chest rise. (500–600cc – about a half a bag squeeze of a BVM) Rescuers should avoid delivering more breaths than are recommended or breaths that are too large or too forceful. Endotracheal intubation reduces the risk of aspiration, should not be attempted by inexperienced people, and should be preceded by some other form of ventilation. Healthcare providers should manually stabilize the head and neck rather than use immobilization devices during CPR for victims with suspected spinal injury.

**Circulation**

The healthcare provider should take no more than 10 seconds to check for a pulse and, once the healthcare provider recognizes that the victim is unresponsive with no breathing or no normal breathing (ie, only gasping) the healthcare provider will activate the emergency response system. After activation, rescuers should immediately begin compressions over the center of chest between nipples, compress at a rate of at least 100/minute, at least 2” in depth allowing full chest recoil. Healthcare provider adult CPR = 30:2 compression to ventilation ratio. Give “High Quality Compressions” trade personnel every 2 minutes. Prolonged interruption of chest compressions is a common potentially fatal mistake in cardiac arrest management. Do not interrupt CPR to apply pads when an AED becomes available. High quality chest compressions immediately preceding a defibrillation attempt increase the likelihood of success in converting the rhythm. If capnography is available, an ETCO2 equal to or greater than 10mmHg would be indicative of effective compressions. EMS providers should consider 2 minutes or 5 cycles of CPR before defibrillation in an unwitnessed arrest. Shock once, resume CPR with NO pulse check. If Pt. starts showing signs of life, stop and assess Pt. When PEA is present, the underlying cause should be determined and treated appropriately.

**5 H’s and 5 T’s of PEA (and asystole) are:**

- Hypovolemia (volume)
- Hypoxia (ventilation)
- Hydrogen ion [acidosis] (ventilation)
- Hyper/hypoelectrolytes
- Hyper/hypothermia

- Toxins [ovds, poisoning, etc.] (supportive)
- Tamponade [cardiac] (pericardiocentesis)
- Tension pneumothorax (decompression)
- Thrombosis [AMI, PE] (fibrinolytics)
- Trauma

If a victim of any age has a sudden witnessed collapse, the collapse is likely to be cardiac in origin, and the healthcare provider should activate the emergency response system, get an AED (when available), and return to the victim to provide CPR and use the AED when appropriate. Compressions only can be given to patients of witnessed collapse when unprotected and in a layperson setting. If a victim of any age has a likely hypoxic (asphyxial) arrest, such as a drowning, the lone healthcare provider should give 5 cycles (about 2 minutes) of CPR before leaving the victim to activate the emergency response system and retrieve the AED.

**Airway**

If a cervical spine injury is suspected, open the airway using a jaw thrust without head extension (Class IIb). If this maneuver does not open the airway, use a head tilt–chin lift technique because opening the airway is a priority for the unresponsive trauma victim (Class I). When breaths are given they should be approximately 1 second each. (Class IIa) Your tidal volume administered to the patient should just cause chest rise. (500–600cc – about a half a bag squeeze of a BVM) Rescuers should avoid delivering more breaths than are recommended or breaths that are too large or too forceful. Endotracheal intubation reduces the risk of aspiration, should not be attempted by inexperienced people, and should be preceded by some other form of ventilation. Healthcare providers should manually stabilize the head and neck rather than use immobilization devices during CPR for victims with suspected spinal injury.
Airway Continued;

Because insertion of an advanced airway may require interruption of chest compressions for many seconds, the rescuer should weigh the need for compressions against the need for insertion of an advanced airway. Airway insertion may be deferred until patient fails to respond to initial CPR and defibrillation or demonstrates return of spontaneous circulation (Class IIb).

The optimal method of managing the airway during cardiac arrest will vary on the basis of provider experience, health system characteristics, and the patient’s condition. Studies suggest that the LMA, Combitube, and King Airway can be inserted safely and can provide ventilation that is as effective as bag-mask ventilation (Class IIa). Continuous waveform capnography is recommended in addition to clinical assessment as the most reliable method of confirming and monitoring correct placement of an endotracheal tube (Class I). Use of capnography allows the team to monitor the quality of compressions and reduces the risk of unrecognized tube misplacement or displacement. A low ETCO\(_2\) reading might indicate ineffective compressions. Providers should use clinical assessment plus a confirmation device such as an exhaled CO\(_2\) detector or an esophageal detector device to evaluate tube location (Class IIa). When a patient attains ROSC yet requires continued ventilation, the recommended ETCO\(_2\) to achieve is 35~40mmHg. Securing the ET tube with circumferential ties around the neck is not recommended due to the potential obstruction of venous return from the brain. Use of a commercial securing device that assures stability and proper location is preferred.

