

ADVANCED LIFE SUPPORT

PARTICIPANT PREPARATION PACKET 2022 – 2025

American Red Cross Version

This information is derived from the International Liaison Committee on Resuscitation (ILCOR)
and The American Heart Association ECC Guidelines Update



This packet contains prep information for the ALS Course as well as EKG and BLS reviews.
We strongly recommend completing the EKG practice exam prior to the course.

MANDATORY REQUIREMENTS- The mandatory pre-test will be emailed to you with your confirmation.
This must be completed, and the completion certificate turned in at the beginning of class. A score of 76%
must be obtained to participate in this course.

If you are attending the BLS section following ALS, a MANDATORY BLS pre-test was also emailed to you.
(There is a mandatory pretest if you are choosing to do BLS)

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This copyrighted prep packet is a supplement for those students taking an ALS program with EMC.

Welcome to Emergency Medical Consultants' **Stress Free ALS** Course. We are pleased that you have chosen us to provide you with this outstanding course and are sure that this will be a worthwhile learning experience for you as a medical professional. **Please remember you will need to be able to perform adult CPR skills and must be familiar with basic dysrhythmia recognition and pharmacology before the course.**

In order to keep our program "stress free" and to assure that all participants meet the requirements for ALS proficiency, preparation is required prior to the actual class. We will be using the latest Emergency Cardiac Care Standards for BLS and ALS.

Certifying agencies mandate that each participant have a textbook to review prior to the course. (Hard copy or digital) The Text can be purchased through a vendor or borrowed from your hospital or departments' Education Center if your facility provides a library. Red Cross texts can be emailed.

Enclosed you will find information to help you prepare for the required skills stations and ALS didactic evaluation. Please take the time to look through this information, begin to learn drug uses and doses, review the algorithms and EKG sections, and take the pretests. **This will ensure a stress free day!** It is important to prepare for the day by reviewing information prior to class for optimal success. For more EKG practice, log onto www.skillstat.com.

MANDATORY PRE-TEST INFORMATION:

For the American Red Cross (ARC) – The mandatory pre-test will be emailed to you with your confirmation. This must be completed, and the completion certificate turned in at the beginning of class. A score of 70% must be obtained to participate in this course.

We strive to make our program realistic and relevant, thus, the scenarios that you will be required to manage will relate to the work that you do.

All information is based on the current ALS standards at the time of printing and thought to be correct. Providers are encouraged to review the ALS textbook and their specific policies prior to implementing any procedures or administering any medication based on this study packet.

We look forward to meeting you at the course and will be happy to answer any questions you may have – just call our office at 772-878-3085.

Sincerely,
Shaun Fix and the ALS Staff
Emergency Medical Consultants, Inc

Table of Contents

Topic

Basic Tips for Patient Management	5
Basic Life Support- A Critical Component of ALS	6
Pharmacology Overview	8
EKG Points	24
ALS Rhythms and Algorithms	
Ventricular Fibrillation or Pulseless Ventricular Fibrillation	25
Asystole / Pulseless Electrical Activity	26
Post Arrest Care	27
Symptomatic Bradycardia	28
Bradycardias- EKG samples	29
Heart Blocks EKG samples	30
For Stabilization of Rhythm After VF or VT Conversion	31
Hypotension	32
Supraventricular Tachycardia – Stable	33
Atrial Fibrillation- Stable	34
Supraventricular Tachycardia – Unstable	35
Tachycardias- EKG samples	36
Ventricular Tachycardia – Stable	37
Ventricular Tachycardia – Unstable	38
Acute Coronary Syndromes	39
The 12 Lead ECG	40
Acute Stroke	41
Inclusion Criteria for Fibrinolytic Therapy	42
Pulmonary Edema	43
Tips for Drips	44
Continual CO2 Monitoring	45
Special Arrest Situations	46
Glossary	53
Practice Exams	
EKG Practice Exam	54
EKG Answer Key	57
BLS Completion information	59

BASIC TIPS FOR PATIENT MANAGEMENT

Rules for Keeping Yourself out of Trouble...

In ALS and in Life!

Be Nice - **“Good professionals get into trouble; bad professionals get into trouble... Nice professionals don’t get into as much trouble.”**

- Rule #1 - Treat the patient, not the monitor, (check pulses and vital signs)
- Rule #2 - Always remember rule #1
- Rule #3 - If you ARE treating the patient for an arrhythmia
 - Always treat in this order: *Rate*, then *Rhythm*, then *Blood Pressure*

TEAM CONCEPT

- Realize that resuscitation involves professionals of various levels throughout the code then following through to post resuscitation management.
- Team leader needs to clearly define each person’s role. If you are assigned a role that you are not skilled to do immediately notify the team leader and offer to function in another capacity.
- Each team member performs a specific task: ventilations, compressions, medications, vascular access, defibrillation, and documentation / timing. The team must work together under the guidance of a Team Leader to coordinate the combined resuscitation attempt.
- The team must work together and understand what “the next step” is going to be in order to be prepared to carry out skills quickly and efficiently during “pause for evaluation” phase every 2 minutes.
- There should be a closed-loop communication from the team leader to the team and back. i.e. as the team leader requests the next procedure the team member should repeat back what they understood the direction to be. This makes for a clearer understanding and reduces mistakes. Keep in mind the team leader could make a mistake in an order and constructive intervention from other team members may be appropriate to maintain consistency within the ALS Guidelines.

The Core Concepts of ALS

- Coronary perfusion! The myocardium needs to receive adequate blood flow - poorly perfused hearts don’t convert electrically
- Cerebral perfusion (restore, improve, maintain)
- Treat patients - not algorithms
- Crawl before you walk (BLS before ALS)
- Time is of the essence
- Look for a cause after the basics are done
- Consider circulatory enhancing devices



Basic Life Support (CPR) - A critical component of ALS

The most current research available suggests that quality CPR is a crucial variable in survival from resuscitation attempts - even more important than previously thought. Every participant in an ALS class must correctly demonstrate adult CPR skills and use of an AED.

Follow these guidelines when performing Basic Life Support skills:

PUSH HARD: Compress the chest of an adult at least 2 inches, allowing for complete recoil of the chest between compressions. 2.4 inches is the maximum depth. Do not lean on the chest in between compressions.

PUSH FAST: Compress the chest at a rate of at 100-120 compressions per minute.
(30 compressions delivered between 15- 18 seconds)

USE CORRECT RATIOS: Deliver 30 compressions and 2 ventilations, in 2-minute blocks. Change compressors every two minutes during pauses in compressions. At that time, also check rhythm and pulses if indicated if the viewed rhythm is one that could produce a pulse. Patients who have had an advanced airway placed should receive continual compressions.

MINIMIZE INTERRUPTIONS IN COMPRESSIONS: Stop CPR only for essential procedures, such as rotating compressors, rhythm checks and pulse check if indicated, no more frequently than every 2 minutes. Make the pause in compressions as brief as possible.

VENTILATE CAUTIOUSLY: Deliver breaths over 1 second, using just enough volume to produce visible chest rise. With an advanced airway in place, deliver 1 breath every 6 seconds (10 breaths per minute) while continuous compressions are being performed. For rescue breathing in a perfusing patient, deliver 10 -12 breaths per minute.

This equates to one breath approximately every 5-6 seconds.

DEFIBRILLATE APPROPRIATELY: Deliver one shock, as soon as possible, and then immediately resume chest compressions. Check the rhythm and pulse if indicated after 2 minutes of CPR. At the end of each 2 minute cycle, have the defibrillator charged and ready if needed.

Emergency Medical Consultants

772-878-3085 www.EMCmedicaltraining.com

Skills Review for Healthcare Providers The ABC's of CPR

Simultaneously Determine unresponsiveness and check for effective breathing

If unresponsive: call a "code" or 911

A = Airway- Open airway (head tilt/chin lift)

B = Breaths- Give 2 breaths then back to compressions

C = Circulation- Check for a pulse Max - 10 seconds. If pulse is not definite, begin compressions.

D = Defibrillator- Attach a manual defibrillator or AED

CPR Reference

	Adults (> puberty)	Children (1 - puberty)	Infants (< 1yr)
Rescue breathing, Victim definitely has a pulse	10 breaths/min recheck pulse every 2 minutes	20-30 breaths/min recheck pulse every 2 minutes	20-30 breaths/min recheck pulse every 2 minutes
Compression landmark No pulse (or pulse <60 in infant or child with poor perfusion)	Middle of the chest, between the nipples	Middle of the chest, between the nipples	1 finger below nipple line
Compressions are performed with	Heel of 2 hands	Heel of 1 or 2 hands	2 fingers OR 2 thumbs when using encircling hands technique
Rate of compressions per minute	100-120/min	100-120/min	100-120/min
Compression depth	At least 2 inches ↑ 2 inches	At least 1/3 depth of chest 2 inches	At least 1/3 depth of chest 1 ½ inches
Ratio of compressions to breaths <i>*Once an advanced airway is placed ventilations will be 1 every 6 sec. with continual compressions.</i>	30:2 Change compressors and reevaluate every 2 min	30:2 15:2 if 2 rescuers Change compressors and reevaluate every 2 min	30:2 15:2 if 2 rescuers Change compressors and reevaluate every 2 min

Foreign Body Airway Obstruction

** If not rapidly removed call Emergency Medical Service **

Conscious choking

Adult	Child	Infant
5 Back Blows / 5 Abdominal Thrusts	5 Back Blows / 5 Abdominal Thrusts	5 Back Blows/5 Chest Thrusts

Unconscious choking

Adult	Child	Infant
Call a "code" or call 911 Begin ABC's of CPR Before giving breaths: look in mouth for foreign body, remove object if it is seen. Repeat cycles of CPR if needed	Begin CPR If second rescuer is present, send them to call a "code" or 911, otherwise, call after 2 min of CPR Before giving breaths: look in mouth for foreign body, remove object if it is seen. Repeat cycles of CPR if needed	Begin CPR If second rescuer is present, send them to call a "code" or 911, otherwise, call after 2 min of CPR Before giving breaths: look in mouth for foreign body, remove object if it is seen. Repeat cycles of CPR if needed

PHARMACOLOGY

Ideally, all medications are given through a large bore IV of NS or LR in the antecubital or external jugular. ***If an IV site is unavailable the next choice is Intraosseous (IO).*** In reality use “what ya got.”

For Patients in Cardiac Arrest:

- Give meds rapidly early in sequence during compressions
- Flush all meds with 10-20mL's of fluid
- Circulate meds with 2 minutes of CPR



ENDOTRACHEAL ADMINISTRATION

*The **LEAST** effective route*
(Lidocaine, Epinephrine Atrypine, Narcan)

- 2 - 2.5 times the IV dose
- Stop compressions
- Use at least 10mL's total (dilute in NS or sterile water)
- Ventilate several times
- Resume CPR

Patients in cardiac arrest:

The Rapid Assessment is utilized to obtain information about the emergency. It includes a quick visual survey and a safety assessment to determine the need for additional resources. If the person appears non-responsive, then quickly move on to check for respirations and pulse while calling out for help.

BLS ASSESSMENT (A.B.C. (D))

Determine unresponsiveness and briefly check for effective breathing. If unresponsive, call a “code” or 911.

A = Airway. Assess patency; open via head-tilt/chin-lift technique

B = Breathing –check for respirations & check pulse for 5-10 sec.

C = Circulation- 30 compressions/ 2 breaths

D = Defibrillator - Attach a manual defibrillator or AED

PPRIMARY ASSESSMENT (A.B.C.D)

A (1) - Advanced airway procedures: Reserved for those skilled at these procedures: Tracheal (intubation), or Perilaryngeal tube (LMA, King, Combitube, etc)

B (2) - Breathing: assessed, assured, and secured. Be sure whichever tube is placed is causing chest rise, apply supplemental O₂, then secure the device. Monitor CO₂ once intubated.
Exhaled CO₂ is an effective means for measuring ET placement and the quality of CPR.

C (3) - Circulatory interventions: Establish or confirm vascular access and begin cardiac pharmacology. What is the cardiac rhythm? Hint: in cardiac arrest the first medication is always a vasopressor such as Epinephrine. Then Epi may be administered every 3-5 minutes.

D (4) - Disability: check for neurologic function: Assess for responsiveness, level of consciousness and pupil dialation.
-- AVPU: Alert, Voice, Painful, Unresponsive

E (5) – Exposure: remove necessary clothing to perform a physical exam, look for obvious signs of injury, unusual marking, or medic alert bracelets.

SECONDARY ASSESSMENT

Evaluates differential diagnosis

Sign and symptoms

Allergies

Medications

Past medical history (especially relating to the current illness)

Last oral intake

Events

Potential reversible causes of cardiac arrest: 5 H's & 5 T's:

Hypoxia

Hypovolemia

Hyper/Hypokalemia

Hypothermia

Hydrogen ion (acidosis)

Toxins (overdose)

Thromboemboli - Pulmonary

Thromboemboli - Coronary

Tension Pneumothorax

Tamponade (cardiac)



Post Cardiac Arrest Induced Hypothermia: Targeted Temperature Mgmt.

Numerous studies show improved neurological recovery for post arrest patients who are cooled to the mid 90's F° (32-36°C) following a successful resuscitation if the patient has no appropriate neurological response. The hypothermic state is maintained for 24+ hours.

The methods utilized to induce hypothermia are: Ice cold fluid bolus, use of endovascular catheters, or cold surface applications such as ice packs, cooling blankets etc.

The patient's core temperature should be continuously monitored throughout therapy.

Things to do:

1. Administer oxygen-if needed (Dyspnea, Hypoxia- keep O₂ sat >90 for ACS **or** 94-99% post arrest)
2. Assess and monitor vital and diagnostic signs (Pulse, Respirations, BP, O₂ sat, EKG rhythm)
3. Establish vascular access
4. Obtain 12 lead ECG and Chest X-ray
5. Obtain Labs-bleeding times, cardiac enzymes, etc.

