Project: Ghana Emergency Medicine Collaborative

Document Title: Advanced Cardiac Life Support

Author(s): Rocky Oteng (University of Michigan), MD 2012

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ACLS

• Systematic approach to assessment and management of cardiopulmonary emergencies
• Continuation of Basic Life Support
• Resuscitation efforts aimed at restoring spontaneous circulation and retaining intact neurologic function

ABCD
The AAA’s

• Assess the patient
  – Establish unresponsiveness
  – Check pulse, respirations

• Activate EMS
  – Call for help

• AED
  – Get an AED (automated external defibrillator)
Primary Survey (BLS)

- Airway
- Breathing
- Circulation
- Defibrillation

Always assess and manage before moving on to the next step!
Airway

• Open the airway
  – Head tilt-chin lift
  – Jaw thrust
Breathing

• Look, Listen and Feel

• Give 2 rescue breaths

• Watch for appropriate chest rise and fall
Circulation

• Check for a pulse
• Start CPR
  – 30 compressions/
    2 respirations
• Compressions more important than respirations!

Defibrillation

• Know your AED

• Universal steps:
  1. Power ON
  2. Attach electrode pads
  3. Analyze the rhythm
  4. Shock (if advised)
Defibrillation

• Most frequent initial rhythm in witnessed sudden cardiac arrest is ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT) which rapidly deteriorates into VF
• The only effective treatment for VF is electrical defibrillation
• Probability of successful defibrillation diminishes rapidly over time
• VF rapidly converts to asystole if not treated
Early Defibrillation = Increased Survival

Chances of success reduced 7% to 10% each minute
Outcomes of Rapid Defibrillation by Security Officers after Cardiac Arrest in Casinos

- NEJM Vol 343 (17) October 26, 2000
- Used AEDs on 105 patients with Ventricular Fibrillation
- 53% survived to discharge (back to casino)
- Previously, less than 5% survive
Public-Access Defibrillation and Survival after Out-of-Hospital Cardiac Arrest

- NEJM 2004
- Community based trial of AED deployment and layperson training.
- 30 in AED group versus 15 survivors in CPR only group to hospital discharge
- Average age of survivor - 69.8 years
- Study cost - $9.5 million
Secondary Survey (ACLS)

• Airway
• Breathing
• Circulation
• Differential Diagnosis

• Assess and manage at each step before moving on!
Airway

- Maintain airway patency
  - Head tilt-chin lift/jaw thrust
  - Oro- or nasopharyngeal airway
- Advanced airway management
  - ETT
  - Combitube
  - LMA
Breathing

• Assess adequacy of oxygenation and ventilation
• Provide supplemental oxygen
• Confirm proper airway placement
• Secure tube
Circulation

• Assess/monitor cardiac rhythm
• Establish IV access
• Give medications as appropriate for rhythm and BP
• Fluid resuscitation
• Minimize interruption of compressions to maximize survival.
Differential Diagnosis

• Look for and treat any reversible cause of arrest
Basic Rhythm Analysis
Basic Rhythm Analysis

• Rate – too fast or too slow?
• Rhythm – regular or irregular?
• Is there a normal looking QRS? Is it wide or narrow?
• Are P waves present?
• What is the relationship of the P waves to the QRS complex?
Rhythm Analysis

Lethal vs non-lethal?

Shockable vs. non-shockable?

Too fast vs too slow?

Symptomatic vs. asymptomatic?
Lethal Rhythms

• **Shockable (Defibrillation)**
  - Ventricular fibrillation
  - Pulseless ventricular tachycardia

• **Non-shockable**
  - Asystole
  - Pulseless electrical activity
Non-Lethal Rhythms

• Too fast (tachycardias)
  – Sinus
  – Supraventricular (including a-fib/flutter)
  – Ventricular

• Too slow (bradycardias)
  – Sinus
  – Heart block (1°, 2°, 3° AV block)
What is a Symptomatic Dysrhythmia?

• Any abnormal rhythm that produces signs or symptoms of hypoperfusion
  – Chest Pain/ischemic EKG changes
  – Shortness of Breath
  – Decreased level of consciousness
  – Syncope/pre-syncope
  – Hypotension
  – Shock - decreased Uop, cool extremities, etc.
  – Pulmonary Congestion/CHF
Name that rhythm...
63 yo man with a witnessed collapse while mowing the lawn

What is the rhythm?
What is the management?
Ventricular Fibrillation

- Rapid and irregular
- No normal P waves or QRS complexes
VF / Pulseless VT

Primary Survey - ABC

Secondary Survey - ABC

Ventricular Fibrillation / Pulseless VT

Cardiac Arrest → Defibrillator Arrives → CPR → Rhythm Check → CPR → Rhythm Check → CPR → Rhythm Check → CPR

- Give Vasopressor
- Consider Antiarrhythmic

Go to A

CPR = 5 cycles or 2 minutes of CPR

CPR while defibrillator charging

Shock
ACLS Algorithm

• Primary Survey
• Shock – 360 J
• Secondary Survey
• Vasopressor - Epi or Vasopressin IV
• Shock 360J
• Antiarrhythmic – Amiodarone, Lidocaine or Magnesium Sulfate IV
• Shock 360J
79yo man s/p NSTEMI