Providers should confirm the placement of any advanced airway immediately after insertion, in the transport vehicle, and whenever the patient is moved. Once an advanced airway is in place 2 rescuers no longer deliver cycles of compressions interrupted with pauses for ventilation. Deliver 100 compressions per minute continuously. Deliver 8 to 10 ventilations per minute for adult victims. Excessive ventilation rates compromise venous return and cardiac output during CPR.

Endotracheal suctioning should be limited to 10 seconds while withdrawing the catheter. Prior to suctioning, the patient should be adequately ventilated to minimize hypoxia.

Emphasis is on adequate ventilation, no matter the method. Providers who perform endotracheal intubation require adequate initial training and either frequent experience or frequent re-training (Class I).

Breathing

Ventilation should be performed to maximize oxygenation, yet not cause abdominal distension. Watch for blood gas abnormalities. Acidosis in arrest, regardless of the cause is treated with increased ventilation with 100% oxygen. When the pO\(_2\) is decreased (hypoxia) and the pCO\(_2\) increases (hypercarbia), the resulting situation reflects a low blood pH (acidosis). Arterial blood gases should be checked to monitor ventilatory effectiveness. Acidosis in cardiac arrest is usually self-limiting once perfusion is restored.

In cardiac arrest, insertion of an advanced airway may not be a high priority. The patient can be effectively ventilated with a BVM with a reservoir attached and oxygen flow rates of at least 12L/min (delivers approximately 100% oxygen). Breaths should be delivered over 1 second, only forceful enough to make the chest rise. The BVM should only be used by trained professionals as it is often difficult for one person to handle. Chest compressions should be paused for breaths and rescue breaths delivered at a rate of 1 second each @ 30:2. The most common problem associated with the use of the BVM is failure to maintain mask seal. All BVM’s should have a clear mask, be self-filling, and not have a pop-off valve (adults). If the patient is dyspneic, is hypoxemic, or has obvious signs of heart failure, providers should titrate oxygen therapy to maintain oxyhemoglobin saturation ≥94%.
Defibrillation should be performed on a victim of cardiac arrest in VFib by the first person available whenever an AED or manual defibrillation is available. **Caution:** Oxygen should not be surrounding the patient’s chest when defibrillation is imminent. The use of ‘hands free’ pads is encouraged as the energy can be delivered more rapidly. VFib can appear to be artifact on the monitor, has no cardiac output, and requires early defibrillation. The most common rhythm produced by electrical shock with AC current is VF (can also be caused by DC current). CPR for 5 cycles or 2 minutes should be done before pulse check or rhythm check on unwitnessed arrests. When an AED arrives, 1 shock followed by immediate CPR is recommended with no rhythm check to limit interruptions in chest compressions.

Energy levels: 360J monophasic; 150J-200J for biphasic truncated exponential waveform, and 120J for biphasic rectilinear waveform. **The default energy level for biphasic is 200 joules.** CPR-Shock-CPR-Shock-Vasopressor-CPR-

**DRUGS**

Adenosine produces a short lived pharmacologic response and has a direct effect on supraventricular tissues it is a (Class I) drug for re-entry SVT. Can be considered for possible VT only when the rhythm is regular. The recommended initial dose is 6mg rapid IV/IO push followed by at least a 20ml normal saline flush. In 1-2 minutes, a dose of 12 mg IV/IO push can be used if no response to the initial dose. A third 12mg dose can follow in 1-2 minutes if the patient still fails to convert. After 30 mg IV/IO push, one should move on to some other therapy. Remember, if the patient is in hemodynamic distress, elective cardioversion frequently is the most successful therapy. If given by central line, consider reducing the dose to 3mg initially.