OXYGEN

Indications:

- Cardiac patients with signs of hypoxia (dyspnea, rales, O₂ sat <94% generally. **BUT**<90% specifically in ACS)
- Suspected hypoxia of any cause
- Cardiac arrest

Actions:

- Reverses hypoxia

Dosage:

- Nasal cannula @ 2 - 6 Lpm = 24 - 44% FiO₂
- Simple plastic face mask @ 6 - 10 Lpm = 40 - 60% FiO₂
- Non-rebreather mask @ 10 - 15 Lpm = 90 - 100% FiO₂
- *Patients with inadequate rate or depth of respirations:*
Bag-valve mask @ 10 - 15 Lpm with an oxygen reservoir = 90 - 100% FiO₂

Side effects:

- High amount for extended period O₂ toxicity to cells
- Rare: Possible respiratory depression in a hypoxic drive patient
- NEVER withhold O₂ in patients who need it

Quick tip:

Let the patient's need be your guide. In general:

- Ideally maintain oxygen levels at 94 - 99% S_aO₂
- Monitor closely; high O₂ may cause oxygen toxicity and impede cellular healing
- Ventilate 10 -12 breaths per minute for the apneic patient with a pulse,
10 breaths per minute for the pulseless patient with an advanced airway in place
- Deliver just enough volume to see the chest rise, around 400 - 700mL

EPINEPHRINE

Classification:

Adrenergic (sympathetic) stimulator

Indications:

- Cardiac arrest
- Symptomatic bradycardia refractory to Atropine & transcutaneous pacing (drip only)
- Severe hypotension where fluids are contraindicated or unsuccessful

Actions:

- Positive β effects, including increased heart rate, contractility, and automaticity
- Positive α effects, including peripheral vasoconstriction.

Dosage:

- Bolus: 1mg IV repeat at 3 - 5 minute intervals

Infusion:

- 4mg/250mL's (16 mcg/mL) D5W or NS.
- For Bradycardia: Infuse 2 -10mcg/min (14-70 mL/hr) titrate
- For Hypotension 2-10 mcg/min. Titrate to SBP above 90

Route:

- IV/IO, ET, IV infusion

Side effects:

- Tachycardia, hypertension, increased O₂ demand, PVC's, tachyarrhythmias

ATROPINE

Classification:

Parasympatholytic (blocks acetylcholine from the parasympathetic nervous system)

Indications:

- Symptomatic bradycardia

Actions:

- Increases heart rate and conduction through the AV node.

Dosage:

- Bolus 1.0mg IV. Repeat at 3 - 5 minute intervals, not to exceed 3mg

Route:

- IV/IO, ET

Side effects:

- Tachycardia, dilated pupils, angina. Smaller doses may cause bradycardia

AMIODARONE

Cordarone

Classification:

Antidysrhythmic

Indications:

- VT or VF
- Rapid atrial arrhythmias (Usually not as an initial agent)

Actions:

- Prolongs the recovery period of cardiac cells after they have carried an impulse
- Effects sodium, potassium, and calcium channels and α and β channels

Dosage:

- VF/VT-Cardiac arrest: 300mg IV, may repeat 150mg in 3 - 5min X 1
- Perfusing patients (VT some SVT's): 150mg IV/IO over 10 minutes
 - May repeat in 10 minutes IF NEEDED
- Use infusion (below) for continued stabilization of a converted rhythm

Infusion:

- 900mg/500mL (1.8mg/mL) / Infuse @ 1mg/min (33mL/hr) x 6hrs then 0.5mg/min (17mL/hr)
Max combined daily dose 2.2grams in any 24 hour period

Side effects:

- Hypotension, bradycardia (can be minimized by slowing drug infusion)
- Sinus bradycardia, atrioventricular block
- Congestive heart failure
- Ventricular proarrhythmias (especially if used in conjunction with Procainamide)

Contraindications:

- Marked sinus bradycardia due to severe sinus node dysfunction
- Second- or third-degree AV block
- Cardiogenic shock

AMIODARONE (Continued)

- Note: Early Amiodarone was diluted by some manufacturers in a carrier solution that foams when agitated. Draw up slowly and avoid shaking the drug vial.
- Note: Don't give antidysrhythmic drugs to bradycardic patients. Premature beats still deliver blood. *Remember to stabilize rate, then rhythm, then blood pressure.*

LIDOCAINE

Xylocaine

Classification:

Antidysrhythmic

Indications:

- VF, PVT

Actions:

- Sodium channel blocker
- Depresses ventricular irritability and automaticity
- Increases fibrillation threshold

Dosage:

- VF & Pulseless VT = 1.0 - 1.5mg/kg. Repeat at half dose if necessary. Max: 3mg/kg

Infusion:

- Maintenance Infusion: Mix 2gm/500mL D5W (4mg/mL)
 - Infuse @ 1 - 4mg/min (15 - 60 mL/hr)

Route:

- IV/IO, ET

Side effects:

- Muscle tremors, paresthesias, CNS symptoms – seizures

PROCAINAMIDE

Pronestyl

Classification:

Antidysrhythmic

Indications:

- Supraventricular arrhythmias especially A-fib and A-flutter
- Control of rapid ventricular rate due to accessory pathway in pre-excited atrial rhythms
- Stable monomorphic VT with normal QT interval
- PSVT not controlled by Adenosine

Actions:

- Depresses atrial and ventricular automaticity
- Slows down conduction through all the pacemakers

Dosage:

- 20 - 50mg/min bolus (1gm/50mL @ 60 - 90mL/hr) not to exceed 17mg/kg

Infusion:

- Maint. Infusion: Mix 2gm/500mL D5W (4mg/mL). Infuse @ 1 - 4mg/min (15 - 60 mL/hr)

Side effects:

- Hypotension (especially with rapid injection), widening of QRS complex. Avoid use in patients with preexisting prolonged QT interval and Torsades de Points

End points of administration:

Arrhythmia suppressed, Hypotension develops, QRS widens by 50%, Max dose is (17mg/kg)

ADENOCARD

Adenosine

Classification:

Antidysrhythmic

Indications:

- Supraventricular Tachycardia (specifically Atrial Tachycardia)
 - may try in regular wide tach (aberrant SVT)

Actions:

- Abolishes reentry, slows AV conduction

Dosage:

- 6mg IV/IO rapidly, followed by saline flush. May be repeated at 12mg rapid IV if needed. Decrease dose to half for patients taking Persantine (Dipyridamole) or Tegretol (Carbamazepine)

Route:

- IV/IO push-rapid (Adenosine has less than 10 second half life)

Side effects:

- Transient reentry dysrhythmias, chest pain, palpitations, flushing, headache
- Warn the patient that he may not feel well and push the monitor's record button before pushing the drug. Push...flush...fast!!

CARDIZEM

Diltiazem HCl

Classification:

Antidysrhythmic (Calcium channel antagonists)

Indications:

- Supraventricular tachydysrhythmias (Especially A-fib and A-flutter)

Actions:

- Calcium channel antagonist
- Slows conduction
- Smooth muscle dilation

Dosage:

- 15 - 20mg (0.25 mg/kg) over 2 minutes, may repeat with 25mg (0.35mg/kg) IVP in 15 minutes if needed
- Infusion: Mix 1:1 (eg: 125mg/100mL) (1 mg/mL) infuse at 5 - 15mg/hr

Route:

- IV push slowly and IV infusion

Side effects:

- Bradycardia, hypotension (Do not use in patient with WPW history)
- Note: Reverse calcium channel blocker adverse effects with calcium administration

VERAPAMIL

Isoptin, Calan

Classification:

Antidysrhythmic (calcium channel antagonist)

Indications:

- Supraventricular tachydysrhythmias (Especially Afib and Aflutter)

Actions:

- Calcium channel antagonist
- Slows conduction
- Smooth muscle dilation

Dosage:

- 2.5 - 5mg IVP over 1- 2 minutes
- May repeat at 5 - 10mg after 15 - 30 minutes

Route:

- IV push slowly

Side effects:

- Bradycardia, hypotension (do not use in patient with WPW history)
- May cause bradycardia

DIGITALIS

Lanoxin, Digoxin

Classification:

Cardiac glycoside

Indications:

- CHF (Better for chronic management than acute)
- Chronic Atrial fibrillation

Actions:

- Increases stroke volume by increasing force of contraction
- Slows conduction through the AV node (may cause bradycardia)

Dosage:

- Loading Dosage: 10 - 15mcg/kg lean body weight (usually 0.5 - 1mg)
- Maintenance Dosage: is determined by patient's size, renal function, and blood levels

MAGNESIUM SULFATE

Classification:

Antidysrhythmic (electrolyte)

(Electrolyte, which has antidysrhythmic properties if ectopy is due to hypomagnesemia)

Indications:

- Refractory ventricular dysrhythmias, Torsades de Pointes, hypomagnesemia

Actions:

- Stabilizes tissue membranes (including myocardial cells), elevates Magnesium levels

Dosage:

- VT with a pulse: 1-2gm diluted in 10mL over 1-2 minutes (if thought to be Torsades)
- Refractory VF or pulseless VT (if potentially Torsades): 1-2gm IV push
- Hypomagnesemia without ectopy: 0.5 - 1gm/hr infusion

Route:

- IV Push or IV infusion

Side effects:

- Mild bradycardia, hypotension

Caution:

- Overdosage: diarrhea, paralysis, circulatory collapse

SODIUM BICARBONATE



Classification:

Alkalinizer, buffer

Indications:

- Metabolic acidosis from any cause (arrest, shock, renal failure, ketoacidosis)
- Tricyclic antidepressant overdose
- Hyperkalemia

Actions:

- Increases pH, reverses acidosis

Dosage:

- 1mEq/kg IV push, followed by 0.5mEq/kg every 10 minutes based on ABG's
 - (may be given as a slow infusion in overdoses where bicarb is indicated)

Route:

- IV push or IV infusion

Side effects:

- Hypernatremia, hyperosmolality, metabolic alkalosis
- Note: The "Give one amp of bicarb" routine only works on TV. Unless the patient weighs 50kg, one amp is under-dosing. Pay attention to weight based dosing.

CALCIUM

Calcium Chloride, Calcium Gluconate

Classification:

Electrolyte (calcium ion)

Indications: (*Should not be administered unless these conditions exist*)

- Hypocalcemia
- Hyperkalemia
- Calcium Channel Blocker or Magnesium overdose

Actions:

- Increased inotropic effect, increased automaticity

Dosage:

- *Calcium Chloride:* 2 - 4mg/kg of a 10% solution repeated in 10 minutes if necessary. Usual dose 500mg - 1gm

Route:

- IV/IO

Side effects:

- Hypercalcemia, VF, exacerbates digitalis toxicity

NOREPINEPHRINE

Levophed

Classification:

Adrenergic stimulator (sympathetic nervous system). Vasopressor

Indications:

- Hypotension refractory to Dopamine
- SBP < 70 mmHg and low peripheral resistance

Actions:

- Primarily alpha effects causing an increase in systemic vascular resistance through vasoconstriction

Dosage:

- Mix 4mg/250ml D5W or NS = 16mcg/mL
- Begin infusion at 0.1-0.5mcg/kg/min (8-40mg=30-150mL/hr)

Route:

- IV infusion only

Side Effects:

- Increased myocardial work and oxygen consumption. May cause tachycardia and myocardial ischemia. Severe tissue necrosis if infiltrated

DOPAMINE

Classification: Adrenergic stimulator (sympathetic nervous system), inotrope, and chronotrope

Indications:

- Symptomatic hypotension (SBP 70 -100 mmHg with signs of shock)
- Refractory bradycardia

Actions:

- Beta effects (2 - 10mcg/kg/min): Primarily increased HR & force increasing cardiac output
- Alpha effects (10 - 20mcg/kg/min): Peripheral vasoconstriction, increasing afterload

Dosage:

- 2 - 20mcg/kg/min (usual cardiac dose 5-20mcg/kg/min)
- Mix 800mg/500mL D5W = 1600mcg/mL. Begin @ 5mcg/kg/min & titrate to a systolic BP of 90

Initial drip rate to infuse 5mcg/kg/min = 10% of patient's weight in pounds
Example: 150 lb. patient: Rate = 15mL/hr, 90 lb. patient: Rate = 9mL/hr

Route:

- IV infusion only

Side effects:

- Chest pain, tachydysrhythmias, hypertension, PVC's
- Note: Consider adding fluid volume when administering an inotropic agent if the patient may be hypovolemic.
- Remember Starling's law: "You need stretch of the muscle before you get squeeze".

NITROPRUSSIDE

Nipride

Classification:

Antianginal, antihypertensive

Indications:

- Hypertension
- CHF with PE

Actions:

- Smooth muscle dilator causing a decrease in preload, afterload, and a resulting increase in venous pooling. Works more on the arterial side than nitroglycerine

Dosage:

- Infusion: Mix 50mg/250mL D5W (200mcg/mL) and start at 0.5 – 8 mcg/kg/min (start at: 15mL/hr)

Route:

- IV infusion only

Side effects:

- Hypotension, headache, thiocyanate toxicity possible when metabolized

FUROSEMIDE

Lasix

Classification:

Loop diuretic

Indications:

- Pulmonary edema

Actions:

- Venodilation: causing reduced central venous pressure
- Inhibits the reabsorption of sodium in the kidneys, causing diuresis

Dosage:

- Generally given in 20mg increments (or double the patients PO dose).

Route:

- IV Push slowly

Side effects:

- Dehydration, Tinnitus, Hypokalemia

NITROGLYCERINE

Nitrostat, Tridil

Classification:

Antianginal, Antihypertensive

Indications:

- Angina, MI, CHF (provided patient has SBP > 90 mmHg)

Actions:

- Smooth muscle dilator causing a decrease in preload, afterload, and a resulting increase in venous pooling, thus reducing the workload of the myocardium
- May also reduce coronary artery vasospasm

Dosage:

- Tablet or metered spray: 1 SL (0.3 - 0.4mg dose) every 5 minutes
- Infusion: 10 mcg/min to start (Mix 50mg/250mL = 200mcg/mL. Start at approx. 3mL/hr & titrate)

Route:

- SL, IV infusion

Side effects:

- Hypotension, headache, tachycardia following hypotension

Caution / Avoid:

- Erectile Dysfunction Drugs ex: Viagra & Levitra (24hrs), Cialis (48hrs), Right Ventricular Infarct, Brady or Tachy (without CHF), Hypotension

MORPHINE

Classification:

Narcotic analgesic

Indications:

- Chest pain during STEMI not relieved by 3 doses of NTG
- Pulmonary edema

Actions:

- Potent analgesic
- Promotes venous pooling causing a decrease in preload
- Reduces anxiety

Dosage:

- 2 - 4mg incremental.

Route:

- IV push slowly

Side effects:

- Respiratory depression, Hypotension, Nausea
- Use with caution in unstable angina / Non ST elevated patients (mortality increase noted)

ASPRIN

Classifications:

Anticoagulant, antipyretic, analgesic

Indications:

- Chest discomfort of cardiac nature
- Unstable angina

Actions:

- Blocks formation of thromboxin A2 which is responsible for platelet aggregation and vasoconstriction, thus keeping platelets from becoming lodged in partially occluded coronary vessels.

