ACLS for the Clinical Pharmacist

Krista A. Wahby, Pharm.D.
Dale Tucker, RPh, MEd, BCPS
June 2007
Objectives

- To review the importance of having a pharmacist attend codes
- To familiarize the pharmacist with the ACLS protocols
- To review routes of administration for medications used in code blue emergencies
- To introduce several common ECG rhythms
- To identify and discuss the most common drugs used by the ACLS algorithms
Why Involve Pharmacist?

- **Implements outcomes in Code Blue**
  - *Pharmacotherapy* 2007. Apr 27(4);481-93.
  - *Pharmacotherapy* 1999. 19(5);556-64.
- Calculate drug doses
- Drug information
- Preparation of drugs
- Source of quick access for medications not on crash cart
- Assessment of patient’s allergies and medication usage
Common Principles in New ACLS Guidelines - 2005

1. Early, effective bystander CPR
2. Early defibrillation - Public Access Defibrillation
3. Minimal interruptions in chest compressions
4. Establishing a specific diagnosis by ECG
5. Choose one antiarrhythmic agent
   *One, and only one antiarrhythmic should be used.*
6. If IV access is not established, Intraosseous cannulation is the first line alternative and endotracheal is an alternative.
Pharmacist Involvement

- Pharmacists should KNOW:
  
  **How?**  ...to use an agent  
  **Why?**   ...we use an agent  
  **When?**  ...to use an agent  
  **What?**  ...to watch for
How To Use the Medication?
Routes of Medications

- **IV Push (IVP)**
  - Preferred route – fast, convenient, + bioavailability
  - Peripheral – flush w/ 20cc bolus and elevate arm for 10-20 seconds. Peak effect takes 1-2 minutes
  - Central line should be placed (however, keep in mind it is a relative contraindication for thrombolytic therapy)

  - **V** - vasopressin
  - **A** – amiodarone, atropine, adenosine
  - **L** – lidocaine
  - **E** – epinephrine
Intravenous Infusion

- Intravenous infusion
  - Medications for continuous IV infusion only
    - P – procainamide
    - I – isoproterenol
    - N – norepinephrine
    - D – dopamine
  - Central line preferred, however, peripheral OK in emergency
Intraosseous Administration

- When IV access not available
- Gives access to a noncollapsible venous access route
- Important when patients are in shock with peripheral vasoconstriction
Endotracheal Administration

- When IV access is not available
- Doses usually 2-2.5 times higher
  - Absorption occurs at alveolar capillary interface
  - Dilute drugs with 10ml 0.9% NaCl or Water to allow for adequate delivery (H2O preferred)
    - L – lidocaine (2-4 mg/kg)
    - E – epinephrine (2-2.5 mg)
    - A – atropine (2-3 mg)
    - N – naloxone (0.8-1.6 mg)
    - V – vasopressin (80-100 Units)
HOW?
Medication Administration

- Do not interrupt chest compressions
- Time to maximum effect of drug may depend on the distance from the heart
- Administer 10-20ml NS after each drug administered (20ml if peripheral administration & elevate arm)
- Have medications labeled and ready in advance
- Best to give immediately after shock
WHEN TO USE WHAT Medication?
Use of Algorithms

- Meant to treat broadest range of patients
- Memory aids
- Use “wisely,” not blindly
- Not meant to replace clinical judgment
  - Where to find?
    - American Heart Association
    - Attached to crash cart
    - Included in DMC Tier 2 policy
    - aclsn.net on the web
Check Rhythm
ECG Rhythms

- Wave forms
ECG Rhythms

- Normal sinus rhythm

<table>
<thead>
<tr>
<th>Heart Rate</th>
<th>Rhythm</th>
<th>P Wave</th>
<th>PR interval (in seconds)</th>
<th>QRS (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60-100 bpm</td>
<td>Regular</td>
<td>Before each QRS, identical</td>
<td>.12 to .20</td>
<td>&lt;.12</td>
</tr>
</tbody>
</table>
ECG Rhythms

- **Asystole**

  
  Ventricular Asystole (standstill)