Amiodarone is a complex agent with effects on the sodium, potassium, and calcium channels. It has both alpha and beta adrenergic blocking properties. In shock resistant VF, a dose of 300mg IV/IO push is recommended (Class IIb) followed by a second dose of 150mg if VF recurs. The maximum dose in 24 hours is 2.2Gm. Generally, once one starts with an antiarrhythmic; one should stick with that one and not combine agents. The combination of several agents is most likely proarrhythmic and unlikely to improve conversion of VF/VT to a perfusing rhythm.

Aspirin inhibits thromboxane A\(_2\) platelet aggregation to reduce coronary reocclusion and recurrent events after fibrinolytic therapy. Also effective for unstable angina. Reduces mortality rate by 10% in AMI patients. All ACS patients should receive ASA unless patient has true allergy, (consider clopidogrel) either in out-of-hospital or ED setting (Class I). Give 160 to 325mg nonenteric-coated orally, crushed or chewed (use rectal suppositories if nausea, vomiting, or peptic ulcer disease). Bleeding disorders, severe hepatic disease, and true aspirin allergy are contraindications for use.

Atropine is used to increase heart rate in symptomatic bradycardia. (Class Ia) doses of 0.5mg IV/IO push up to a total dose of 0.04mg.Kg (about 3mg in an average patient). It is also useful in treating second and third degree heart block (but use with caution, it can worsen second and third degree block also). Atropine can exacerbate ischemic pain associated with AMI. Atropine can be given down the ET tube (2 to 2.5 times the IV/IO dose). Remember the sequence for bradycardias is Atropine, TCP, Epinephrine then Dopamine. Do not delay TCP use if patient is symptomatic and has no IV/IO access; proceed directly to TCP.

Calcium Chloride is the antidote for magnesium toxicity and is the clearly indicated treatment for calcium channel blocker overdose. The usual dose is 500-1000mg IV/IO push. Care should be taken in administering CaCl to patients receiving digitalis products is warranted.

Diltiazem and other (Class Ia) calcium channel blockers can be used to slow the rapid ventricular response associated with atrial fibrillation or flutter (with preserved heart function). Diltiazem (Cardizem) is most commonly used and dosed at 0.25mg/Kg over 2 minutes initially, in 15 minutes 0.35 mg/kg, then infusion IV/IO push followed by a maintenance infusion of 5-15mg/Hr and titrated to heart rate.
**Dopamine** is a catecholamine used to increase cardiac output and blood pressure. Can be considered for bradycardia instead of pacing to increase patients heart rate. Its effects are dose related and generally follow the pattern 1-5mcg/Kg/min (renal effects), 5-10mcg/Kg/min (Beta effects), and 10-20mcg/Kg/min (Alpha effects).

**Epinephrine** (Class IIb) benefits the patient in cardiac arrest primarily by increasing myocardial and CNS blood flow due to its alpha effects. Give 1mg IV/IO push every 3-5 minutes for VF/Pulseless VT or 2 - 2.5 times that dose down the ET tube. Epinephrine is the drug of choice for pulseless rhythms. Can be considered for bradycardia instead of pacing to increase patient’s heart rate. Higher doses may be considered with beta blocker or calcium blocker OD.

**Lidocaine** should be considered an alternative therapy for refractory VF/Pulseless VT. Initial bolus is 1-1.5mg/Kg IV/IO push followed by a 1-4 mg/min infusion. Bolus therapy only is used in cardiac arrest. The patient that has VT with a pulse and develops hemodynamic consequences should be cardioverted immediately (usually the most successful therapy).

**Magnesium** is indicated for the (Class IIa) treatment of Torsade de Pointe VT. Hypomagnesaemia hinders the cellular movement of potassium and thereby makes the heart proprhythmic. Magnesium is given during resuscitation as a 1-2Gm IV/IO push over 1-2 minutes followed by a continuous infusion if necessary. For Torsades with pulses the dose is 1 – 26 mg diluted in 100 in D5W over 5 – 60 minutes.

**Metoprolol** and other beta blockers have a depressing effect on the pumping action of the heart. Indicated in the treatment of AMI, they are used primarily to decrease associated morbidity and mortality.

**Morphine** is the analgesic of choice for treatment of ischemic pain associated with Acute Coronary Syndromes and not completely relieved by nitroglycerine. Pain relief is a high priority in treating acute coronary syndromes. Morphine is dosed in 2-4mg IV push increments and titrated to relieve pain. It is also useful in treating pulmonary edema as it decreases venous return to the heart and has a mild bronchodilatory effect.