Route:

- Oral

Dosage:

- 160 - 325mg chewable tablets

BETA BLOCKERS

Metoprolol (Lopressor), Sotalol (Betapace), Esmolol (Breviblock)

Classification:

Beta Adrenergic Blocker

Indications:

- Secondary management ACS after patient is stable; usually 6-8 hours
- Supraventricular tachydysrhythmias, refractory to other therapies

Actions:

- Decreases heart rate, stroke volume, automaticity, and conductivity (may cause bradycardia)

Dosage:

- Metoprolol (Lopressor): 5mg; may repeat in 5 minutes to max of 15mg
- Sotalol (Betapace): 100mg over 5 minutes (for VT)
- Esmolol (Brevibloc): Load with 500mcg/kg over 1 min, then maintenance = 50mcg/kg over 4 min, (may repeat loading and increase maintenance if unsuccessful)

Route:

- Depends on the drug
 - *Oral doses are generally used unless acutely hypertensive

Contraindications:

- CHF, Hypotension, Cardiogenic shock, Acute Heart Failure, Asthma, Bradycardia, Heart Blocks

CLOPIDOGREL

Plavix

Classification:

Anticoagulant

Indications:

- ST segment elevation MI (STEMI)
- High risk ST depression or T wave inversion
- Patients with planned PCI
- Antiplatelet therapy in patients who cannot take Aspirin (especially during ACS)

Actions:

- Blocks ADP which inhibits glycoprotein and the effectiveness of the clotting process

Dosage:

- 300mg po initially, followed by 75mg po daily (reduce initial dose for elderly)

Considerations:

- Caution in patients with hx of bleeding. Contraindicated in patients actively bleeding
- Metabolized by the liver - caution in patients with impaired hepatic function
- Do not administer if cardiac surgery planned in the near future

FIBRINOLYTICS

rtPA (Alteplase), Retavase (Reteplase), Tenecteplase (TNK)

Classification:

Fibrinolytic

Indications:

- AMI less than 12 hours old with 12 lead EKG showing ST elevation in 2 related leads
- Acute ischemic stroke of less than 3 hours with no bleed on CT scan

Actions:

- Lysis of fibrin, which holds together thrombi blocking coronary or cerebral arteries.
- Decrease in thrombus size allows enhanced blood flow distal to the clot and decreases the size of the infarct.

Dosage:

- Tenecteplase (TNK): Single bolus 30 - 50mg (depending on weight) IVP over 5 seconds
- Reteplase (Retavase): 10 Units IV followed by a 10 unit bolus 30 minutes apart
- Alteplase (Activase-tPA): 15mg IV bolus, then 0.75mg/kg over 30 minutes, then 0.5 mg/kg over 60 min
- *Activase for stroke: 0.9mg/kg (max. 90mg) 10% as bolus and remaining over 60 minutes

Side effects:

- Bleeding, allergic reaction, reperfusion arrhythmias

Contraindications:

- Active bleeding, hemorrhagic stroke, intracranial neoplasm, aortic dissection
- There are also numerous relative contraindications for physician consideration

HEPARIN

Classification:

Anticoagulant

Indications:

- Patients undergoing angioplasty
- Selected patients receiving fibrinolytic therapy
- In MI patients for pulmonary embolism prophylaxis until fully ambulatory

Actions:

- Prevents conversion of fibrinogen to fibrin and prothrombin to thrombin to inhibit clotting

Dosage:

- Bolus dose of 60U/kg followed by infusion of 12U/kg/hr

Side effects:

- Hemorrhage, thrombocytopenia

Contraindications:

- Active bleeding, peptic ulcer disease, severe hepatic disease, hemophilia

LOW MOLECULAR WEIGHT HEPARIN (FRACTIONATED HEPARINS)

Enoxaparin (Lovenox), Dalteparin (Fragmin)

Classification:

Anticoagulant

Indications:

- Chest pain with ST depression or positive cardiac markers

Actions:

- Inhibit clotting factor Xa. Only slightly effects thrombin, PT and PTT

Dosage:

- Enoxaparin (Lovenox): 30mg IV bolus in STEMI, then 1mg/kg SQ every 12 hrs
- Dalteparin (Fragmin): 120U/kg SQ every 12 hrs x 5 - 8 days

Contraindications:

1. Sensitivity to Heparin or pork products
2. Caution in patients with heparin induced thrombocytopenia, elderly, renal insufficiency

Adverse reactions:

- Bleeding, ecchymosis
- Spinal column hematomas in patient's post spinal or epidural anesthesia

GLYCOPROTEIN IIb/IIIa INHIBITORS

ReoPro (Abciximab), Aggrastat (Tirofiban), Integrilin (Eptifabide)

Indications:

- Chest pain with ST segment depression
- Non Q wave MI
- Unstable Angina

Action:

- Blocks enzyme glycoprotein IIb/IIIa, which is essential for platelet aggregation

Dosage:

- Eptifabide (Integrelin): 180mcg/kg IV over 1 - 2 min followed by infusion of 2mcg/kg/min (decrease to 0.5mcg/min pre cardiac cath). Drug available in 100mL bolus vials and 100mL infusion vials, which can be spiked directly for administration.
- Tirofiban (Aggrastat): Infuse 0.4mcg/kg/min x 30 min and then 0.1mcg/kg/min for 18 - 24 hrs
- Abciximab (ReoPro): 0.25mg/kg IV followed by infusion of 1mcg/min for 18 - 24 hrs

Side effects:

- Bleeding (more likely in females, pt < 75 lbs, > 65yr, hx of GI disease, or receiving fibrinolytics)
- Nausea, vomiting, hypotension, bradycardia
- Further risk of bleeding when used in combination with Aspirin and Heparin

Contraindications:

- Active internal bleeding / bleeding in past 30 days. Platelets < 100,000
- B/P Systolic >180, Diastolic >100

ACE INHIBITORS

Enalapril (Vasotec), Captopril (Capoten), Lisinopril (Prinivil)

Classification:

Antihypertensive

Action:

- Selectively suppresses the renin-angiotensin-aldosterone system
- Inhibits conversion of angiotensin I to angiotensin II, resulting in dilation of arterial & venous vessels
- Attenuates cardiac remodeling post MI

Indications:

- Hypertension, CHF
- Post MI (first 24 hours then long term)

Dosage:

- Vasotec: 5 - 40mg po Q day, 0.625 - 1.25mg IV over 5 min every 6hr
- Capoten: 12.5 - 50mg po BID/TID
- Prinivil: 10 - 40mg po Q day

Route:

- IV, PO

Side effects:

- Hypotension, chest pain, tachycardia, dysrhythmias

Good to Know!

Bag Valve Masks (BVM) can be used to assist ventilations in a non, or insufficiently breathing individual. They are best utilized by 2 people for adequate seal.

-Depress the bag slowly over 1 second and watch for chest rise. Depress only half the bag.

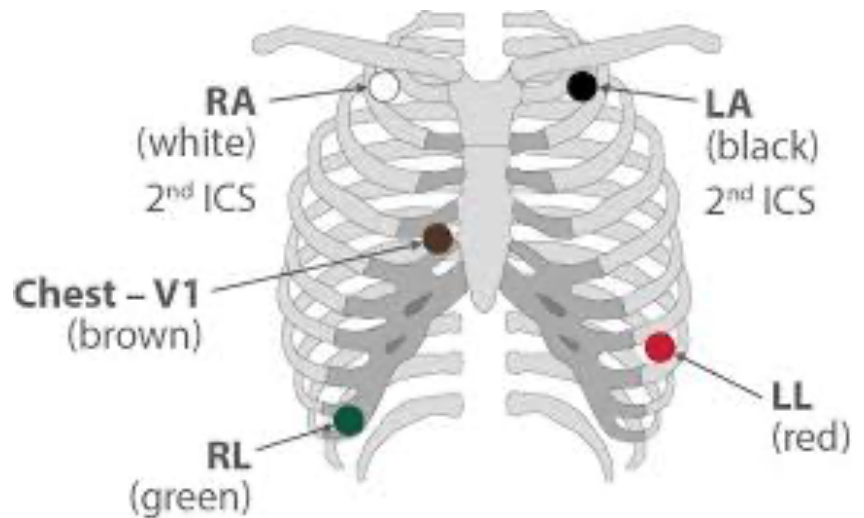
-Complications may include: decreased cardiac output, gastric insufflation
barotrauma, pneumothorax (watch for increased difficulty to bag)

Prognostication: a prediction of future medical outcomes following ROSC in the comatose patient. Necessary for decision making related to the continuation of life support.

-Multimodal based (@72 hrs) based on clinical exam, imaging, biomarkers and electrophysiology

-Includes: TTM, corneal reflex, Electrophysiology, serum NSE, Brain imaging/EEG/CT

EKG Points:



EKG Rhythm Strip:

Utilizes 3-5 leads to record the electrical signals in the heart. Specifically measuring rate, regularity and origin of the activity. Proper lead placement is required to obtain a clear and accurate image.

12 Lead EKG: evaluates for evidence of decreased coronary artery blood flow (STEMI).

Requires a specific 12 lead unit with 10 electrode cables properly placed to obtain an accurate image

STEMI: or ST-segment elevation: myocardial infarction, is characterized by new ST-segment elevation at the J point, of at least 1mm (0.1mV) in 2 related leads, which may indicate myocardial infarction.

OR

NSTE-ACS, or non-ST-segment elevation ACS, is characterized by ST-segment depression, T-wave inversion or transient T-wave elevation. May be indicative of unstable angina (UA) as well. Cardiac enzyme evaluation (Troponin) is utilized to diagnose myocardial injury, which is considered NSTEMI.

Unstable angina-often presents with complaints of chest pain, but displays no ST-segment elevation (NSTEMI), and normal cardiac serum markers. This patient will require further cardiology assessment and monitoring, as serum markers (cardiac enzyme test) could later become elevated and denote a high risk indication for further progression.

Common physical signs of hemodynamic imbalance: (ventricular dysfunction)

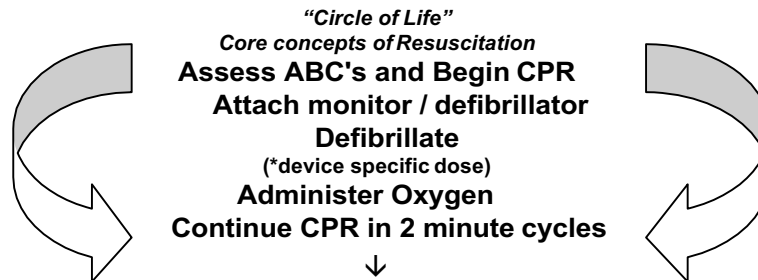
Left Ventricular Failure: hyper or hypotension, crackles, weak peripheral pulses

Cardiogenic Shock: hypotension, cool clammy skin

12 Lead ECG Management Goals:

- ✓ Identify patients with STEMI and determine their options for early intervention
- ✓ Relieve the ischemic chest pain
- ✓ Assess and manage complications

VENTRICULAR FIBRILLATION or PULSELESS VENTRICULAR TACHYCARDIA



↓
[Secondary procedures]
**Secure Airway and Establish IV or IO with
NS or LR during CPR**

↓
***Defibrillate @ device specific dose**
Continue CPR 2 minutes

↓
Given during CPR
Epinephrine 1mg
(Continue Epinephrine Q 3-5 min.)

↓
***Defibrillate @ device specific dose**
Continue CPR 2 minutes

↓
Antidysrhythmic of choice
Given during CPR

Amiodarone 300mg OR
Lidocaine 1-1.5 mg/kg

↓
***Defibrillate @ device specific dose**
Continue CPR 2 minutes


Repeat Sequence of CPR 2 min-Defibrillate-1 Medication
Repeat Epinephrine Q 3-5 minutes
Repeat Amiodarone 150mg 1x
OR
Lidocaine 0.5 - 0.75mg/kg up to 3mg/kg max

*Device specific dose relates to the type and brand of defibrillator used and may range from 120 joules to 360 joules depending on your specific machine.

***Biphasic** 120 – 200J (initial)
*subsequent dose = to, or greater than first dose
***Monophasic** 360 J
*If unknown, use max dose

*Subsequent shocks may be at the same or higher dose.

*Become familiar with the recommendations of your specific defibrillator

 Tips for successfully managing this case:

- ⚡ Don't forget:
- Continue CPR
 - Throughout and for 2min between shocks
 - Monitor for effective CPR - Use ETCO₂
 - 2" compression
 - Full recoil
 - No rush to intubate
 - Start/upgrade IV or IO
 - Gather focused history

Primary goal: continue effective CPR followed by rotating medications.

*Verbalize appropriate drug, dose, route, flush, and reevaluate patient every 2 minutes.