<table>
<thead>
<tr>
<th>Heart Rate</th>
<th>Rhythm</th>
<th>P Wave</th>
<th>PR interval (in seconds)</th>
<th>QRS (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent</td>
<td>Absent</td>
<td>Absent or present</td>
<td>N/A</td>
<td>Absent</td>
</tr>
</tbody>
</table>

- **Bradycardia**

  
  Sinus Bradycardia

<table>
<thead>
<tr>
<th>Heart Rate</th>
<th>Rhythm</th>
<th>P Wave</th>
<th>PR interval (in seconds)</th>
<th>QRS (in seconds)</th>
</tr>
</thead>
</table>
  | < 60 bpm   | Regular | Before each QRS, identical | .12 to .20 | <.12 }
## ECG Rhythms

- **Ventricular Tachycardia**

  ![Ventricular Tachycardia](image)

<table>
<thead>
<tr>
<th>Heart Rate</th>
<th>Rhythm</th>
<th>P Wave</th>
<th>PR interval (in seconds)</th>
<th>QRS (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;100</td>
<td>Regular</td>
<td>Absent or not related</td>
<td>N/A</td>
<td>≥ .12</td>
</tr>
</tbody>
</table>

- **Ventricular Fibrillation**

  ![Ventricular Fibrillation](image)

<table>
<thead>
<tr>
<th>Heart Rate</th>
<th>Rhythm</th>
<th>P Wave</th>
<th>PR interval (in seconds)</th>
<th>QRS (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300-600</td>
<td>Extremely irregular</td>
<td>Absent</td>
<td>N/A</td>
<td>Fibrillatory baseline</td>
</tr>
</tbody>
</table>
ECG Rhythms

- Artifact (waveform interference)

AC Interference (60 cycle)

Sixty even, regular spikes in a 1 second interval caused by electrical current near the patient
Cardiac Arrest Management

1. Pulseless Cardiac Arrest – i.e. ASYSTOLE and PEA
2. VENTRICULAR FIBRILLATION and PULSELESS V.TACH
Pulseless Arrest Algorithm

- Minimize interruptions in chest compressions
- Limit pulse and rhythm checks
- Do not check pulse immediately after shock – give 5 cycles, then check!
- Once advanced airway in place – do not interrupt compressions
Asystole and Pulseless Electrical Activity (PEA)

- Asystole is a cardiac standstill
- PEA-pt has mechanical contractions but no pulse. Any rhythm possible
- Both are non-shockable rhythms
- Most do not survive
- Asystole means the patient’s life has ended

<table>
<thead>
<tr>
<th>Heart Rate</th>
<th>Rhythm</th>
<th>P Wave</th>
<th>PR interval (in seconds)</th>
<th>QRS (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
<td>N/A</td>
<td>Absent</td>
</tr>
</tbody>
</table>
Asystole & PEA Algorithm

BLS Algorithm:
Call for help, give CPR
Give oxygen when available
Attach monitor/defibrillator when available

Check rhythm: shockable? YES or NO
If NO and **problem** is asystole/PEA

Resume CPR immediately for 5 cycles

Give vasopressor: **Epinephrine** or vasopressin
Consider **Atropine** for asystole or slow PEA rate

Give 5 cycles of CPR

Check rhythm: shockable? If no:
# Asystole and PEA Algorithm

<table>
<thead>
<tr>
<th>P</th>
<th>Problem search via Differential Diagnosis table; treat accordingly. (PATCH 4MDs) Continue algorithm if indicated.</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td><strong>Epinephrine</strong> 1 mg IVP/IO q3-5 min. OR Vasopressin 40 units IV/IO, once, in place of the first or second dose of epinephrine.</td>
</tr>
<tr>
<td>A</td>
<td><strong>Atropine</strong> 1 mg IVP/IO q3-5 minutes; 3mg maximum.</td>
</tr>
</tbody>
</table>
Problem Search: Differential Diagnosis
PATCH(4) MDs