**Nitroglycerine (NTG)** is a (Class I) vasodilator which relaxes vascular smooth muscle. It is useful managing ongoind chest pain, managing hypertension, and management or pulmonary congestion. It may be given sublingually, by spray, topically, and intravenously. IV NTG is highly recommended in any AMI complicated by CHF, HTN, Large anterior MI, and with persistent or recurring ischemia.

**Procainamide** is one of several drugs that can be used in treating stable monomorphic VT with preserved ventricular function, controlling rate at atrial fib/flutter, or controlling rate in reentry SVT. The dosing of procainamide has four end points: Procainamide use in pulseless arrest is not supported by science and is therefore not recommended.

- QRS increases in width by 50%
- Hypotension develops
- Total of 1.2 Gm administered at 20-50mg/min
- Dysrhythmia subsides

This calculation is for the average 70Kg patient.

**Sodium bicarbonate (NaHCO3)** is an inorganic buffer which reverses acidosis and causes alkalosis. It should not come into contact with catecholamines. The initial dose (without a blood gas) is 1meq/Kg IV push followed approximately every 10 minutes by half the initial dose. You should not use NaBicarb unless you have to and generally no bicarb is required. NaBicarb is the clearly indicated agent for arrests associated with tricyclic overdoses, hyperkalemia, and pre-existing metabolic acidotic conditions. It is not considered a first line agent in arrest.

**Vasopressin** (Class Indeterminate) can be utilized for shock refractory VF/Pulseless VT & asystole in place of the initial or second dose of epinephrine. Vasopressin is the naturally occurring antidiuretic hormone that has powerful vasoconstrictive properties at high doses. Interestingly, it does not have the same negative effects on the heart that are associated with epinephrine (ie: myocardial irritability and increased ischemia). One dose of 40u IV/IO push can be the initial or second medication after the first 1 shock fails to convert the patient. A return to epinephrine administration is indicated if, after vasopressin, the patient continues to be if VF/Pulseless VT.
Acute Coronary Syndromes include the diagnosis of ST elevation AMI, ST depression strongly suggestive of ischemia, and the nondiagnostic ECG. An ECG is done to determine heart damage and monitor the patient for dysrhythmias. A normal ECG does not mean the patient is not having an MI; but neither does an abnormal ECG mean that they are having a MI. Serial ECG’s are required to make intelligent decisions about intervention and are combined with other data such as serum markers to make proper patient disposition. The uncomplicated AMI routinely needs only oxygen and pain relief during initial management. All patients presenting with Acute Coronary Syndromes should be evaluated for catherization (or fibrinolytic) therapy. Patients with clear indications for PCI (or fibrinolysis) (ST elevation, refractory pain, tachycardia, increasing B/P) should receive (Triple A’s) antianginal /anti-ischemic, antiplatelet, and antithrombin treatment within 30-60 minutes of arrival at the ED. Stroke is the number 3 killer in the U.S. and must be treated with the same urgency as AMI. Immediate performance of a stroke scale assessment is indicated on all presenting possible stroke patients. A CT scan should be performed ASAP after arrival at the ED when a stroke is suspected. If CT capability is not available at a facility, then EMS must divert to a hospital with CT immediately available.

ROSC patient’s that remain hypotensive should receive fluid boluses of NS or LR of 1-2L as needed to maintain a minimum systolic BP of 90mmHg. Continued optimization of patient’s ventilation and oxygenation is also a treatment priority.

Medicolegal considerations include always initiating CPR when there is no medical or legal reason to withhold it. Negligence can be claimed by failure to act or improper action; an injury to the patient must occur; and an act of omission or commission on the part of the care giver must be shown. However, a bad outcome, in and of itself, is not evidence of negligence. Remember, resuscitation may be stopped on the basis of cardiovascular unresponsive-ness. ACLS “certification” indicates that an individual has successfully completed the cognitive and performance standards of the AHA course; it implies no expertise in resuscitation (nor authority to perform any skills).