Once a rhythm is restored, maintain ventilations as appropriate then stabilize in order:

1. rate
2. rhythm
3. blood pressure

Evaluate for & treat reversible causes anytime during the sequence

Hypoxia
Hypovolemia
Hydrogen ion (Acidosis)
Hyper/Hypokalemia
Hypothermia

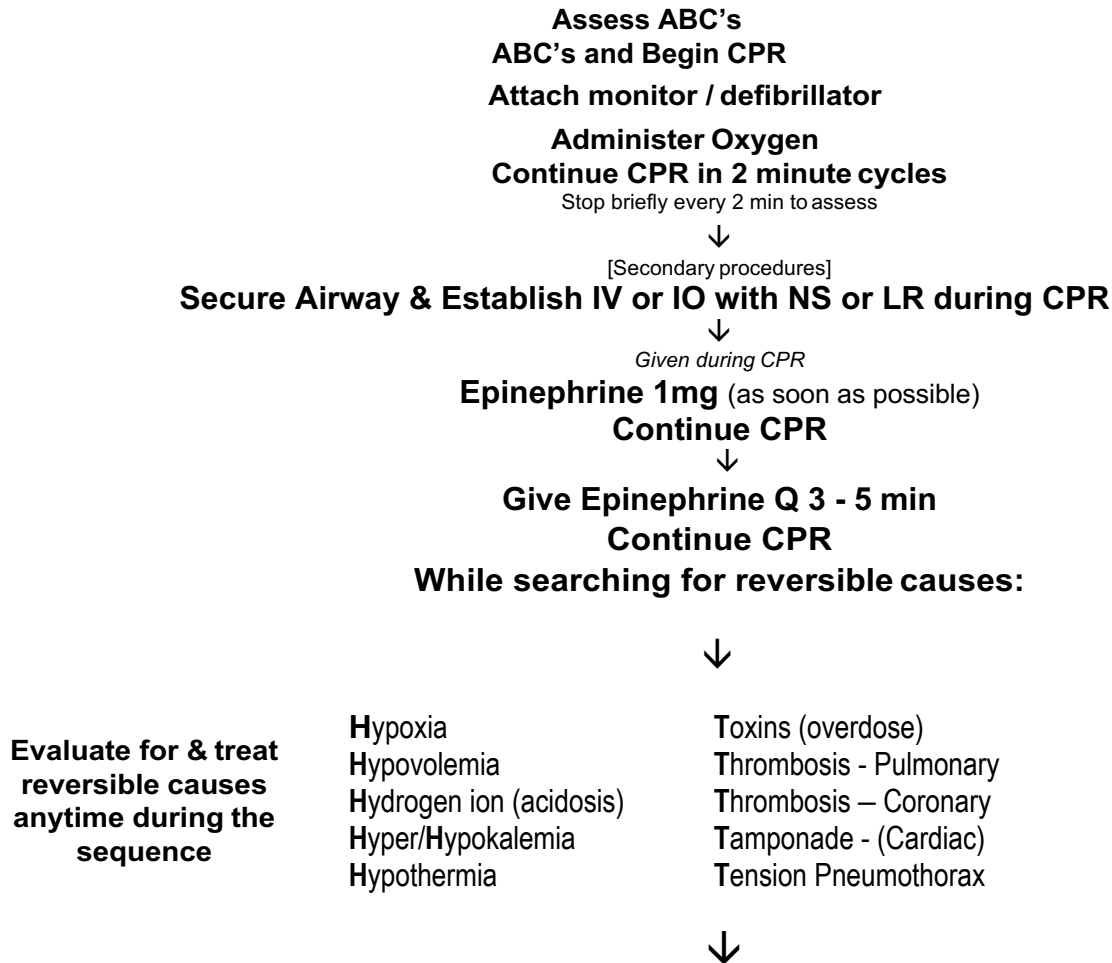
Toxins (overdose)
Thrombosis - Pulmonary
Thrombosis - Coronary
Tamponade - (Cardiac)
Tension Pneumothorax



Quick tip

The sequence should be:
CPR → Drug → Shock → CPR

ASYSTOLE or PULSELESS ELECTRICAL ACTIVITY (PEA)



***If patient remains in asystole or other agonal rhythms after successful airway control and appropriate medications and no reversible causes are identified, over 20 minutes, consider termination of resuscitative efforts**



Tips for successfully managing this case:

- ☞ Don't forget:
- Continue CPR throughout
 - Monitor for effective CPR - Use ETCO₂
 - 2" compression
 - Full recoil
 - No rush to intubate
 - Start/upgrade IV or IO
 - Gather focused history

Primary goal: continue effective CPR followed by rotating medications.

*Verbalize appropriate drug, dose, route, flush, and reevaluate patient every 2 minutes.

Once a rhythm is restored, maintain ventilations as appropriate then stabilize in order:

1. Rate
2. Rhythm
3. Blood pressure



To work on Asystole or PEA:

Think **DEAD**: **D**o CPR, **E**pi, **A**nd, **D**o it again or

Think **PEA** (for both PEA and Asystole) **P**ush **E**pi **A**nd... Consider the cause

POST ARREST CARE

Return of spontaneous circulation (ROSC)



Optimize Ventilation and Oxygenation

Secure airway as appropriate

Maintain respiratory rate approximately 10/min

Maintain oxygen saturation 94-99%

Maintain PaCO₂ 35-45mmHg

Maintain exhaled ETCO₂ 35-45 mmHg



Optimize Cardiac Function



Stabilize Heart Rate
(above 60 BPM)

**Only if needed:
Stabilize Rhythm**
Antiarrhythmic Infusion
or

(bolus and infusion for serious ectopy)



Stabilize Blood Pressure
Fluids up to 1-2 liters
Vasoactive Infusions



Advanced Critical Care



12 Lead ⊕ for STEMI
↓
Consider PCI Center



**Inappropriate Neurological
Response**
(not following commands)



**Induce Targeted
Temperature Management**
(32 – 36°C)



Monitor, Address, and Maintain All:

Hypoxia
Hypovolemia
Hydrogen ion (Acidosis)
Hyper/Hypokalemia
Hypothermia

Toxins (overdose)
Thrombosis - Pulmonary
Thrombosis - Coronary
Tamponade (Cardiac)
Tension Pneumothorax



While much of this is done simultaneously, the general mode of treatment is:

Stabilize the **Rate** → Stabilize the **Rhythm** → Stabilize the **Blood Pressure**

Excessive Ventilation

Although the delivery of oxygen is important to support breathing after ROSC some tips to keep in mind:

- Avoid **hyperventilation** due to potential for increased intrathoracic pressure, decreased cardiac output and decreased blood flow to the brain
- Titrate oxygen to achieve O₂ sat ≥94-99%. **Hyper-oxygenation** may cause cellular toxicity

SYMPTOMATIC BRADYCARDIA

(hypotension, ventricular ectopy)

Assess and maintain ABC's

Administer O₂ if needed

Assess vitals

Apply monitors (EKG, Pulse Ox, B/P)

Targeted history / Physical exam

Establish IV access



Evaluate rhythm

Wide complex 3rd degree
or 2nd degree type II heart block?



YES

May attempt
Atropine



Prepare for
transcutaneous
Pacemaker,
Dopamine or
Epi-infusion



Prepare for
transvenous
pacemaker

NO



Atropine 1.0mg IVP (repeat q 3 - 5 min, max 3mg)



If unsuccessful and seriously symptomatic



Apply transcutaneous pacemaker @ 60 BPM

or

Dopamine infusion

5-20mcg/kg/min titrate to heart rate >60
(not to exceed 20mcg/kg/min)

or

Epinephrine infusion

2-10 mcg/min titrate to heart rate >60



Prepare for transvenous pacemaker if needed



Tips for
successfully
managing this case:

⚡ Don't forget:

- Administer O₂ if needed
- Start/upgrade IV

*Determine whether patient is stable or unstable
-Gather data
-Get vital signs
-Attach monitor(s)
-EKG
-Pulse oximeter
-BP

Start with:

- Level of consciousness
- Blood pressure
- Lung sounds
- Presence/absence of chest pain
- Gather problem focused history

*Your goal:
Control the rate, improve perfusion and maintain a normal rhythm

*Verbalize appropriate drug, dose, route flush, and reevaluate patient after each intervention



Quick Tip

For symptomatic bradycardia's:

After In Don't Eat : Atropine, Transcutaneous Pacemaker, Dopamine Infusion, Epinephrine Infusion

Bradycardias

Bradycardias are treated if the patient is symptomatic. ie,- has signs of poor perfusion or PVC's

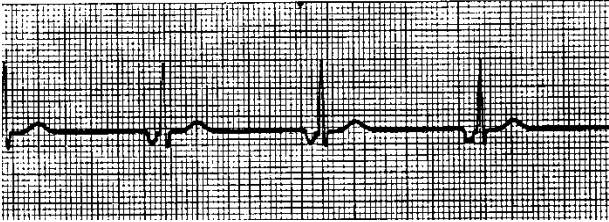
Junctional Escape Rhythm

When higher pacemaker sites fail, the AV JUNCTION takes over. The atria are depolarized via retrograde conduction. Ventricular conduction is normal

REGULARITY: The rhythm is regular

RATE: Usually 40 - 60

P-WAVES: The P-wave can come before or after the QRS complex, or it can be lost entirely within the QRS



Idioventricular Rhythm

In the absence of a higher pacemaker, the VENTRICLES initiate a regular impulse at their inherent rate of 20 - 40 beats/minute

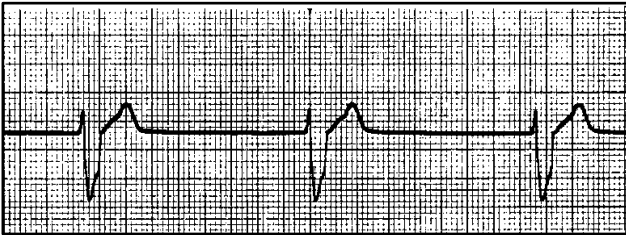
REGULARITY: Is usually regular

RATE: Is usually 20 - 40 beats per minute

P-WAVES: No P-waves in this arrhythmia

PRI: There is no PRI

QRS: The QRS complex is wide and bizarre



First Degree Heart Block

The AV NODE holds each sinus impulse longer than normal before conducting it through the ventricles. Each impulse is eventually conducted. Once into the ventricles, conduction proceeds normally.

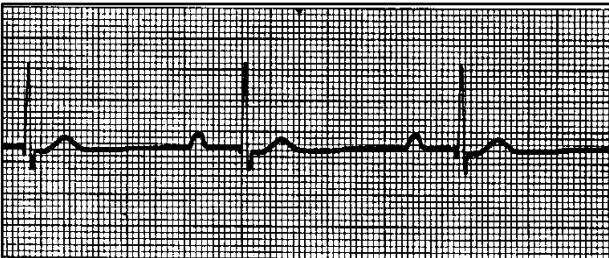
REGULARITY: This will depend on the regularity of the underlying rhythm

RATE: Will depend on the rate of the underlying rhythm

P-WAVES: The P-waves will be upright and uniform. Each P-wave will be followed by a QRS complex.

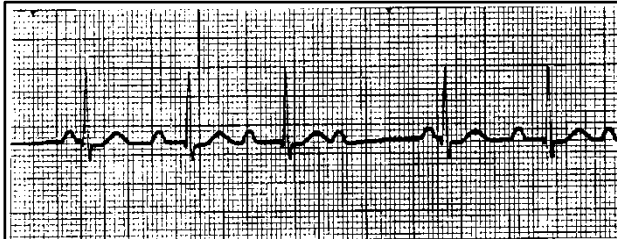
PRI: The PRI will be constant across the entire strip, but it will always be greater than .20 seconds.

QRS: The QRS complex measurement will be less than 0.12 seconds



Heart Blocks

In the acute setting, heart blocks are treated as bradycardias. However, there is some controversy over whether to use Atropine in the MI setting. Also, for wide 3° blocks and 2° type II blocks, many experts choose to avoid Atropine and apply the pacemaker or chronotropic infusions.



Wenckebach (Mobitz Type I)

As the sinus node initiates impulses, each one is delayed in the AV NODE a little longer than the preceding one, until one is eventually blocked completely. Those impulses that are conducted travel normally through the ventricles.

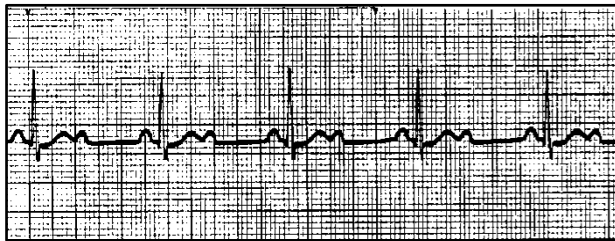
REGULARITY: Irregular in a pattern of grouped beating.

RATE: Since some beats are not conducted, the ventricular rate is usually slightly slower. The atrial rate is normal.

P WAVES: Upright and uniform. Some P waves are not followed by QRS complexes.

PRI: Get progressively longer, until on P wave is not followed by a QRS complex. After the blocked beat, the cycle starts again.

QRS: The QRS complex measurement will be normal



Classic Second Degree Heart Block (Mobitz Type II)

The AV NODE selectively conducts some beats while blocking others. Those that are not blocked are conducted through to the ventricles.

Once in the ventricles, conduction proceeds normally.

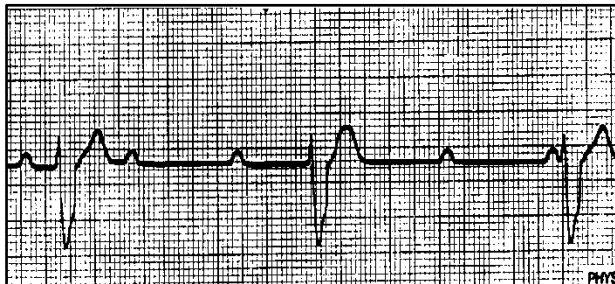
REGULARITY: If the conduction ratio is consistent, the rhythm will be regular. If the conduction ratio varies, the rhythm will be irregular.

RATE: The atrial rate is usually normal. Since many of the atrial impulses are blocked, the ventricular rate will usually be in the bradycardia range.

P WAVES: Upright and uniform. There are more P waves than QRS complexes.

PRI: Conducted beats will be constant.

QRS: The QRS complex measurement will be normal



Complete (3°) Heart Block

The block between the atria and the ventricles is complete. The sinus beats are not conducted through to the ventricles. An escape mechanism from either the junction (if the block is high in the AV node) or the ventricles (if the block is in the bundle branches) will take over to pace the ventricles. The atria and the ventricles function in a totally dissociated fashion.

REGULARITY: Both the atria and the ventricles are firing so the P-P intervals and the R-R intervals are regular.

RATE: The atrial rate will usually be in a normal range. The ventricular rate may be 20-60.

P WAVES: More P waves than QRS complexes.

PRI: No atrial impulses conducted to the ventricles. The P-waves have no relationship to the QRS complexes. May occasionally see a P-wave on or near a QRS complex.

QRS: If the ventricles are being controlled by a junctional focus, the QRS complex will measure less than .12 sec. If the focus is ventricular the QRS will be wide.

For Stabilization of Rhythm after VF or VT Conversion

Evidence recommends treating the underlying cause rather than treating the PVC's unless the PVC's occur frequently or in groups (i.e. Salvos or VT). "Routine use not recommended".

Assess and maintain ABC's

Administer O₂ if needed

Assess vitals

Apply monitors (EKG, B/P, Resp Pulse Ox)

Targeted history/ Physical exam

Establish IV access

Look for underlying causes and consider whether pharmacologic intervention is appropriate. If indicated:



Antidysrhythmic of choice

May bolus, if not already done

Otherwise, move to infusion section below

Procainamide 20-50 mg/min—follow guidelines, or

Amiodarone 150mg over 10 min, or

Sotalol 100mg over 5 min.