- **Pulmonary embolism**
  - Thrombolytics

- **Acidosis**
  - Bicarb./hyperventilation

- **Tension pneumothorax**
  - Thoracostomy

- **Cardiac tamponade**
  - Pericardiocentesis

- **Hyperkalemia**
  - HCO3, CaCl, Ins/Glc, HD, diuresis, kayexylate

- **Hypokalemia**

- **Hypovolemia**

- **Hypoxia**

- **Myocardial infarct**
  - ACS protocol
  - Avoid BB if cocaine

- **Drugs**

- **Shivering**
Basic Pharmacology Review
Vasoactive Receptor Effects

- $\alpha_1$ – VASOCONSTRICTION of arteries and veins
- $\alpha_2$ – Feedback and Vasoconstriction
  - Decreases NE release
- $\beta_1$ – INOTROPE & CHRONOTROPE
- $\beta_2$ – VASODILATION (skin, kidneys, skeletal muscles, visceral and pulmonary arteries) and BRONCHODILATION
Vasopressor Therapy

- Increases SBP by increasing preload and ventricular filling pressure
- Enhance organ perfusion, increase cerebral and coronary perfusion pressures (increases success of defibrillation)
- Mostly via $\alpha_1$ stimulation and $V_1$ stimulation
- List the Vasopressors:
  - Epinephrine
  - Vasopressin
  - Norepinephrine
  - Phenylephrine
  - Dopamine
Inotropic Therapy

- Increase cardiac contractility and increase cardiac output (CO)
- Work via β1 stimulation and/or by increasing cAMP and Calcium influx
- List the Inotropes:
  - Dobutamine
  - Milrinone (or inamrinone)
  - Digoxin
  - Glucagon
Catecholamine Pharmacology

- Bind to β-adrenoreceptor and stimulate Gs protein
- Stimulates adenylate cyclase, \( \uparrow \) cAMP
- cAMP acts to INCREASE Ca INFLUX
- VASOCONSTRICTION, INOTROPY
E = Epinephrine

- 1mg IVP/IO every 3-5 minutes.

**GOAL** – Improve Perfusion to Essential Organs (Heart, Brain). Shifts blood centrally.

- **MOA** – Alpha and Beta Adrenergic Agonist
  - $\alpha_1$ – Vasoconstriction. Increases BP; improves cerebral and coronary perfusion pressures
  - $\beta_{1-2}$ - Stimulates the cardiac muscle increasing the strength of ventricular contraction. + inotrope and chronotrope. Does increase myocardial work
Epinephrine Side Effects

- Nervous system: anxiety, agitation
- Cardiovascular: dilated CM, LV dysfunction
- Psychiatric: disorientation, hallucinations
- Metabolic: acidosis, hypokalemia
- Renal: renal insufficiency
- Other: extravasation, skin necrosis
Vasopressin

- Vasopressin 40 units IVP/IO x 1 (2 vials required. Each vial = 20 Units)
- May replace 1st or 2nd dose of epinephrine
- Pharmacology: Endogenous ADH
  - Causes vasoconstriction at high doses by directly stimulating smooth muscle $V_1$ receptors
  - Dilates cerebral blood vessels
  - Coronary & renal vasoconstriction
Vasopressin Rationale

- Enhance organ perfusion
- Advantages over epinephrine?
  - Longer half-life (10-20 minutes)
- Not affected by acidosis
- Unique MOA - nonadrenergic
- Best outcomes in ASYSTOLE?
Vasopressin Side Effects

- GI: nausea, intestinal cramps
- Increased mesenteric vascular resistance
- Bronchial constriction
- Uterine contractions
- Extravasation - necrosis
A = Atropine

- 1mg IVP/IO every 3-5 minutes up to a maximum of 3 mg
  - Excessive parasympathetic tone may play a role in stopping ventricular and supraventricular pacemaker activity
  - Avoid if lack of cardiac activity has a clear explanation such as hypothermia
Atropine Pharmacology

- Competitive antagonist of acetylcholine
- Vagolytic action causes restoration of heart rate and blood pressure
- Reverses cholinergic-mediated decreases in:
  - Heart rate
  - Systemic vascular resistance
  - Blood pressure
Atropine Side Effects

