

ADVANCED CARDIAC LIFE SUPPORT OVERVIEW

LEARNING OBJECTIVES: The student will have an understanding of the general guidelines for resuscitation as updated October 2015.

Many of the treatment guidelines for Advanced Cardiac Life Support (ACLS) are unchanged from 2010. Those that have significant changes in content or application have been highlighted in **RED**.

Changes in the Way Science is Reviewed and Released

Rather than five year updates the Guidelines have been posted in a Web Based Format and will be updated continuously. This will help to ensure that new science that may impact mortality and morbidity reach patient care professionals more rapidly.

GOALS OF THE AMERICAN HEART ASSOCIATION

- **Double bystander CPR rates by 2020**
- **Double cardiac arrest survival rates by 2020**

Ethics:

- Goal is Neuro Intact Discharge not ROSC
- Respect for the individuals ability to make their own medical decisions
- Withholding and withdrawing care during resuscitation are equivocal
- Withholding resuscitation is acceptable if;
 - The safety of the rescuers is in question
 - Obvious signs of death are present
 - There is a valid advanced directive from the patient
- Use of ECPR (ECMO, Fem – Fem) is acceptable for a short time in patients who have a condition that is fixable in a relative short amount of time
- Multiple variables should be used to decide to stop resuscitation.
 - PETCO Less than 10 in the intubated patient is a poor prognostic indicator for survival
- **The phase “limitations of care” has been replaced with “limitations of interventions.”**

BASIC LIFE SUPPORT

- Compressions and basic life support remain the key to survival in both in hospital and out of hospital cardiac arrest
- Untrained Lay Persons should be directed by the dispatcher to perform Hands only CPR
 - There was no difference in outcome between CPR with ventilations and CPR without ventilations
- Trained rescuers should continue to provide ventilation to all patients

- Pediatric patients most often have hypoxic arrests – therefore hands only CPR is not recommended
 - If the rescuer is unable or unwilling to perform ventilations compression only CPR may be used but is not recommended if at all possible
- Coronary Perfusion Pressure is an important component of successful defibrillation. (the amount of blood feeding the heart muscle) This occurs during diastole and so is a function of the full recoil of the chest compression
- Healthcare providers should assess level of consciousness, normal breathing and presence of a pulse simultaneously as part of an organized team
- Compression rate was changed to between 100-120
- Ratio remains at 30 compressions to 2 ventilations
- Ventilation rate for the intubated patient is changed to 1 breath every 6 seconds (10 breaths per minute)
- Compression depth remains at 2 inches for adults and children. 1/3 of the chest wall depth for infants. A maximum compression depth of 2.4 inches or 6cm. Deeper compressions were associated with non life threatening injury
- The most common error was compressions that were too shallow
- Press hard, press fast with complete chest recoil
- Rescuers should continue to switch every two minutes avoiding rescuer fatigue which has been shown to result in incomplete chest recoil
- The defibrillator should be utilized immediately when it arrives
- Compressors should be continued up until the defibrillator is charged and ready to shock.
- Compressions should be started IMMEDIATELY after defibrillation without pause for pulse check or rhythm check. They should be continued for two minutes before a pulse check or rhythm check is performed
- Compressions devices are not recommended except in situations where it is dangerous or difficult to do manual compressions, such as in moving ambulances or angiography suites.
- Waveform capnography is recommended
 - Validate tube placement
 - PETCO less than 10 with CPR in progress indicates either poor compressions or poor prognosis
 - Return of Spontaneous Respirations (ROSC) will result in an increase in PETCO to 40
 - No need to interrupt compressions for pulse checks

TWO DIFFERENT CHAINS OF SURVIVAL

OUT OF HOSPITAL CHAIN OF SURVIVAL

1. Recognition and activation of the emergency response system
2. Immediate high quality CPR
3. Rapid Defibrillation
4. Basic and Advanced emergency medical services

5. Advanced Life Support post arrest care

IN HOSPITAL CHAIN OF SURVIVAL

1. Surveillance and prevention
2. Recognition and activation of the emergency response system
3. Immediate high quality CPR
4. Rapid defibrillation
5. Advanced life support post arrest care