OR

Lidocaine 0.5-1.5mg/kg



Repeat antidysrhythmic if needed



If effective, consider an antidysrhythmic infusion of the agent used in the bolus

Infusions:

Amiodarone 1mg/min for 6 hours (900mg in 500mLs @ 33mLs/hr)

Then 0.5mg/min for 18 hours (17mLs/hr)

OR

Lidocaine or Procainamide 1 - 4mg/min (2grams in 500mLs @ 15mLs/hr)



Quick tip

Generally choose only 1 antidysrhythmic until expert consult:

- Amiodarone bolus can be given 1x then repeated every 10 minutes (max 2.2 grams in 24 hrs bolus & infusion)
- Lidocaine bolus 1 - 1.5mg/kg then repeated @ half doses to max of 3mg/kg
- Procainamide 20 - 50mg/min to max of 17mg/kg
- Sotalol 100 mg (1.5mg/kg) over 5 min
- Magnesium 1 - 2 grams over several minutes (ok to mix with others if needed)

HYPOTENSION

(Symptomatic with systolic < 90 mmHg)

Assess and maintain ABC's

Administer O2 if needed

Assess vitals

Apply monitors (EKG, B/P, Resp Pulse Ox)

Review history/ Physical exam

Establish IV access



Administer fluid bolus' (1-2 liters)

(If lung sounds are clear)



If needed and lung sounds are still clear
Repeat fluid bolus



← Reassess BP →
If still low



Dopamine drip 5-20mcg/kg/min

(not used as often)
(generally start at 5mcg/kg/min)
(not to exceed 20mcg/kg/min)

May Consider:

Norepinephrine:

If SBP <70 and patient
has signs of shock
0.1-0.5 mcg/kg/min

May Consider:

Epinephrine infusion

2-10mcg/min IV

***Reminder: Treat the rate, then the rhythm, then the blood pressure**



Quick tip:

If hypotension is caused by a dysrhythmia, FIX THE RHYTHM:

- Try to identify cause of hypotension (hypovolemia, pump failure, profound vasodilation) to help identify the most effective treatment.
- Watch for unwanted cardiac symptoms such as tachycardia or ectopy when using Norepinephrine, Dopamine, or Epinephrine.

SUPRAVENTRICULAR TACHYCARDIA STABLE

Narrow complex, rate over 150- no signs of Afib or A Flutter

(Maintaining adequate mentation, blood pressure, respiratory status & absence of serious chest pain)

Assess and maintain ABC's

Administer O₂ if needed

Assess vitals

Apply monitors (EKG, B/P, Resp, Pulse Ox)

Targeted history/ Physical exam

Establish IV access

RULE OUT NON CARDIAC CAUSES



Consider ordering:

Atrial fib/flutter? See AF algorithm (next page) ← (12 lead ECG, Cardiac enzymes, CXR)
(Expert cardiology consult)



Vagal Maneuvers



Adenosine 6mg IVP rapidly followed by flush

If unsuccessful, additional dose of

Adenosine 12mg IVP rapidly followed by flush



If rhythm fails to convert



Choose 1:

Calcium Channel Blocker (one)

Diltiazem 15 - 20mg may repeat 20 - 25 mg in 15 minutes

OR

Beta Blocker (one)

Metoprolol (Lopressor) 5mg over 5 minutes may repeat Q 5 minutes X 2

Atenolol (Tenormin) 5mg over 5 minutes may repeat in 10 minutes



If rhythm still fails to convert



May choose sedation and elective cardioversion or other medications based on a more definitive diagnosis-



Tips for successfully managing this case:



- Don't forget:
- Administer O₂ if needed
 - Start/upgrade IV

*Determine whether patient is stable or unstable

- Gather data
- Get vital signs
- Attach monitor(s)
- EKG
- Pulse oximeter
- BP

Start with:

- Level of consciousness
- Blood pressure
- Lung sounds
- Presence/absence of chest pain
- Gather problem focused history

*Your goal:

Control the rate, improve perfusion and maintain a normal rhythm

*Verbalize

appropriate drug, dose, route, flush, and reevaluate patient after each intervention.

Rates less than 150 = sinus tach

*underlying cause usually systemic:

- Anxiety
- Dehydration
- Infection
- Hypoxia

Treat accordingly

ATRIAL FIBRILLATION STABLE WITH RAPID VENTRICULAR RESPONSE

Sustained rate over 150

(maintaining adequate mentation, blood pressure, respiratory status, & absence of chest pain)

Assess and maintain ABC's

Administer O₂ if needed

Assess vitals

Apply monitors (EKG, B/P, Resp Pulse Ox)

Targeted history/ Physical exam

Establish IV access



Consider ordering:

(12 lead ECG, Cardiac enzymes, CXR) (Expert cardiology consult)



Control rate with: Choose 1:

Calcium Channel Blocker

Diltiazem 15 - 20mg may repeat 20 - 25mg in 15 minutes

(consider infusion)

OR

Beta Blocker

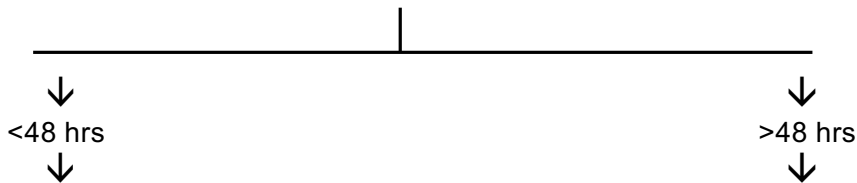
Metoprolol (Lopressor) 5mg over 5 minutes

may repeat Q 5 minutes X 2

May choose other Beta blockers: Atenolol, Esmolol

Convert rhythm after expert cardiology consult?

Duration of fib?



Convert rhythm by the same means as the patient who had emboli ruled out

Delay rhythm conversion unless unstable:

R/O emboli or Anticoagulation up to 4 weeks

**Once emboli R/O, May consider any of the following:*

1. Elective cardioversion.
~ Start: 120 - 200J Biphasic / 200J Monophasic
2. Amiodarone 150mg over 10min then infusion
3. Digitalis 10 - 15mcg/kg (0.5 - 1.0mg)

**Be cautious with medications that may convert A-fib prior to cardiac consult (Amiodarone)*

**A history of atrial fibrillation increases a patient's stroke risk*



Tips for successfully managing this case:

- ☞ Don't forget:
 - Administer O₂ if needed
 - Start/upgrade IV

*Determine whether patient is stable or unstable

- Gather data
- Get vital signs
- Attach monitor(s)
- EKG
- Pulse oximeter
- BP

Start with:

- Level of consciousness
- Blood pressure
- Lung sounds
- Presence/absence of chest pain
- Gather problem focused history

*Your goal:

Control the rate, improve perfusion and maintain a normal rhythm

*Verbalize appropriate drug, dose, route, flush, and reevaluate patient after each intervention.

SUPRAVENTRICULAR TACHYCARDIA UNSTABLE

(Any SVT with a rate over 150 with decreased LOC, hypotension, pulmonary edema, or chest pain)

Assess and maintain ABC's

Administer O₂ if needed
Assess vitals
Apply monitors
(EKG, Pulse Ox, B/P)

RULE OUT NON CARDIAC CAUSES



Brief history
IV/IO access
(do not delay cardioversion)



Immediate management

Sedation
(if conscious and B/P allows)



← **Synchronized cardioversion**
Start at 50-100j

(based on machine - could increase stepwise between 120-360J)

If unsuccessful: medication sequence for stable



Tips for successfully
managing this case:

⚡ Don't forget:

- Administer O₂ if needed
- Start/upgrade IV

- Determine whether patient is stable or unstable
- Gather data
- Get vital signs
- Attach monitor(s)
- EKG
- Pulse Oximeter
- BP

Start with:

- Level of consciousness
- Blood pressure
- Lung sounds
- Presence/absence of chest pain
- Gather problem focused history

*Your goal:

Control the rate; improve perfusion and maintain a normal rhythm

*Verbalize appropriate drug, dose, route, flush, and reevaluate patient after each intervention



Quick tip:

If tachycardic and awake (or otherwise stable) first we try to medicate

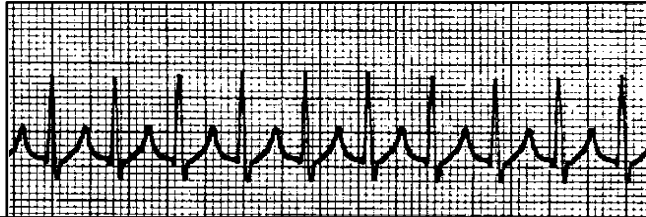
If tachycardic with a nap (or otherwise unstable) then the treatment is Zap Zap Zap!

Tachycardias

Tachycardias fall into one of two categories. Wide or Narrow and Stable or Unstable

- Consider wide rhythms to be Ventricular in origin
- Consider narrow rhythms to be Supraventricular in origin

Unstable Tachycardias are those with decreased LOC, hypotension, pulmonary edema, or chest pain. These patients require synchronized cardioversion.



Atrial Tachycardia

The pacemaker is a single irritable site within the ATRIUM which fires repetitively at a very rapid rate. Conduction through the ventricles is normal.

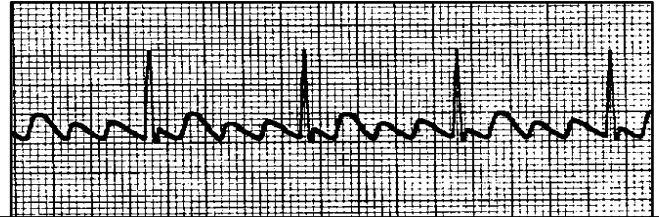
REGULARITY: Regular

RATE: Usually 150-250

P-WAVES: There is one P-wave for every QRS but it is usually hidden in the T-wave. As P-wave & T-wave come together they make a peak between complexes

PRI: Normal, but P-wave is hidden in the T-wave.

QRS: Should be normal width



Atrial Flutter

A single irritable focus within the ATRIA issues an impulse that is conducted in a rapid, repetitive fashion. To protect the ventricles from receiving too many impulses, the AV node blocks some of the impulses from being conducted through to the ventricles.

REGULARITY: May be regular or irregular

RATE: Atrial rate is 250-350 beats/min

P-WAVES: Ventricular rate may range from normal to tachy. In atrial flutter produce a saw tooth appearance.

PRI: Because of the unusual configuration of the Flutter and the proximity of the wave to the QRS complex, it is often impossible to determine a PRI.

QRS: Should be normal width



Atrial Fibrillation

The ATRIA are so irritable that they rapidly initiate impulses, causing the atria to depolarize repeatedly in a fibrillatory manner. The AV node blocks most impulses, allowing only a limited number through to the ventricles. May increase stroke risk!

REGULARITY: The ventricular rate is grossly irregular

RATE: The atrial rate cannot be measured because it is over 300. The ventricular rate may range from bradycardia to severe tachycardia.

P-wave: The atria are fibrillating. No distinct P's

PRI: No PRI can be measured.

QRS: Usually normal.



Ventricular Tachycardia

An irritable focus in the VENTRICLES fires regularly at a rate of 150-250 to override higher sites for control of the heart.

REGULARITY: Usually regular

RATE: Atrial rate cannot be determined. Ventricular rate range is 150-250.

P-WAVES: None of the QRS complexes will be preceded by P-waves. You may see dissociated P-waves intermittently.

PRI: Since the rhythm originates in the ventricles, there will be no PRI.

QRS: Wide and bizarre.

VENTRICULAR TACHYCARDIA STABLE

(Maintaining adequate mentation, blood pressure, respiratory status, and absence of chest pain)
Wide complex, rate over 150, regular with no P waves or signs of A-fib or flutter

Assess and maintain ABC's

Administer O₂ if needed

Assess vitals

Apply monitors
(EKG, Pulse Ox, B/P)

Targeted history/ Physical exam

Establish IV access



(Consider ordering)
(12 lead ECG, Cardiac enzymes, CXR)
(Cardiology consult)



← **Preferred Antidysrhythmic**



Consider the following at any time



Sedation and synchronized cardioversion
Begin at 100j, and increase PRN.
(based on machine –
could increase stepwise between 120-360J)

Prepare an infusion of the antidysrhythmic
medication used if conversion is successful



Tips for successfully
managing this case:

☞ Don't forget:

- Administer O₂ if needed
- Start/upgrade IV

- Determine whether patient is stable or unstable
- Gather data
- Get vital signs
- Attach monitor(s)
- EKG
- Pulse oximeter
- BP

Start with:

- Level of consciousness
- Blood pressure
- Lung sounds
- Presence/absence of chest pain
- Gather problem focused history

*Your goal:

Control the rate, improve perfusion and maintain a normal rhythm

*Verbalize appropriate drug, dose, route, flush, and reevaluate patient after each intervention

May use: (generally only one):

Procainamide 20-50 mg/min
~Or~

Amiodarone 150 mg IV drip
over 10 min
(May repeat 150 mg IV)
~Or~

Sotalol 100 mg over 5 min
~Or~

Magnesium 1 - 2 gm IV
for Torsades or
suspected hypomagnesemia



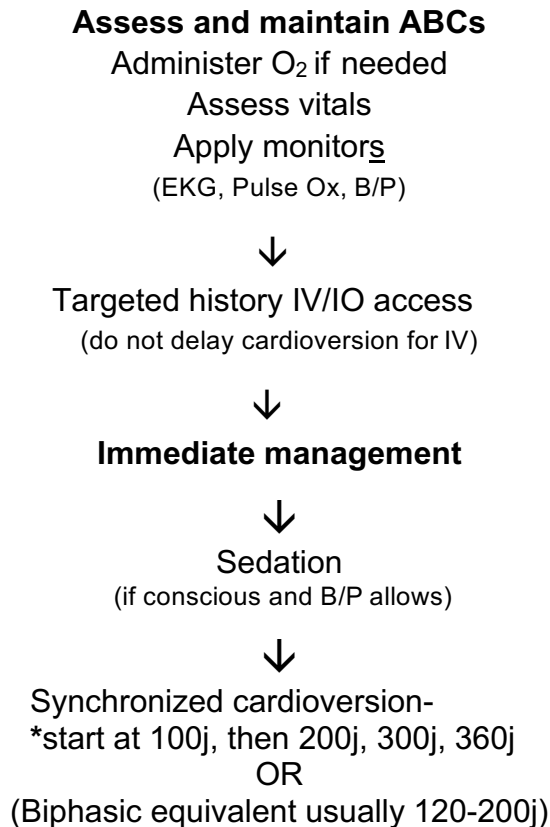
Quick tip

Find the cause:

Patients don't have Ventricular Tach because they are low on Amiodarone (or any other antidysrhythmic). Medications are a temporary "Band-Aid" for ventricular irritability, but it is likely to recur if the cause is not diagnosed and treated.