- Anticholinergic
  - Confusion
  - Blurred vision
  - Dry mouth, skin, nose
  - Constipation
  - Urinary retention
  - Lightheadedness
VF and PVT

- **VF** = ventricular fibrillation
  - Fibrillary contractions of the ventricular muscle due to rapid repetitive excitation of myocardial fibers without coordinated contraction of the ventricle
- **PVT** = pulseless ventricular tachycardia
  - An abnormally rapid ventricular rhythm with aberrant ventricular excitation most commonly associated with atrioventricular dissociation
  - The patient has no pulse
ECG Rhythms

- Ventricular fibrillation

<table>
<thead>
<tr>
<th>Heart Rate</th>
<th>Rhythm</th>
<th>P Wave</th>
<th>PR interval (in seconds)</th>
<th>QRS (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300-600</td>
<td>Extremely irregular</td>
<td>Absent</td>
<td>N/A</td>
<td>Fibrillatory baseline</td>
</tr>
</tbody>
</table>
ECG Rhythms

- Ventricular tachycardia

Ventricular Tachycardia (3 or more consecutive beats)

<table>
<thead>
<tr>
<th>Heart Rate</th>
<th>Rhythm</th>
<th>P Wave</th>
<th>PR interval (in seconds)</th>
<th>QRS (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;100</td>
<td>Regular</td>
<td>Absent or not related</td>
<td>N/A</td>
<td>≥ .12</td>
</tr>
</tbody>
</table>
VF/PVT Algorithm: SCREAM

Give 1 shock
Resume CPR immediately for 5 cycles

Check rhythm: Shockable? YES or NO?

YES - Continue CPR while defibrillator is charging
Give 1 shock
Resume CPR immediately after the shock
When IV/PO available give vasopressor (epinephrine or vasopressin) during CPR before or after the shock

Check rhythm: if shockable

Continue CPR while defibrillator is charging
Give 1 shock
Resume CPR immediately after the shock
Consider antiarrhythmic medications (amiodarone, lidocaine, magnesium): give during CPR before or after the shock
After 5 cycles of CPR
Shock

- Manual biphasic
  - Device specific
  - Typically 120-200 J
  - If unknown, use 200 J
- AED
  - Device specific
- Monophasic
  - 360 J
### VF/PVT Algorithm: SCREAM

<table>
<thead>
<tr>
<th></th>
<th>Shock</th>
<th>360J monophasic, 1st and subsequent shocks. Shock every 2 minutes if indicated.</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>CPR</td>
<td>After shock, immediately begin chest compressions followed by respirations for 2 minutes. Do not check rhythm or pulse.</td>
</tr>
<tr>
<td>C</td>
<td>Rhythm</td>
<td>Rhythm check after 2 minutes of CPR (and after every 2 minutes of CPR thereafter) and shock again if indicated. Check pulse only if an organized or non-shockable rhythm is present.</td>
</tr>
</tbody>
</table>

Implement the Secondary ABCD Survey. Continue this algorithm if indicated. Give drugs during CPR before or after shocking. Minimize interruptions in chest compressions to < 10 seconds. Consider differential diagnosis.
# VF/PVT Algorithm: SCREAM

<table>
<thead>
<tr>
<th>E</th>
<th>Epinephrine</th>
<th>1mg IVP/IO q3-5 minutes or vasopressin 40 units IV/IO, once, in place of the 1\textsuperscript{st} or 2\textsuperscript{nd} dose of epinephrine.</th>
</tr>
</thead>
</table>
| A | Antiarrhythmic Medications | Consider antiarrhythmics:  
- **Any Legitimate Medication**  
  - **Amiodarone** 300mg IVP/IO, may repeat once at 150mg in 3-5 minutes if VF/PVT persists or  
  - **Lidocaine** (if amiodarone unavailable) 1-1.5mg/kg IVP/IO, may repeat X2, q5-10 min at 0.5-0.75mg/kg  
    - Max LD= 3mg/kg  
  - **Magnesium Sulfate** 1-2 gm IVP/IO diluted in 10m D5/W (5-20 min push) for torsades de pointes or suspected/known hypomagnesemia. |
Amiodarone