**Esophageal-Tracheal Combitube**

The Combitube is an invasive alternative airway device that is a tracheal tube bonded side by side with an esophageal obturator. Ventilation can be achieved through either lumen depending on where the end of the Combitube rests. More than 80% of the time, the Combitube ends up in the esophagus after blind insertion. After inflating the two balloons on the Combitube, ventilation should proceed through the esophageal obturator. If no chest rise is seen and breath sounds are absent, one should immediately begin ventilating the tracheal tube to achieve ventilation.

**Advantages**

Blind insertion
Superior to BVM ventilation
Roughly equivalent to intubation
Preferred when visualization of vocal cords is obscured
Does not interrupt compressions during CPR
**Laryngeal Mask Airway (LMA)**

The LMA is an alternative invasive device that has a cuffed masklike projection at the end of the airway pathway. It is inserted into the airway until resistance is felt; then the cuff is inflated in the hypopharynx which seals the airway and provides a clear airway into the trachea.

**Advantages**

Blind technique
No need for positioning the airway axes
Low incidence of fatal error

**Caution**

The LMA provides less airway protection from regurgitation than the tracheal tube.

**Airway Confirmation**

**Primary confirmation** of proper placement of an airway device is by physical exam. Upon the first squeeze of the BVM, one should listen over the epigastrum while observing for chest rise. If no chest rise and you hear stomach gurgling, immediately remove the tube and reoxygenate the patient for another attempt at intubation. Reassess with each patient movement. If the chest wall moves and no gurgling is heard, auscultate the lung fields with a 5 point process: left and right anterior, left and right midaxillary, and over the stomach.

**Continuous waveform** capnography is recommended in addition to clinical assessment as the most reliable method of confirming and monitoring correct placement of an endotracheal tube (Class I). Capnography also allows the team to monitor the quality of compressions performed as with an ETCO₂ reading of 10mmHg or greater would be indicative of effective compressions performed on the patient.

**Other confirmation** of correct placement involves the use of colorometric carbon dioxide detectors, “fogging” of the tube, or esophageal intubation detectors.

The “EasyCap” is a colorometric device that changes color in response to exhaled CO₂. This device will be affected by heat, length of time in use, and recent ingestion of carbonated liquids.

The esophageal detection devise (EDD) is a bulb device that can be attached to the 15mm connector on the end of the ET tube. When squeezed and attached to a tube in the esophagus, it will not rapidly re-inflate (if at all) as the esophagus is a collapsible structure whose walls will be suctioned into the ET tube. If the tube is in the trachea, the EDD will immediately re-inflate as the trachea is a rigid structure that will not suction into the holes in the end of the ET tube.
Endotracheal Intubation

This method secures and protects the airway. It is the placement of a tube (ETT) into the trachea to ensure complete oxygenation into the patient’s lungs, and to minimize chances of aspiration of fluids into the lungs. It is used for patients in deep coma, respiratory arrest, CPR, and for patients where complete airway obstruction may be imminent i.e. burns, epiglottitis, etc. and for patients needing deep tracheal suctioning.

Providers must organize care to minimize interruptions in chest compression for rhythm check, shock delivery, advanced airway insertion, or vascular access. If an advanced airway is inserted, rescuers should no longer deliver cycles of 30:2 CPR. Chest compressions should be delivered continuously and a breath should be given once every 6~8 seconds. Insertion of an advanced airway device may not be a high priority unless the patient arrest is probable from a respiratory compromised event.

**Laryngoscope Blades**
Those are two blades:
- **Miller and MacIntosh.**
  They attach to a handle (batteries inside).

**Miller – Straight Blade**
Fits under epiglottis.

**MacIntosh – Curved Blade**
Fits into vallecula

**Handle** (shown on left) must be held in the left hand. Hyperventilate patient well for 2 minutes. Place head in sniffing position, neck flexed forward and head extended back. Time to intubate is 30 second max (15 – 20 better), remember that you must visualize cords!

Listen for breath sounds bilaterally and auscultate epigastrium. Inflate cuff, mark and secure tube (with umbilical tape), then insert bite block to protect ETT.
**INTUBATION COMPLICATIONS**

1. Inadvertent esophageal intubation
2. Intubation of right mainstem bronchus
3. Trauma to mouth, teeth and trachea
4. Hypoxia or anoxia during procedure
5. Aspiration prior to insertion
6. Laryngospasm

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