VENTRICULAR TACHYCARDIA UNSTABLE

(Rate over 150 with decreased LOC, hypotension, pulmonary edema, or chestpain)



*If Torsades de Pointes use
(wide irregular rhythm)
unsynchronized countershock
at defibrillation doses*



Tips for successfully
managing this case:



Don't forget:

- Administer O₂ if needed
- Start/upgrade IV

*Determine whether patient
is stable or unstable Gather
data

Get vital signs

Attach monitor(s)

- EKG
- Pulse oximeter
- BP

Start with:

- Level of consciousness
- Blood pressure
- Lung sounds
- Presence/absence of chest pain
- Gather problem focused history

*Your goal:

Control the rate, improve
perfusion and maintain a
normal rhythm

*Verbalize appropriate
drug, dose, route, flush,
and reevaluate patient after
each intervention

If unsuccessful: medication sequence for stable



Quick tip

If tachycardic and awake (or otherwise stable) first we try to medicate

If tachycardic with a nap (or otherwise unstable) then the treatment is Zap Zap Zap!

Unstable = **CASH**, which gets Joules ("Those with CASH get Joules")

(Chest pain, Altered LOC, SOB w/ Pulm. Edema/ Hypotension)

ACUTE CORONARY SYNDROMES

(Activate EMS)

Assess and maintain ABC's

Administer O₂ only if needed

Assess vitals

Apply monitors

(EKG, Pulse Ox, B/P)

Targeted history /Physical exam

Establish IV access

Perform 12 LEAD ECG

(electrolytes, enzymes-troponin, coags)

Symptoms:

May or may not be present---
Dizziness
Dyspnea
N/V
Diaphoresis
Anxiety.
Extreme fatigue



Tips for successfully managing this case:

☞ Don't forget to:

- Use a pain scale to help your patient rate the pain
- Perform PQRST assessment to determine if the cause of pain is likely myocardial ischemia or injury
- Determine time of onset early
- History/physical should include screening for Fibrinolytic contraindications
- Assess vital signs before and after administering Nitrates
- Obtain 12 lead EKG early
- Administer Morphine only if Nitro fails to relieve the pain
- Reassess vital signs and pain frequently

Perform simultaneously with initial assessment

Oxygen (to maintain saturation *90 - 99%)

Nitroglycerine SL or spray (maintain BP above 90mmHg)

Aspirin (to patient without contraindications)

Morphine IV if pain not relieved by 3 NTG. Only recommended if STEMI

ECG + for AMI <12 hrs

*ST elevation greater than 1mm in height (0.1mV) in 2 or more contiguous leads may indicate STEMI

-IV Nitroglycerine (continuing ischemia, HTN, PE)

-Heparin or LMWH

-Ace inhibitors (after 6 hrs)

-B Blockers (after stable)

Immediate: Prepare patient for:

PCI (Percutaneous Coronary intervention)

#1 choice for pt, <75 yrs old;

Cath, Stent, CABG

Ideal first contact to cath time 90 min

Fibrinolytics
(within 30min. of first medical contact)

High risk Acute Coronary Syndromes

-ST depression/T wave inversion

-High risk unstable angina

(female, rales Hx MI, diabetes,
hypotension, tachycardia, atrial fib)

-AMI >12 hrs

-IV Nitroglycerine

-Heparin or LMWH

-Antiplatelets (GPIIb/IIIa inhibitors)

-Ace inhibitors (after 6 hours)

-B Blockers (after stable)

As Available: Cardiac cath to evaluate OR

If suitable for revascularization
PCI (goal—90 min)
CABG

Nondiagnostic ECG
or enzymes,
Admit to ED/
chest pain unit
Serial ECGs, Serial
cardiac markers

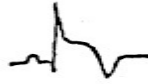
THE 12 LEAD ECG

ST Elevation



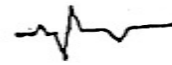
In 2 or more related leads
Arouses suspicion for injury

T-Wave Inversion



Arouses suspicion for ischemia
(may be Angina or early MI)

Q Wave



Small Q wave may be normal
> 0.04 sec wide or >1/3 depth of QRS
Represents infarction (old MI)

Related leads on the ECG:

S – Septal: V1, V2
A – Anterior: V3, V4
L – Lateral: V5, V6, I, AVL
I – Inferior: II, III, AVF

New ST-segment elevation of 1mm, or greater at the J point in leads v2 and v3, may be indicative of ACS and requires additional follow up.

“The Imposters” non AMI causes of ST and QRS changes

Left Bundle branch block	QRS > 0.12 sec, QRS inverted in V1, upright in V6, S-T elevation, depression, and T wave inversion seen throughout. Cannot accurately diagnose MI
Right bundle branch block	QRS 0.12 sec or wider, rSR pattern in V1, (QRS upright in V1), S-T elevation, depression, and T wave inversion may be seen throughout. May be able to detect MI, especially if comparison ECG available
Other causes of Wide QRS	Ventricular rhythms, (PVCs, VT), electronic pacemakers, medications, (Quinidine, Pronestyl), any depolarization abnormality can cause repolarization abnormalities
Left Ventricular hypertrophy	Strain pattern of depressed S-T segments, large QRS complexes in chest leads
Digitalis	ST segment “sags”. May also be seen with calcium ingestion
Pericarditis	Widespread ST elevation, T waves upright, no pathological Q waves, Possible PR interval depression in V6. Clinical correlation is necessary. Look for viral syndrome: fever, malaise. Patient will prefer to lean forward, obtaining some relief
Angina Pectoris	Flat (plane) depressions of S-T segment. Inverted T waves possible. ECG changes may improve with pain relief.
Prinzmetal’s angina	Slope elevation of S-T, especially in V4-V6. Changes may resolve with pain relief.
Early repolarization	Normal variant. S-T slightly elevated with normal concave slope in most leads. J point is elevated, possibly with “fishhook” appearance.

ACUTE STROKE

Immediate assessment - Stroke scales / scores

Assess and maintain ABC's

Administer O₂ only if needed

Assess vitals

Apply monitors (EKG, Pulse Ox, B/P)

Review history /Physical exam

Establish IV access

Conservative IV sticks and blood draws. Blood sugar/Rule out other non-stroke causes

Establish onset Time

Rapid Noncontrast CT



No ----
↓

CT positive for stroke? (hemorrhagic) ---- **Yes**



Repeat Neuro Exam :
Symptoms improving?
No, to all of the above



- Consult Neurology
- Consider **Fibrinolytics** if <3 hours since onset of symptoms
- Since 2010 this has been extended to 4.5 hours for certain patients
- Consider Interventional Facility (Comprehensive Stroke Center)

Various tools such as the National Institutes of Health Stroke Scale (**NIHSS**) effectively evaluate:

Level of consciousness

Visual function

Motor function

Sensation and neglect

Cerebellar function

& Language deficits

Cincinnati PreHospital Stroke Scale (CPSS)

Rapid Stroke Assessment Tool

Screens for 3 indicators only:

- Facial droop
- Arm drift
- Abnormal speech

1 abnormal finding = 72% probability of stroke

Consult Neurosurgeon

Noncontrast CT or MRI scan of the brain within 10 minutes of the patient's arrival.

Results should be obtained within 20 minutes and interpreted within 45 minutes.

Goal: door to needle time= 1hr.

Don't forget:

- Administer O₂ if hypoxic
- Establish IV access
- Assess for subtle signs of stroke
- Determine time of onset
- Rule out non-stroke causes of deficits
- Alert receiving facility of stroke alert if pre-hospital

Rapid Arterial Occlusion Evaluation Scale (RACE)

***Scores 5 areas-to screen for possible large vessel occlusion**

INCLUSION CRITERIA FOR FIBRINOLYTIC THERAPY

CARDIAC

Inclusion criteria:

- ☐ Chest pain &/or symptoms of acute MI
- ☐ QRS duration <120 ms (.12 sec)
- ☐ ST segment elevation >1mV (1mm) in 2 or more related leads
 - ☐ II, III, aVF
 - ☐ V1, V2, V3, V4, V5, V6
 - ☐ I, aVL

Exclusion criteria:

- ☐ Active internal bleeding
- ☐ History of CVA/TIA

Recent (< 2 months)

- ☐ Intracranial/intraspinal surgery, trauma
- ☐ Brain tumor, aneurism
- ☐ Arteriovenous malformation
- ☐ Bleeding disorder/anticoagulant

Recent (<2 weeks)

- ☐ Major surgery
- ☐ Trauma
- ☐ Organ biopsy
- ☐ GI or GU bleeding
- ☐ Severe uncontrolled HTN (200/120)
- ☐ Pregnancy/ Menses
- ☐ Diabetic eye problems &/or other hemorrhagic ophthalmic condition
- ☐ Disoriented, uncooperative
- ☐ Prolonged/traumatic CPR
- ☐ Aortic dissection
- ☐ Allergy to streptokinase

STROKE

Inclusion criteria:

- ☐ Diagnosis of ischemic stroke causing measurable neurologic deficit
- ☐ Onset of symptoms <3 hours before beginning treatment
- ☐ Age ≥ 18 years

Exclusion criteria:

- ☐ Head trauma or prior stroke in previous 3 months
- ☐ Symptoms suggest subarachnoid hemorrhage
- ☐ Arterial puncture at noncompressible site in previous 7 days
- ☐ History of previous intracranial hemorrhage
- ☐ Elevated blood pressure (systolic >185 mm Hg or diastolic >110 mm Hg)
- ☐ Evidence of active bleeding on examination
- ☐ Acute bleeding diathesis, including but not limited to
 - Platelet count <100,000/mm³
 - Heparin received within 48 hours, resulting in an aPTT greater than the upper limit of normal
 - Current use of anticoagulant with INR >1.7 or PT >15 seconds
- ☐ Blood glucose concentration <50 mg/dl (2.7 mmol/L)
- ☐ CT demonstrates multilobar infarction (hypodensity >1/3 cerebral hemisphere)

Relative Exclusion Criteria

Patients may receive rtPA but risk/benefit must be carefully weighed if presented with the following:

- ☐ Only minor or rapidly improving stroke symptoms (clearing spontaneously)
- ☐ Seizure at onset with postictal residual neurologic impairments
- ☐ Major surgery or serious trauma within previous 14 days
- ☐ Recent gastrointestinal or urinary tract hemorrhage (within previous 21 days)
- ☐ Recent acute myocardial infarction (within previous 3 months)

PULMONARY EDEMA

Assess and maintain CAB's

Administer O₂

Assess vitals

Apply monitors

(EKG, Pulse Ox, B/P)

Targeted history/ Physical exam

Establish IV access

Fowler's position

Consider positive pressure
(CPAP/BIPAP)



Nitroglycerine 0.4mg SL may
repeat or begin infusion
(if systolic BP above 100 mmhg)



Note: Lasix and Morphine are used less frequently in areas that utilize BiPAP/CPAP initially

Morphine 2 - 4mg slow IVP



Lasix up to 0.5 to 1mg/kg slow IVP (generally given in 20mg increments)
(contraindicated if systolic BP < 100 mmhg)



Reassess pulmonary status Consider positive pressure ventilation



For CHF with hypotension consider:

- * Dopamine 5-20mcg/kg/min (if shocky)
- * NorEpinephrine 0.5-30mcg/min (if B/P < 70 systolic)
- * Dobutamine 2-20mcg/kg/min (with no other signs of shock)

For CHF with systolic > 100 consider:

- * Nitroglycerin 10-20mcg/min
- * Nitroprusside 0.5-8mcg/kg/min



Tips for successfully
managing this case:

☞ Don't forget:

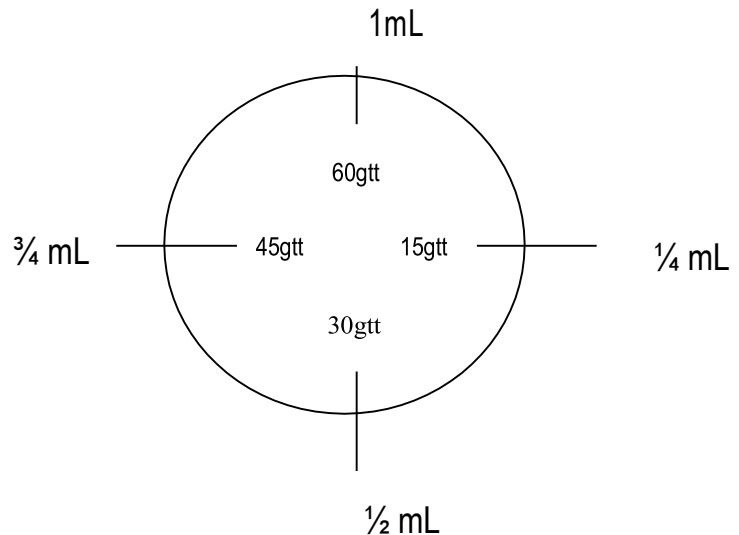
- Administer O₂
- Start/upgrade IV
- Monitor oxygenation,
- Reassess airway status frequently
- Administer dilators and diuretics
- Keep an eye on BP

TIPS FOR DRIPS

The following is merely one of the methods for calculating drip medications. It should not be considered “the only way” or “the ALS way” to mix and administer infusions. If you are familiar with another method, use what works for you. Many IV pumps will perform these calculations.

Clock Method:

Think of a mini drip chamber or IV pump as a clock. A clock has 60 seconds in 1 minute. A drip chamber has 60 drops in 1mL.



To use the clock method to calculate your drip rate you must figure the mixed concentration (the amount of drug per mL). This is done by dividing the amount of the fluid volume in the IV bag (500mL, etc) into the supplied drug amount. This number gives you the amount of medication administered per mL. Then, insert this number in the “60” slot on your clock, $\frac{1}{2}$ of it at the 30, $\frac{1}{4}$ of it at the 15 and $\frac{3}{4}$ of it at the 45. Remember, when drugs are diluted for infusions, the concentration becomes the next lowest unit (for example, add a gram of drug to a bag and the concentration becomes mg/mL).