- 300mg IVP/IO once, then consider additional 150mg IVP/IO once
  - If pt is pulseless, give IVP, otherwise dilution with 20-30ml and a slower infusion results in less bradycardia, hypotension and phlebitis
  - Infusion OK peripherally if < 2mg/ml
  - Not for ET administration
Amiodarone

- MOA: Inhibits conduction through Sodium, Potassium and Calcium channels and $\alpha$ & $\beta$ adrenergic blocking ability
- Inhibits adrenergic stimulation, prolongs the action potential and refractory period in myocardial tissue, and decreases AV conduction and sinus node function
- Based on ARREST and ALIVE Trials
- Side effects: hypotension, bradycardia, nausea, vomiting, tremor, dizziness, headache, phlebitis
Lidocaine

- 1-1.5 mg/kg first dose then 0.5-0.75 mg/kg
  IVP/IO q5-10 minutes
- Maximum of 3 doses or 3 mg/kg
- After return of ROSC infuse at 1-4 mg/min
  (50% reduction if cardiac or liver failure)
- Suppresses automaticity of conduction tissue and blocks both the initiation and conduction of nerve impulses
- Side effects: hypotension, headache, shivering
Magnesium

- 1-2 grams IVP/IO diluted in 10ml D5W over 5-20 minutes. If patient has pulse, can slow down infusion to 30-60 min

- INDICATION: torsades de pointes
  - Low magnesium causes inhibition of conduction through K+ channels in heart – prolongs AP and QT prolongation

- Side effects: flushing, somnolence, complete heart block, respiratory paralysis
Arrhythmia Management

-Bradycardia

-Tachycardia: SVT
Bradycardia

- Bradycardia:
  - HR < 60 beats/minute or when the heart rate is slower than expected

- Signs and symptoms might include:
  - Chest pain, shortness of breath
  - Hypotension, pulmonary edema, congestive heart failure
ECG Rhythms

- Sinus bradycardia

<table>
<thead>
<tr>
<th>Heart Rate</th>
<th>Rhythm</th>
<th>P Wave</th>
<th>PR interval (in seconds)</th>
<th>QRS (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 60 bpm</td>
<td>Regular</td>
<td>Before each QRS, identical</td>
<td>.12 to .20</td>
<td>&lt; .12</td>
</tr>
</tbody>
</table>
Bradycardia Algorithm:

Pacing Always Ends Danger

Maintain patient airway; assist breathing as needed
Give oxygen
Monitor ECG, blood pressure, oximetry
Establish IV access

⇓

Signs/symptoms of poor perfusion caused by the bradycardia?
If yes:

⇓

Prepare for transcutaneous pacing
Consider atropine IV while awaiting pacer; if ineffective begin pacing
Consider epinephrine or dopamine infusion while awaiting pacer or if pacing ineffective

⇓

Prepare for transvenous pacing
Treat contributing causes
Consider expert consultation
Bradycardia Algorithm: Pacing Always Ends Danger

<table>
<thead>
<tr>
<th>Mnemonic</th>
<th>Intervention</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pacing</td>
<td>TCP</td>
<td>Immediately prepare for TCP with serious circulatory compromise due to bradycardia (especially high-degree blocks) or if atropine failed to increase rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Consider medications while pacing is readied.</td>
</tr>
<tr>
<td>Always</td>
<td>Atropine</td>
<td>First line drug, 0.5mg IV/IO q3-5 min (maximum 3mg)</td>
</tr>
<tr>
<td>Ends</td>
<td>Epinephrine</td>
<td>Second line drugs to consider if atropine and/or TCP are ineffective. Use with extreme caution</td>
</tr>
<tr>
<td>Danger</td>
<td>Dopamine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2-10 mcg/kg/min</td>
<td></td>
</tr>
</tbody>
</table>
Transcutaneous Pacing

- Used to speed up a cardiac rhythm that is too slow
- If considered, start immediately
- To be effective, must be performed early and combined with drug therapy
Transcutaneous Pacing Apparatus
Atropine