DEFIBRILLATION

- Efficacy drops 7-10% for each minute that defibrillation is delayed
- Goal in hospital is defibrillation within 5 minutes
- Out of hospital goal is to increase public access defibrillation programs that have been proven to improve survival from out of hospital cardiac arrest (OHCA)
- Defibrillator (or AED) should be used immediately when it becomes available
- Manufacturer's guidelines should be used for first defibrillation level
- Each defibrillation should be followed by immediate compressions without pause for pulse or rhythm check.
- Each subsequent defibrillations the energy level should be increased
- If using an AED and the only available pads are adult, they can be placed on infants
- Acceptable pad positions: Lateral-Lateral, Anterior-Lateral, Anterior – Posterior
- Combi pads provide for faster defibrillation (after the first pad placement) then the use of paddles

PLACEMENT OF AEDS IN HOSPITALS

- Increase the number of people able to defibrillate
- Decrease the need for arrhythmia recognition in low risk areas
- Decrease the amount of time to defibrillation
- Recommendation: AED provides for defibrillation times under 3 minutes
- Competing with casinos for survival rates

AIRWAY MANAGEMENT

- Healthcare providers should always provide ventilation
- Advanced airway (intubation) should be delayed to ROSC (depending upon level of provider)
- **If the patient is intubated the ventilations should be delivered 10 times a minute (1 every 6 seconds)**
- Use of 100% oxygen during resuscitation is acceptable. Following ROSC oxygen should be decreased to maintain a saturation between 94-99%
- **The use of ITD devices is not acceptable**

- The routine use of passive ventilation is not recommended, although can be acceptable in EMS systems that are delivering “bundled CPR” with groups of high performance CPR and Defib with a tiered response system.
- Narcan has been added to the protocol for patients who are found to have abnormal or inadequate breathing but continue to have a pulse. It has been added for both healthcare providers and basic life support providers.

OXYGEN THERAPY

- Target oxygen saturation is 94-99%. The routine administration of oxygen if the saturation is normal is not recommended
- If patient is short of breath =oxygen
- COPD = goal oxygen saturation is >90% in the absence of shortness of breath

PRINCIPLES OF CARDIAC ARREST MANAGEMENT

- Medications, advanced airway management and other advanced techniques have no impact on survival to discharge
- Basic Life Support remains the foundation of cardiac arrest survival both in and out of the hospital
- Science shows that patients treated at cardiac arrest centers, teaching hospitals have higher survival rates. Recommendation to establish comprehensive cardiac arrest centers and that post arrest patients be triaged there.
- The post cardiac arrest phase of care is being emphasized. Treatment post arrest has a large impact on neuro intact survival.

PRINCIPLES OF MEDICATION

- Peripheral line is the preferred method of administration if a central line is not already in place
 - EMS regularly utilizes intraosseous (IO) as first vascular access in cardiac arrest
 - IO is also acceptable as first line access in hospital, but is not used as frequently.

EPINEPHRINE

- While still being utilized at standard doses (1mg every 3-5 minutes) a caution has been added. Epinephrine increases the ischemic load of the heart muscle. It has been associated with ROSC but not with an increase in survival to discharge
- May increase coronary perfusion pressure during CPR

VASOPRESSIN

- Removed from use during cardiac arrest
- No advantage over the use of Epinephrine

AMIODARONE

- Only antiarrhythmic that increased survival to admission. No drug had a proven effect on survival to discharge.
- Does not decrease left ventricular function
- 300mg (5mg/kg) IV bolus for refractory ventricular fibrillation or non perfusing ventricular tachycardia

LIDOCAINE

- No longer indicated in the treatment of cardiac arrest in the adult patient unless it is the only drug available
- **Science does not support the routine use of Lidocaine in the post arrest patient.**

SEARCHING FOR THE CAUSE – if the cause of arrest cannot be discovered and fixed, it is difficult to achieve lasting return of spontaneous circulation. The following are the most common causes of cardiac arrest. They are referred to as the H's and T's of cardiac arrest.