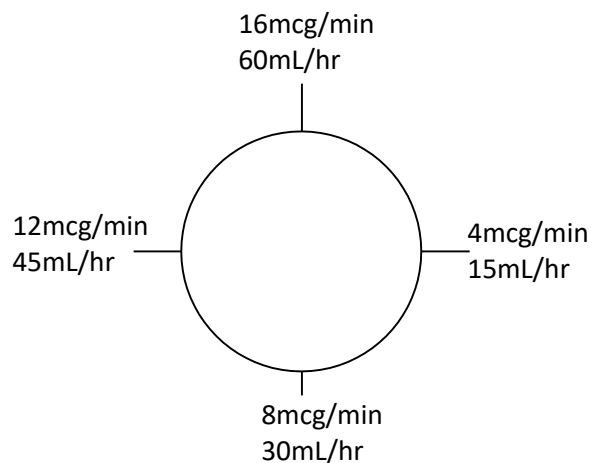
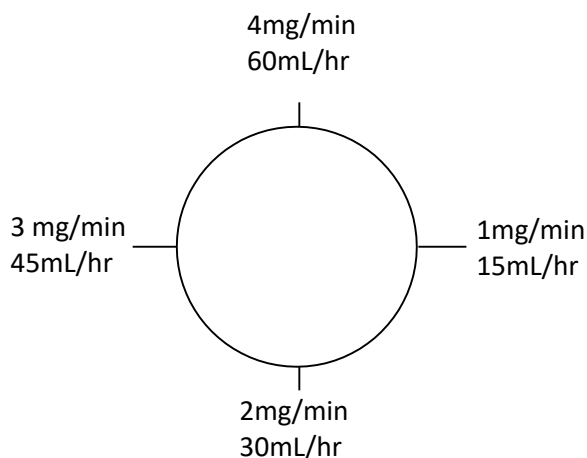
FOR EXAMPLE:

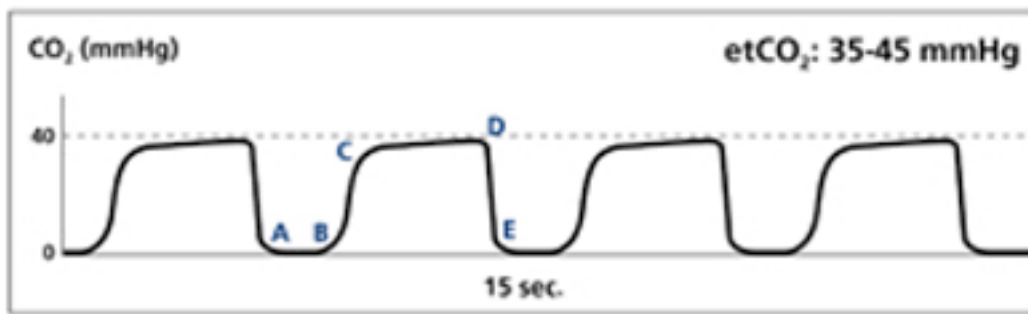
Antidysrhythmic: mix 2gm in 500mL

Cardiac stimulants: Mix 4mg in 250mL

$$2000\text{mg}/500\text{mL}=4\text{mg/mL}$$

$$4000\text{mcg}/250\text{mL}=16\text{mcg/mL}$$





Capnography: Waveform

Phase I (A–B): Beginning of exhalation; (respiratory baseline)

Phase II (B–C): Respiratory upstroke

Phase III (C–D): Expiratory plateau; (*D is the ETCO₂ measurement point)

Phase IV (D–E): Inspiratory downslope

Continual Exhaled CO₂ Monitoring

(Continuous Waveform Capnography, PETCO₂, ETCO₂)

- Specifically evaluates perfusion at the alveoli level (evaluates ventilation)
- CO₂ waveforms provide a more sensitive and rapid evaluation of respiratory function than pulse oximetry
- Good indicator of CPR quality
- Normal exhaled CO₂ is 35-45 mmHg
- High CO₂ denotes respiratory acidosis (ineffective breathing)
=ventilate more effectively and more frequently
- Low CO₂ indicates low perfusion (could be hyperventilation in normally perfused pt)
=may be common during arrest due to CPR being the only perfusion
- In a code, attempt to maintain CO₂ above 10 mmHg (ideally higher)

Respiratory Distress: earliest stage of respiratory compromise. ETCO₂ may start low; increases as compensatory mechanisms fail.

Respiratory Failure: SaO₂ less than 90% + ETCO₂ greater than 50mmHg

Respiratory Arrest: complete cessation of breathing.

Special Arrest Situations

Other Considerations in ALS Management

In general, Critical Care Personnel are quite good at performing ALS skills-intubations, defibrillation, vascular access, and appropriate medical treatment according to ALS type protocols. However, in our haste to rapidly treat patients, we may miss clues as to why this person arrested and why he is not responding to your best ALS treatment.

Occasionally, the provider may need to pull some “tricks” out of their drug box based on history labs, bystander information, the scene, and the fact that the patient is not responding to the standard ALS treatment.

PLEASE NOTE: These are merely recommendations from current guidelines and should not be construed as the only standard. All treatment should be approved by the supervising physician.

Some interesting facts to keep in mind: These things will cause PEA:

Pulmonary emboli, Acidosis, AMI, Tension Pneumothorax, Cardiac Tamponade, Hypoxia, Hypovolemia, Hyperkalemia, Drug overdose.

These things will cause Asystole:

Hypoxia, hypothermia, hypokalemia, hyperkalemia, acidosis, drug overdose, and death.

V-Fib or pulseless VT can be caused by anything.

Electrolyte Imbalances

Certainly, if labs have been “drawn” or if values are rapidly available this information can be utilized to guide treatment.

Since providers do not all have the ability to rapidly obtain and evaluate ABG’s or blood work, here are a few clues for patients not responding to your routine regime; consider these early:

Renal dialysis patients

- May have Pre dialysis Acidosis, Hyperkalemia, Hypoglycemia, or Post dialysis Hypokalemia & Hypovolemia.

Diabetics

- May have Acidosis, Hypoglycemia, Hypovolemia, Hyperkalemia, Hypokalemia.

Alcoholics

- May have Hypokalemia, Hypoglycemia, Hypomagnesemia.

Prolonged Vomiting

- May have Dehydration, Metabolic, Alkalosis, Hypokalemia.

Prolonged Diarrhea

- May have Dehydration, Acidosis, Hypokalemia, Hypomagnesemia.

Ventricular Tachycardia? Suspect hypocalcemia, hypomagnesemia and hypokalemia

Management of Electrolyte Related Arrests, In Addition To Standard ALS, could Include:

Hyperkalemia (>6.5 mmol/L) (One of the most potentially life threatening):

- Most Commonly occurs in renal failure patients, though other conditions can cause “release” from the cells. (Look for tall, peaked T waves)

While Performing Standard ALS:

1. Administer Calcium Chloride 500mg-1gram to stabilize myocardial cells
2. Administer Sodium Bicarbonate 50 mEq to shift potassium into the cells
3. A mix of Glucose (25g) and Insulin 10u may be infused over 15 minutes

Hypomagnesemia (< 1.3 mEq/L)

- Most commonly occurs in the malnourished, chronic alcoholic, or chronic diarrhea
- May cause VT, Polymorphic VT (Torsades de point)
- Administer 1-2g magnesium IV bolus

Metabolic Acidosis (Ph < 7.35)

- Occurs during an extended period of arrest or in a patient who is without CPR for an extended period of time initially
- May occur with medical conditions (Ketoacidosis) or overdoses
- Initially provide adequate CPR and ventilations
- Ideally use ABG's to guide treatment, but may be given based on history
- Administer Sodium Bicarbonate 1mEq/kg, repeat at half dose

Unique Respiratory Conditions

- COPD and asthma have caused arrests in the old and the young from respiratory failure and acidosis. Immediate assistance with a BVM is indicated for respiratory failure.
- The Pneumothorax patient with JVD, poor BVM compliance, cyanosis, apnea, or hyperresonance on percussion may require pleural decompression, if they fail to respond to standard ALS measures. Pneumothorax may be a complication of BVM use.
- Lateral pressure applied to the chest during exhalation may help expel trapped air and reduce intrathoracic pressure and the incidence of barotrauma during resuscitation.
- Intubated asthma patients in arrest should be ventilated slower and with less tidal volume.

Unique Respiratory Conditions (Continued)

- Any Intubated patient who deteriorates after stabilization, along with managing cardiac dysfunction, should be evaluated for the following:
 - **D**islodged ET Tube
 - **O**bstructed ET Tube
 - **P**neumothorax
 - **E**quipment Failure (ventricular)

Drowning

- Hypoxia and Acidosis are the initial causes.
- Consider **S**pinal **M**otion **R**estriction, if indicated.
- Consider sodium bicarbonate (for extended down time)
- Hypothermia BLS management
 - Protect from heat loss; cover victim.
 - Begin CPR without delay (even though pulse may be difficult to detect).
 - Check rectal or tympanic temperature. $<86^{\circ}\text{F}(30^{\circ}\text{C})$ =Severe, $>86^{\circ}\text{F}(30^{\circ}\text{C})$ =mild to moderate.
- Hypothermia ALS management
 - Perform ALS skills (ET) gently especially in severe hypothermia.
 - Move towards aggressive core warming (warm lavages, bypass, etc.) as primary.
 - Withhold antiarrhythmics until core temp is $>86^{\circ}\text{F}(30^{\circ}\text{C})$.
 - Perform all other ALS procedures.
- Do not terminate efforts until temperature is near normal.

Trauma Arrests

- Though survivability rates are low, scene management should include spinal motion restriction (PRN), airway control, bleeding control, and a rapid search for reversible conditions such as Tension Pneumothorax, and V-Fib. IV fluids, and medication should take place enroute to a trauma facility
- Utilize the H's and T's to rapidly evaluate reversible causes.
- Some areas may choose not to resuscitate trauma arrests due to poor prognosis.

Electrocution

Assess closely for scene safety

- Known to precipitate immediate v.fib

Pregnancy

- Point-of-care ultrasound could be used in the management of maternal cardiac arrest to determine gestational age of the fetus to guide decision making.
- Use the standard ALS protocols but keep defib pads off breast tissue.
- Manually, shift fetus to the left, if the fundus is at or above the umbilicus (**this will take 3 people:** 1 for airway, 1 for CPR, & 1 to provide left uterine displacement).
- Consider C-Section if there is no response to 5 minutes of ALS, if the uterus is at or above the umbilicus= 20 weeks gestation (now called “resuscitative cesarean delivery”-RCD)
- Fetal monitors should be promptly removed if fetus is pulseless. **Focus on maternal care.**
- If the pregnant female was receiving Magnesium, administer 1 gram Calcium Chloride
- Place IV above the diaphragm. (If no IV access; intraosseous to the proximal humerus)
- Extracorporeal CPR (ECPR) may be considered to manage maternal cardiac arrest, only if the uterus has not reached the umbilicus or for post arrest organ procurement.
- Do not induce cooling in the prehospital setting after return of ROSC.

Anaphylaxis

- Allergic reactions, while usually easily reversible, may progress to cardiovascular collapse due to profound vasodilation and hypoperfusion
- For patients in near arrest or arrest states, administer Epinephrine IV .05-0.1mg IV
~ rather than SQ or IM, then follow standard ALS to manage arrhythmias
- Emphasis should be placed on securing an appropriate airway early on
- In severe shock, administer large fluid boluses – 1 liter at a time (4-8 liters)
- Norepinephrine or Vasopressin can be considered for severe hypotension where Epi & fluids failed
- Glucagon 1-5mg can be given if treatment is unsuccessful on a patient that takes beta blockers

Arrests Related to Overdose

- **The initial management for drug induced arrests is basically unchanged. Follow the standard BLS and ALS regime while searching for reversible causes.**

The following will outline consideration in specific overdoses:

Cocaine - Tachyarrhythmias, vasoconstriction, pulmonary edema, seizures, HTN, & hypothermia

- **SVT:** Often short-lived, not requiring therapy
 - ~However, for sustained SVT consider administering benzodiazepines (Valium, Ativan, etc.)
- **Hemodynamically stable VT:** Consider benzodiazepines. If persistent, administer standard antidysrhythmics. Follow with Sodium Bicarbonate 1 mEq/kg IV

Arrests Related to Overdoes (Continued)

- **Hypertension**- Treat initially with benzodiazepine. Follow with vasodilator such as Nitroglycerine or Nitroprusside. (Nitroglycerine preferred if concurrent chest pain)
- ****Do not use β blockers** – blocking β stimulus may allow the α blocking properties of cocaine to function unopposed, potentially increasing blood pressure
~A pure α -blocker such as Phentolamine (1mg q 2 - 3 min up to 10mg) may be used
- **Pulmonary edema** - Standard medical management including + pressure ventilation
- **Acute Coronary Syndromes** - With cocaine use, more often due to spasm rather than thrombus. Use O₂, ASA, NTG, titrated doses of benzodiazepine

Tricyclic Antidepressants (Elavil, Tofranil, Amitriptyline, etc.) - Cardiotoxic when overdosed. Expect mental status changes, Tachycardias, Prolonged QT intervals, and anticholinergic effects. Interventions include:

- Symptoms = 3 C's – Convulsions, Coma, Cardiac dysrhythmia
 - then Acidosis and Hypotension
- Consider activated charcoal in non-cardiac arrest within 1 hour of ingestion
- Terminate seizures with benzodiazepines
- During arrest consider sodium bicarbonate 1mcg/kg
- Pre arrest or post arrest cardiovascular collapse with widened RS
 - Administer sodium bicarbonate, consider fluid bolus NaCL as needed

Digitalis - Overdose may cause bradyarrhythmias and heart failure, ventricular arrhythmias, and hyperkalemia. There is no evidence to support antidotes during cardiac arrest. Pre or post arrest cardio-toxicity treatment should include:

- Activated charcoal within 1 hour of ingestion
- Use standard ALS treatment for critical bradycardias
- Cautious use of transvenous pacemakers due to pacemaker induced dysrhythmias.
- K + >5mEq/L patients have a poor prognosis
- Fab fragment therapy (digibind):
 - 2 vials per mg of drug ingested
 - 10-20 vials for unknown amount ingestion

Calcium Channel Blocker and β Blocker toxicity - May cause hypotension, decreased contractility, bradycardias, decreased LOC, seizures, hypoglycemia & hyperkalemia. With β blockers, hyperglycemia with Ca^{+} Channel Blockers, rapid progression to shock.