- Atropine 0.5 mg IV while awaiting pacer
  - 50% reduction in dose when compared with PEA algorithm
- May repeat to a total dose of 3 mg
- If ineffective, begin pacing
Epinephrine

- Consider epinephrine 2-10 mcg/min continuous infusion while awaiting pacer
- Use 1ml of the 1:1000 or 10 ml of the 1:10,000 in 500ml D5W
- Alternatively, 0.5 mg IVP boluses
  - To avoid tachyarrhythmias
  - Until continuous infusion available
  - Until pacemaker available
- Or if pacing ineffective
Dopamine

- Or consider dopamine 2-10 mcg/kg/min infusion while awaiting pacer or if pacing ineffective
- MOA: Precursor of norepinephrine, stimulates heart through both alpha- and beta-adrenergic receptors
- Increases both cardiac output and arterial perfusion pressure
Dopamine Side Effects

- Cardiovascular: ectopic heartbeats, tachycardia, vasoconstriction, hypotension, ventricular arrhythmias
- CNS: headache
- GI: nausea, vomiting
- Respiratory: dyspnea
- Other: Adrenal insufficiency
Tachycardia Algorithm

Assess and support ABCs as needed
- Give oxygen
- Monitor ECG, blood pressure, oximetry
- Identify and treat reversible causes

↓

Symptoms persist and patient **stable**

- Establish IV access
- Obtain **12-lead ECG** or rhythm strip
  - Is QRS narrow or wide?

↓

Narrow QRS (<0.12 sec) with regular rhythm
Tachycardia Algorithm (continued)

Attempt **vagal** maneuvers
Give **adenosine** 6mg rapid IVP
If no conversion, give 12mg rapid IVP
May repeat 12mg dose once

Does rhythm convert?
Note: Consider expert consultation

Yes: Probable reentry SVT. Observe for recurrence. Treat recurrence with adenosine or diltiazem (**Cardizem**) or beta-blockers.

or

No: Possible atrial flutter, ectopic atrial tachycardia, or junctional tachycardia. Control rate with diltiazem (**Cardizem**) or beta-blockers. Treat underlying cause. Consider expert consultation.
Tachycardia Algorithm

- Tachycardia is stable, narrow, and regular:
  - Yes 1-2-3, think SVT, then V-A-C

<table>
<thead>
<tr>
<th>1. Stable?</th>
<th>Yes: see question 2</th>
<th>No: unstable = immediate electrical cardioversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Narrow?</td>
<td>Yes: see question 3</td>
<td>No: wide = consult an expert with QRS ≥ 0.12 sec</td>
</tr>
<tr>
<td>3. Regular?</td>
<td>Yes: see mnemonic</td>
<td>No: irregular = consult an expert</td>
</tr>
</tbody>
</table>
Tachycardia Algorithm

- Yes 1-2-3, think SVT, then V-A-C
  - Vagal maneuvers, if this fails...
  - Adenosine 6 mg rapid IVP (may repeat X2, q1-2 min at 12mg)
  - Cardizem (diltiazem) managed by an expert if stable, narrow, regular tachyarrhythmia continues
Vagal Maneuvers

- **Valsalva’s maneuver**
  - A forcible exhalation effort against a closed glottis which results in an increase in intrathoracic pressure which interferes with venous return to the heart

- **Carotid sinus massage**
  - Firm rotatory pressure applied to one side of the neck over the carotid sinus in a supine patient to cause vagal stimulation in order to slow or terminate tachycardia
Adenosine

- To convert SVT: 6 mg rapid IVP over 1-3 sec followed by 20 ml saline flush; if rate does not convert in 1-2 min give 12 mg IVP & repeat 12 mg in 1-2 minutes again
  - Larger doses required for patients with significant blood levels of theophylline, caffeine, or theobromine
  - Reduce initial dose to 3 mg in patients taking dipyridamole or carbamazepine or those with transplanted hearts or if given by central venous access
Adenosine