1. Hypoxia
2. Hypovolemia
3. Hydrogen ion (Acidosis)
4. Hypo-hyperkalemia
5. Hypothermia

T's are:

1. Toxins (overdoses, medication errors, exposures)
2. Tamponade (cardiac)
3. Tension Pneumothorax
4. Thrombosis (coronary)
5. Thrombosis (pulmonary)

THE NOT RECOMMENDED

- Sodium Bicarbonate during arrest (only after ROSC, governed by blood gases)
- Pacing during arrest
- Precordial thump outside the hospital environment

ARRHYTHMIAS

In the acute care setting of cardiac failure, the diagnosis of rhythm is de-emphasized. The type of arrhythmia is less important than the resulting heart rate. The equation that determines blood pressure and hemodynamic stability is $\text{CARDIAC OUTPUT} = \text{HEART RATE} \times \text{STROKE VOLUME}$. Therefore the treatment of heart rate, whether too slow or too fast is central to adequate resuscitation.

- Not all arrhythmias need to be fixed.
- Treated only if causing a problem
- Things go wrong when we rush to unnecessary intervention

BRADYCARDIA – heart rate less than 60

- Treat only if symptomatic
- Atropine 0.5mg to a total dose of 3mg
- Transcutaneous Pacing
- Dopamine 2-10 mcgms/kg/min titrated to heart rate and blood pressure
- Epinephrine 2-10 mcgms per minute titrated to heart rate and blood pressure (use with extreme caution if ischemia is suspected)

TACHYCARDIA – most tachycardias with a rate less than 150 are compensatory for something else. Be careful not to remove the patient's compensatory mechanism by slowing the heart rate.

STABLE – NARROW COMPLEX TACHYCARDIA

- Attempt vagal maneuvers
- Adenosine 6mg followed by 12mg if unsuccessful
 - If the rhythm converts, the diagnosis of SVT can be confidently made
- Beta Blocker or Calcium Channel Blocker (pick one only)
- Consider expert consultation
- Remember the goal is not to convert the rhythm, but to control the heart rate

UNSTABLE – NARROW OR WIDE COMPLEX TACHYCARDIA – the risk of stroke is high with cardioversion without prior anticoagulation. The patient must be unstable to make this risk acceptable. Hypotension, unmanageable chest pain, shortness of breath and hemodynamic instability may all indicate the need for emergent cardioversion.

STABLE – WIDE COMPLEX TACHYCARDIA

- Adenosine 6mg followed by 12mg if unsuccessful
 - If conversion occurs this was SVT not Ventricular Tachycardia (VT does not respond to Adenosine)
- Procainamide 20-50mg/min until suppressed or side effect
- Amiodarone 150mg over 10 minutes (repeat as needed)
 - Prefer consultation with Cardiology first if possible
 - Be aware of extremely long half life (28 days in healthy adult, 60 days in patients with depressed renal function)
- Sotalol IV 100mg (1.5mg/kg) over 5 minutes
 - Avoid if Prolonged QT

POST ARREST CARE

- Consider direct transport to or transfer to a comprehensive post cardiac arrest facility (tertiary teaching hospital) who have higher neuro intact discharge rates
- All patients who are comatose following arrest should have induced hypothermia (32-34 Degrees centigrade) for 12-24 hours
- Recommend against the use of induced hypothermia using cooled IV fluids in the prehospital setting
- 12 Lead ECG as soon as possible following ROSC to define STEMI cause
- All post arrest patients with suspected ischemic cause should be taken to the cardiac catheterization laboratory emergently. It is reasonable to take all post arrest patients to the lab emergently. Early reperfusion is important to long term survival and maintenance of left ventricular function post arrest.
- Avoid hypotension less than 90mmHg systolic or a mean arterial pressure of 65. Treat hypotension aggressively.
- Fever should be actively avoided following cardiac arrest, particularly in patients who have been rewarmed following induced hypothermia.
- EEGs for diagnosis and treatment of seizures in comatose patients should be performed early and repeated often. Seizures should be treated aggressively.
- Patients who have been resuscitated with 100% oxygen (recommended for adults in cardiac arrest) the Fio2 should be reduced to the lowest level that will maintain an oxygen saturation above 94% in the post arrest period.
- All patients who are resuscitation who ultimately progress to death or brain death should be considered potential organ donors.
- Patients who do not have ROSC can be considered for liver and kidney donations. **These grafted organs do equally well in recipients long term.**

ACUTE CORONARY SYNDROMES (ACS) includes Non ST Elevation MI (NSTEMI), ST Elevation MI (STEMI and unstable angina.