There is no evidence to support antidotes during cardiac arrest. Cardiovascular Toxicity (collapse) pre or post cardiac arrest could include:

- O_2 , ECG, monitor BP, establish vascular access
- Volume for hypotension
- Check blood glucose
- Activated charcoal within 1 hour of ingestion with mild hemodynamic effects
- A mix of high dose Insulin 1u/kg + 0.5g/kg dextrose may improve hemodynamic ability by improving myocardial energy utilization

For Calcium Channel Blocker overdose, to treat myocardial dysfunction

~ (not cardiac arrest):

1. NS boluses 500 - 1000mL
2. Epinephrine infusion 2 - 100 mcg/min
3. Calcium chloride 0.2mL/kg if shock refractory to fluids and Epinephrine
4. May use calcium gluconate 10% (0.3mEq/kg)
5. Pacing for bradycardia

For β blocker overdose, to treat myocardial dysfunction (not cardiac arrest):

- NS boluses
- Epinephrine infusion 2-100 mcg/min
- Calcium chloride 0.2 mL/kg
 - May use calcium gluconate 10% (0.3mEq/kg)
- Glucagon 3 - 10mg IV

Narcotics or Benzodiazepines - Generally cause CNS and respiratory depression. There is no indication for treating these conditions during cardiac arrest.

Narcotic (Opioid) Overdose:

- Little value treating during cardiac arrest (though often attempted)
- May treat respiratory depression secondary to overdose
- Naloxone (narcan) 0.4mg IV/IM; or 2 mg IN; may *repeat* after 2-3 min.

Benzodiazepines:

- **No** indication to treat during cardiac arrest
- May treat respiratory depression secondary to overdose only in known nonhabitual users (i.e.: overdoses given during a procedure)
- Flumazenil 0.2mg increments up to 1mg

Cyanide Poisoning

- Found in industry and jewelry cleaners
- Very common in smoke inhalation from fires
- Causes CNS depression, metabolic acidosis, and cardiovascular collapse
- Along with standard BLS and ALS resuscitation regimes:
 - Administer Cyanide poison kit -
 - IV Sodium Nitrate, IV Sodium Thiosulfate (for cyanide not from toxic smoke)
 - Cyano kit-Hydroxocobalamin IV for any cyanide including toxic smoke.
(most common/popular kit)

Local Anesthetic Toxicity

- Accidental IV administration of anesthetics such as Lidocaine and Mepivacaine may cause toxicity, seizures and cardiovascular collapse
- A rapid IV of 20% long chain fatty acid emulsion (LipidRescue™) may redistribute the toxin or stabilize the myocardial cells
- Studies document 1.5 mL/kg repeated Q5 may be more effective than epinephrine in these cases

Glossary

(Guide to ALS abbreviations and terms)

ALS - Advanced Life Support

ACS (Acute coronary syndrome) - A range of cardiac conditions involving decreased oxygen delivery to myocardial tissue. Includes; myocardial ischemia, angina, unstable angina, and acute myocardial infarction.

Bolus - IV push, or administration of moderate or high volume of fluid over a relatively short period of time.

Cardiac output - The amount of blood ejected from the left ventricle in 1 minute. Expressed by the equation: Cardiac output = Heart rate x stroke volume.

Chronotropic effect - Pharmacologic effect causing increase in heart rate.

Code - A semi slang term denoting cardiac arrest or the management of cardiac arrest. (i.e., The patient “coded” or we’re “coding” the patient)

Combitube or King Airway - Two Peri-laryngeal type airway devices used as an alternative to intubation. These require less time and skill than placing an ET tube.

Ejection fraction - The percentage of blood in the ventricle that is ejected each time the ventricle contracts.

Hypothermia - Low body temperature. For ALS, defined as core body temperature <94° F.

Inotropic effect - Pharmacologic effect causing increase in force of contraction of the ventricle.

Infarction - Death of tissue, in the case of myocardial infarction; due to lack of oxygen, most often occlusion of coronary artery.

IO (Intraosseous) - an alternative route for administration of medications and fluids when intravenous access is not available. Utilizes a marrow aspirating type needle placed in the marrow cavity of the lower leg, upper arm or sternum.

Ischemia - A state of low oxygenation in myocardial cells.

LMA (Laryngeal mask airway) - a noninvasive airway, used as a BLS airway device, when intubation is delayed or not possible. Occludes the supraglottic area and facilitates oxygen flow to the trachea.

PCI (Percutaneous cardiac intervention) - Invasive cardiac procedures, such as angioplasty or stenting.

Perfusion - Delivery of oxygenated blood to tissues.

Perfusing - A state where oxygenated blood is delivered to tissues. (i.e., a patient with a pulse)

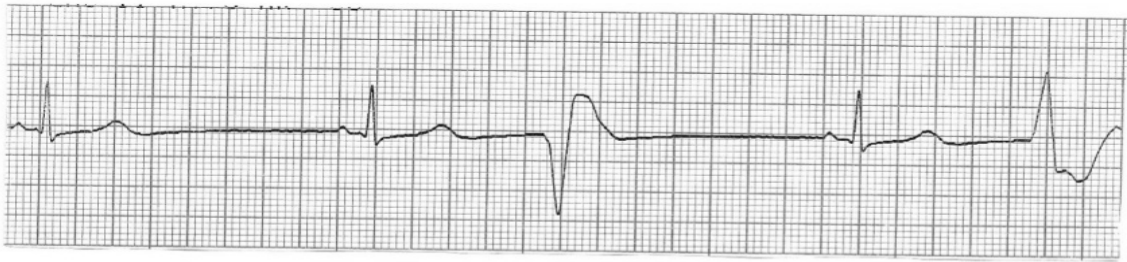
Stroke volume - The amount of blood ejected from the ventricle in 1 contraction.

Tidal volume - The amount of air taken into the lungs in one breath or ventilation.

Vasopressor - Medication which causes vascular constriction.

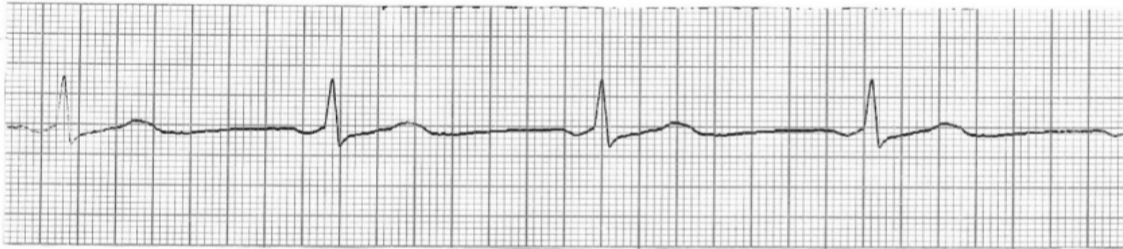
EKG Practice Exam

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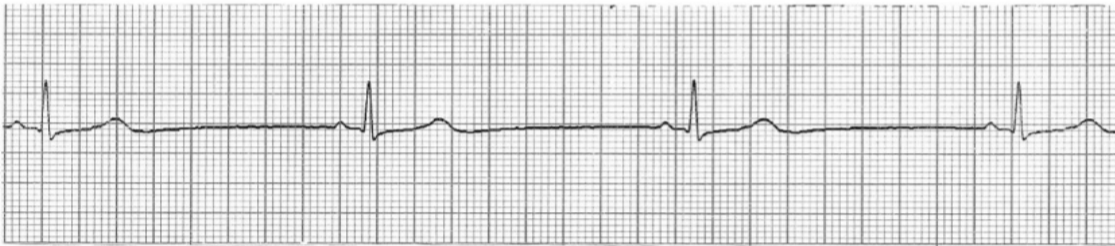
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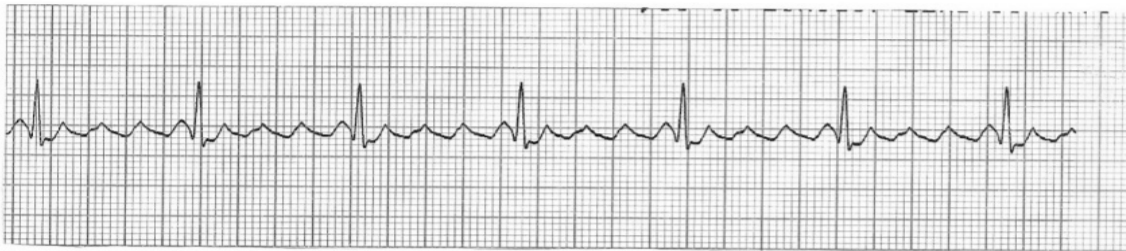
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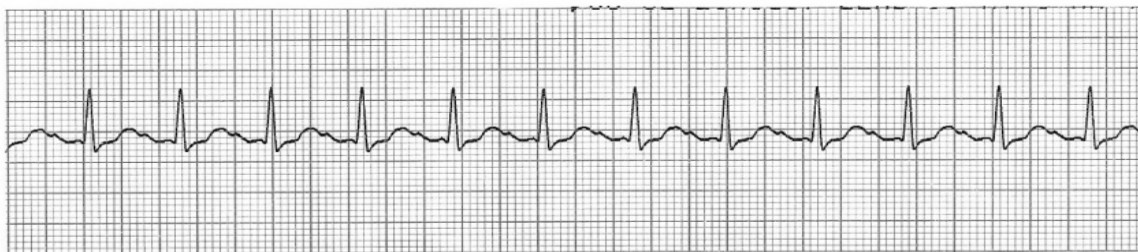
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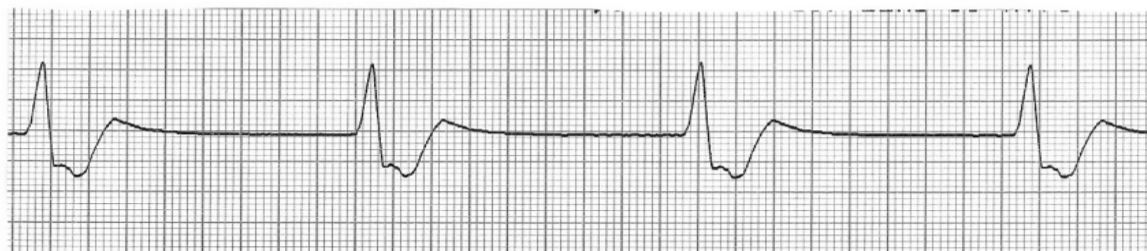
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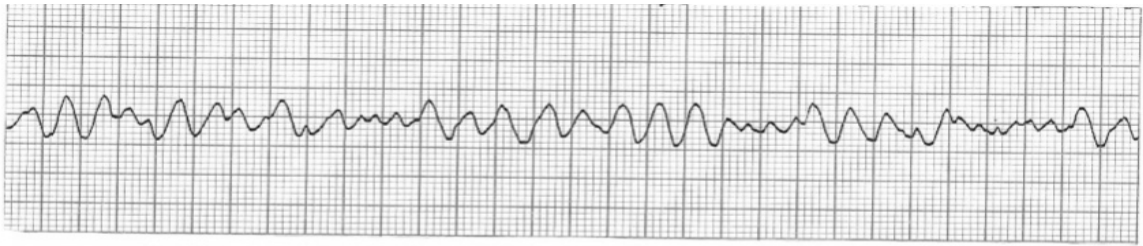
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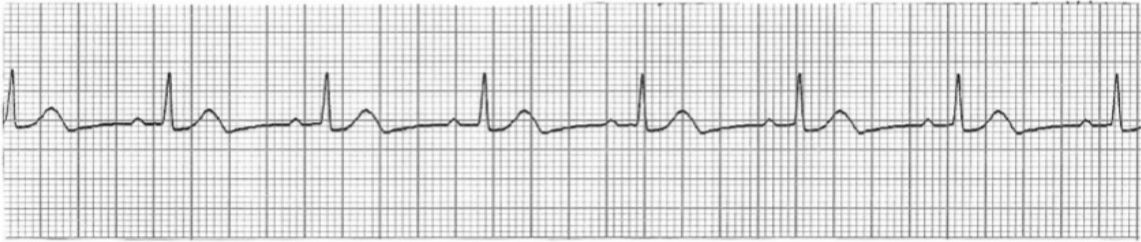
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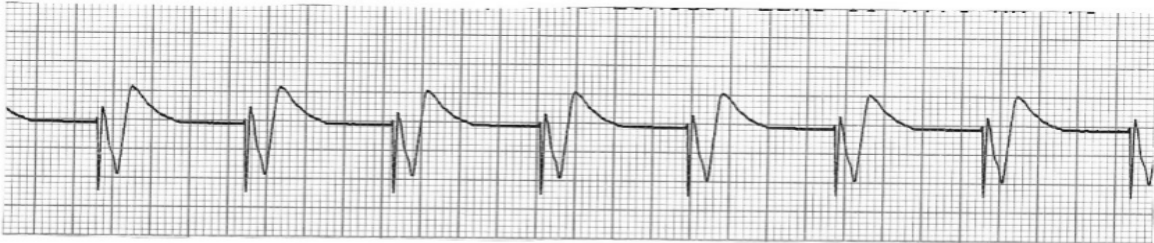
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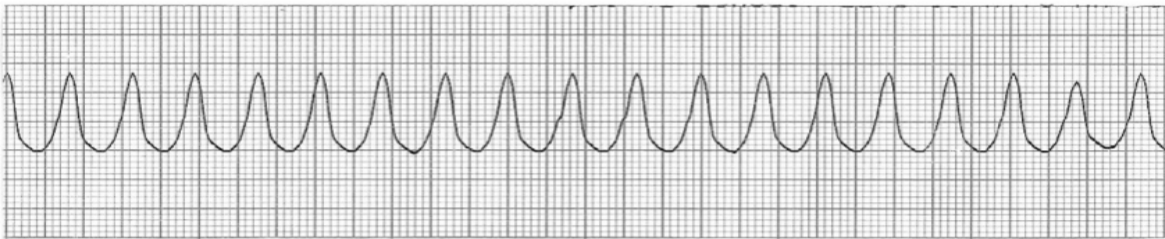
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EKG Practice Exam - Key

1. Sinus Bradycardia with Multifocal PVC's
2. Junctional Rhythm
3. Sinus Bradycardia
4. Atrial Flutter
5. Supraventricular Tachycardia, A-Tach
6. Sinus Tachycardia
7. Atrial Fibrillation
8. Idioventricular Rhythm
9. Complete Heart Block, 3rd Degree AVB
10. Mobitz II, 2nd Degree AVB type II
11. Ventricular Fibrillation
12. Normal Sinus Rhythm
13. Ventricular Pacer, 100% capture
14. Ventricular Tachycardia (monomorphic)
15. Mobitz 1, 2nd degree AVB type 1, Wenkebach