- Slows conduction time through AV node, interrupts reentry pathways through AVN and restores NSR
- Side effects common but transient: flushing, dyspnea, chest pain
Diltiazem (Cardizem)

- Use if adenosine fails
- 15-20mg (0.25mg/kg) IVP over 2 min; if needed in 15 minutes give an IVP dose of 20-25mg (0.35mg/kg)
- Maintenance infusion dose is 5-15mg/hr
- Blocks conduction through the AV node
- Harmful if given to patients with atrial fibrillation or atrial flutter associated with known pre-excitation such as Wolf-Parkinson-White
Cases:

- **Rhythm:**

- **What is this?** Ventricular Fibrillation
- **Algorithm?** SCREAM
- **Drugs/Doses?**
  - Epi 1 mg q3-5min
  - Amiodarone 300mg IVP, may repeat with 150mg
Cases:

- **Rhythm:**

- **What is this?**
  - Asystole
  - PEA

- **Algorithm?**

- **Drugs/Doses?**
  - Epi 1 mg q3-5min (or vasopressin 40 Units IVP)
  - Atropine – 1mg q3-5 min to max dose = 3mg
Cases:

- **Rhythm:**

- **What is this?**
- **Algorithm?**
- **Drugs/Doses?**

- **Bradycardia**
- **Pacing Always Ends Danger**
- **Atropine 0.5 mg q3-5min to max = 3mg**
- **Epi 2-10 mcg/min**
- **Dopamine 2-10 mcg/kg/min**
Cases:

- **Rhythm:**

- **What is this?**
- **Algorithm?**
- **Drugs/Doses?**

- SVT
- Yes 1, 2, 3, then think VAC
- Adenosine 6mg IVP then 12mg IVP, then 12mg IVP
- Cardizem 15-20 mg IVP then 5-15 mg/hr
Other Code Situations

- **Anaphylaxis:**
  - Epi 0.3-0.5 mg IV, steroids, ranitidine, diphenhydramine

- **AFib:**
  - diltiazem, βB, digoxin, amiodarone, ibutilide

- **Hyperkalemia:**
  - Insulin + D50; CaCl; Bicarb; albuterol, dialysis, kayexylate, furosemide

- **Hypotension:**
  - Norepinephrine 5-20 mcg/min, Phenylephrine 20-180 mcg/min; Vasopressin 0.01-0.03 Units/min, Dopamine 10-20 mcg/kg/min
Other Code Situations

- **Pulmonary Embolism:**
  - Massive PE with shock or hemodynamic instability should receive tPA 100mg IVPB over 2 hr

- **Status Epilepticus:**
  - Lorazepam 0.1mg/kg IVP, Phenytoin 10-20 mg/kg IVPB or Fosphenytoin

- **Prolonged Code:**
  - Systemic acidosis ensues – NaBicarb may be appropriate
Induced Hypothermia

- Hypothermia for 24 hr
- Hypothermia After Cardiac Arrest (HACA) *NEJM 2002;346:557-63*
- Ice packs, Artic Sun Protocol, Cooling blankets
- Requires continuous sedative and analgesic infusions, meperidine for shivering and avoidance of anticoagulation
Take Away Points

- Most frequently used medications
  - Epinephrine: asystole, bradycardia, PEA, VF/PVT
  - Atropine: asystole, bradycardia, PEA
  - Vasopressin: asystole, PEA, VF/PVT
Take Away Points

- Medications IVPB only
  - P - procainamide
  - I - isoproterenol
  - N - norepinephrine
  - D - dopamine

- Medications IVP or IVPB
  - V - vasopressin
  - A – amiodarone, adenosine, atropine
  - L - lidocaine
  - E - epinephrine

- Tracheal administration
  - L – lidocaine
  - E – epinephrine
  - A – atropine
  - N – naloxone
  - V - vasopressin

- Doses usually 2-2.5 times those given IVP
- Follow each dose with 10 ml NS flush down tracheal tube if not diluted to that volume for administration
Supplemental Reading

- Pharmacotherapy considerations in advanced cardiac life support. Pharmacotherapy 2006;26(12):1703-1729
It's QUESTION TIME!!