How well the patient will do long term is directly related to how much heart muscle is lost during the acute event. This is a function of the amount of time that the coronary vessel remains closed. For this reason, early recognition of ACS is of paramount importance. Patients at high risk of delayed recognition and treatment include:

PREHOSPITAL

- Older age
- Racial and ethnic minorities
- Female gender
- Lower socioeconomic status
- Solitary living arrangements

IN HOSPITAL

- Non-classical presentation
- Confounding diagnostic issues

- Provider misinterpretation

EARLY 12 LEAD ECGs

- Proven to decrease the amount of time to vessel opening upon arrival at the hospital
- **Computer assisted interpretation is not recommended because of high incidence of false negatives**
- **If the ECG cannot be transmitted, studies have shown that the interpretation of trained non physician health care providers is accurate and should be used to activate the cardiac catheterization laboratory prior to patient's arrival**
- Transmission of the ECG to the Emergency Department MD is the preferred method of interpretation

ACUTE TREATMENT - ACS

- Continuous monitoring for arrhythmias
- Oxygen therapy if short of breath or if oxygen saturation is less than 94% (90% in COPD)
- Nitroglycerin
 - Hold if RV Infarction with inferior wall MI
 - Move V4 to V4R – if 1mm ST elevation hold Nitroglycerin
- Pain Control
 - Goal is zero (Pain is associated with ischemia and increased risk of life threatening arrhythmias)
 - Caution if using Morphine in the treatment of Unstable Angina

ACUTE MYOCARDIAL INFARCTION – STEMI – the goal of treatment is the earliest possible reperfusion of the vessel. Door to balloon time should be 90 minutes. The ultimate goal is opening the vessel within 120 minutes of symptoms onset.

- **Biomarkers alone cannot be used to risk stratify ACS patients. High sensitivity Troponin at presentation and then at 3 and 6 hours in conjunction with Low Risk Stratification such as TIMI score should be used to predict less than 1% chance of MACE at 30 days.**
- **Plavix 300mg – It would be reasonable to consider administration in the prehospital setting for patients being triaged for direct PCI.**
- **When possible STEMI patients should be transported directly to centers capable of percutaneous coronary intervention 24/7 (PCI)**
- **There is no clear evidence to support the administration of Heparin by EMS**
- Aspirin 325mg
- Beta Blockade in the first 12 hours
- Heparin should be administered for 48 hours
- Consider the use of Glycoprotein IIb/IIIa Inhibitors
- ACE Inhibitor prior to Discharge
- Statin prior to discharge

REPERFUSION RECOMMENDATIONS

- PCI is the preferred and lowest risk intervention for acute MI. However there are situations in which fibrinolysis may be considered.
- **The combined treatment of fibrinolysis followed by immediate PCI is not recommended.**
- Fibrinolysis may be considered when
 - Patient presents within 2 hours of symptom onset and delay to PCI is >60 minutes
 - **Patient presents within 2-3 hours of onset and delay to PCI is >60-120 minutes (may be reasonable)**
 - **Patient presents within 3-12 hours of onset and delay to PCI is up to 120 minutes (may be considered)**
- **Fibrinolysis becomes considerably less effective after 6 hours and so delayed PCI may actually be preferred if it is not possible immediately.**
- **In patients presenting to the ED of a non PCI capable hospital, the recommendation is immediate transfer to PCI facility rather than the administration of fibrinolysis.**

ACUTE CORONARY SYNDROME (ACS) NSTEMI – ST Depression or Dynamic T wave Inversion

- Aspirin 325mg
- Nitroglycerin (if not contraindicated)
- Heparin (for at least 48 hours)
- Consider PO Beta Blockade
- Consider Plavix
- Consider Glycoprotein IIb/IIIa Inhibitor

STROKE RECOGNITION AND TREATMENT

RECOGNITION

- Utilization of Cincinnati Prehospital Stroke Scale (72% accuracy)
 - Facial Droop
 - Arm Drift
 - Speech
 - Obtain ONSET OF SYMPTOM TIME

TREATMENT

- EMS – direct triage to Comprehensive Stroke Treatment Centers
- Non Contrast CT within 10 minutes of arrival in the Emergency Department
- rtPA within 3 hours of onset of symptoms acceptable for all patients
- rtPA within 4.5 hours of onset of symptoms acceptable for most patients
- Interventional Radiology for patients beyond acceptable time frames or with special presentations or comorbidities