What is the rhythm?
What is the management?
Ventricular Tachycardia

- Rapid and regular
- No P waves
- Wide QRS complexes
Ventricular Tachycardia

- Monomorphic VT

- Polymorphic VT
Ventricular Tachycardia

- Assume any wide complex tachycardia is VT until proven otherwise
  - SVT with aberrant conduction may also have wide QRS complexes
- Attempt to establish the diagnosis
  - Ischemia risk and VT go together
Treatment of VT

• If pulseless - follow VF algorithm
• If stable try anti-arrhythmic
  – Amiodarone
  – Lidocaine
  – Procainamide?
• If patient has a pulse, but is unstable or not responding to meds - shock
Treatment of VT

- Anti-arrhythmics are also pro-arrhythmic
- One antiarrhythmic may help, more than one may harm
- Anti-arrhythmics can impair an already impaired heart
- Electrical cardioversion should be the second intervention of choice
60yo diabetic man with chest pain

What is the rhythm?
What is the management?
Normal Sinus Rhythm

- Regular rate and rhythm
- Normal P waves and QRS
- Evaluate for cause of chest pain and monitor for change in rhythm
40 yo woman found down, pulseless and apneic

What is the rhythm?
What is the management?
Pulseless Electrical Activity

• Any organized (or semi-organized) electrical activity in a patient without a detectable pulse
• Non-perfusing

• Treat the patient NOT the monitor
• Find and treat the cause!!!!!
PEA and Asystole

Secondary Survey - ABCD

Primary Survey - ABC
PEA

A t r o p i n e  1  m g  I V P
i f  P E A  i s  s l o w

E p i n e p h r i n e  1  m g  I V P
r e p e a t  e v e r y  3 - 5  m i n u t e s

S e a r c h  f o r  a n d  T r e a t  C a u s e s

S e c o n d a r y  S u r v e y

P r i m a r y  S u r v e y
Find and Treat the Cause

- Non-shockable rhythm
- The **most** effective treatment is to find and fix the underlying problem
So what causes PEA?

• #1 cause of PEA in adults is hypovolemia
• #1 cause in children is hypoxia/respiratory arrest

• Other causes?
The H’s and T’s

- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hyper-/hypokalemia
- Hypothermia
- Hypoglycemia (rare)
- Toxins
- Tamponade
- Tension pneumothorax
- Thrombosis (coronary or pulmonary)
- Trauma
Treat the H’s and T’s

- Hypovolemia
  - Volume – IVF, PRBC’s
- Hypoxia
  - Oxygenate/Ventilate
- Hydrogen ion (acidosis)
  - Sodium bicarbonate
  - Hyperventilation
- Hyper-/hypokalemia
  - Sodium bicarbonate
  - Insulin/glucose
  - Calcium
- Hypothermia
  - Warm -- invasive
- Hypoglycemia
  - Dextrose

- Toxins
  - Check levels
  - Charcoal
  - Antidotes
- Tamponade
  - pericardiocentesis
- Tension pneumothorax
  - Needle decompression
  - Tube thoracostomy
- Thrombosis (coronary or pulmonary)
  - Thrombolytics
  - OR/cath lab
- Trauma
19yo man with palpitations

What is the rhythm?
What is the management?
Supraventricular Tachycardia

- Rapid (usually 150-250 bpm) and regular
- P waves cannot be positively identified
- QRS narrow
Treatment of Stable SVT

• Consider vagal maneuvers
  - Carotid sinus massage
  - Valsalva
  - Eyeball massage
  - Ice water to face
  - Digital rectal exam

• Adenosine
  - 6 mg, 12 mg, 12 mg
Treatment of Unstable SVT

• Electrical Cardioversion
• Cardioversion is not defibrillation
• Use defibrillator in “sync” mode
  – prevents delivering energy in the wrong part of the cardiac cycle (R on T phenomenon)
Electrical Cardioversion

• Energy level – somewhat controversial
• 100 J → 200J → 300J → 360J
• Atrial flutter may convert with lower energy – 50J
• For polymorphic VT – start with 200J
• The EP guys tend to start with 360J
Electrical Cardioversion

• Be prepared
  – Patient on monitor, IV, Oxygen
  – Suction ready and working
  – Airway supplies ready

• Pre-medicate whenever possible
  – Conscious sedation
  – Electrical shocks are painful!
Tachycardia

- Treat the patient **NOT** the monitor!!!
Stable Tachycardias

• Narrow complex?
  – Regular rhythm
    • Sinus tachycardia
    • SVT
    • AV nodal reentry
  – Irregular rhythm
    • Atrial fibrillation
    • Atrial flutter

• Wide complex?
  – Uncertain rhythm – assume VT
  – Narrow complex tachycardia with aberrancy
  – Ventricular tachycardia
    • Monomorphic or polymorphic
56 yo woman with shortness of breath and chest pain

What is the rhythm?
What is the management?
Atrial fibrillation/flutter

- May be rapid
- Irregular (fib) or more regular (flutter)
- No P waves, narrow QRS
Atrial fibrillation/flutter

- Treatment based on patient’s clinical picture
  - Unstable = Immediate electrical cardioversion
  - Stable
  - Control the rate
    - Diltiazem
    - Esmolol (not if EF < 40%)
    - Digoxin
  - Provide anticoagulation

- Treat the patient NOT the monitor!!!
78yo man found down, pulseless and apneic, unknown duration

What is the rhythm?
What is the management?
Asystole

- Is it really asystole?
- Check lead and cable connections.
- Is everything turned on?
- Verify asystole in another lead.
- Maybe it is really fine v-fib?
68 yo woman with h/o hypertension presents with dizziness

What is the rhythm?
What is the treatment?
Sinus Bradycardia

- Slow and regular
- Normal P waves and QRS complexes

Mysid, Wikimedia Commons
Bradycardias

• Many possible causes
  – Enhanced parasympathetic tone
  – Increased ICP.
  – Hypothyroidism
  – Hypothermia
  – Hyperkalemia
  – Hypoglycemia
  – Drug therapy
Bradycardias

• Treat only symptomatic bradycardias
  – Ask if the bradycardia causing the symptoms
• Recognize the red flag bradycardias
  – Second degree type II block
  – Third degree block
BRADYCARDIA
Heart rate <60 bpm and inadequate for clinical condition

1. Maintain patent airway; assist breathing as needed
   - Give oxygen
   - Monitor ECG (identify rhythm), blood pressure, oximetry
   - Establish IV access

2. Signs or symptoms of poor perfusion caused by the bradycardia?
   (e.g., acute altered mental status, ongoing chest pain, hypotension or other signs of shock)

3. Adequate Perfusion
   - Observe/Monitor

4. Poor Perfusion
   - Prepare for transcutaneous pacing; use without delay for high-degree block (type II second-degree block or third-degree AV block)
   - Consider atropine 0.5 mg IV while awaiting pacer. May repeat to a total dose of 3 mg. If ineffective, begin pacing
   - Consider epinephrine (2 to 10 μg/min) or dopamine (2 to 10 μg/kg per minute) infusion while awaiting pacer or if pacing ineffective

4A. Reminders
   - If pulseless arrest develops, go to Pulseless Arrest Algorithm
   - Search for and treat possible contributing factors:
     - Hypovolemia
     - Hypoxia
     - Hydrogen ion (acidosis)
     - Hypo-/hyperkalemia
     - Hypoglycemia
     - Hypothermia
     - Toxins
     - Tamponade, cardiac
     - Tension pneumothorax
     - Thrombosis (coronary or pulmonary)
     - Trauma (hypovolemia, increased ICP)

5. Transvenous pacing
   - Prepare for transvenous pacing
   - Treat contributing causes
   - Consider expert consultation

Figure 1. Bradycardia Algorithm.
Transcutaneous pacing

• Class I for all symptomatic bradycardias
• Always appropriate
• Doesn’t always work
• Technique
  – Attach pacer pads
  – Set a rate to 80 bpm
  – Turn up the juice (amps) until you get capture
• Painful – may need sedation / analgesia
Transvenous Pacing

• Invasive
• Time-consuming to establish
• Skilled procedure
• Better long-term than transcutaneous
• May have better capture than transcutaneous pacing
Bradycardia Treatment

• Medications
  – Vagolytic
    • Atropine
  – Adrenergic
    • Epinephrine
    • Dopamine
What if the same patient had this rhythm?

What is the rhythm?
What is the treatment?
Junctional Escape

- Slow and relatively regular
- No P waves
- Narrow QRS
- Arises from site near the junction of the atria and ventricles
29 yo asymptomatic female

What is the rhythm?
What is the management?
1° AV block

- Regular rate and rhythm
- Normal P wave with long PR interval (>0.2msec/1 big box)
- Normal QRS
58yo asymptomatic woman

What is the rhythm?
What is the management?
2° AV Block - Type I

- aka Wenckebach
- Regular rate and rhythm
- Normal P waves and QRS complexes
- Increasing PR interval until QRS dropped
80 yo man with syncope

What is the rhythm?
What is the management?
2° AV Block – Mobitz Type II

- Regular atrial rate with normal P wave
- Consistent PR interval
- Random QRS dropped
Another 80 yo man with syncope

What is the rhythm?
What is the management?
3° AV Block

- Normal P waves
- Normal QRS
- No relationship between P and QRS
- aka complete heart block
Know When To Stop

• With return of spontaneous circulation
• No ROSC during or after 20 minutes of resuscitative efforts
  – Possible exceptions include near-drowning, severe hypothermia, known reversible cause, some overdoses
• DNR orders presented
• Obvious signs of irreversible death
Take Home Points

• Assess and manage at every step before moving on to the next step
• Rapid defibrillation is the ONLY effective treatment for VF/VT
• Search for and treat the cause
• Treat the patient not the monitor
• Reassess frequently
• Minimize interruptions to chest compressions
Special thanks to:
Steve Kronick, MD and
Suzanne Dooley-Hash, MD
for contributing slides and content for this lecture.