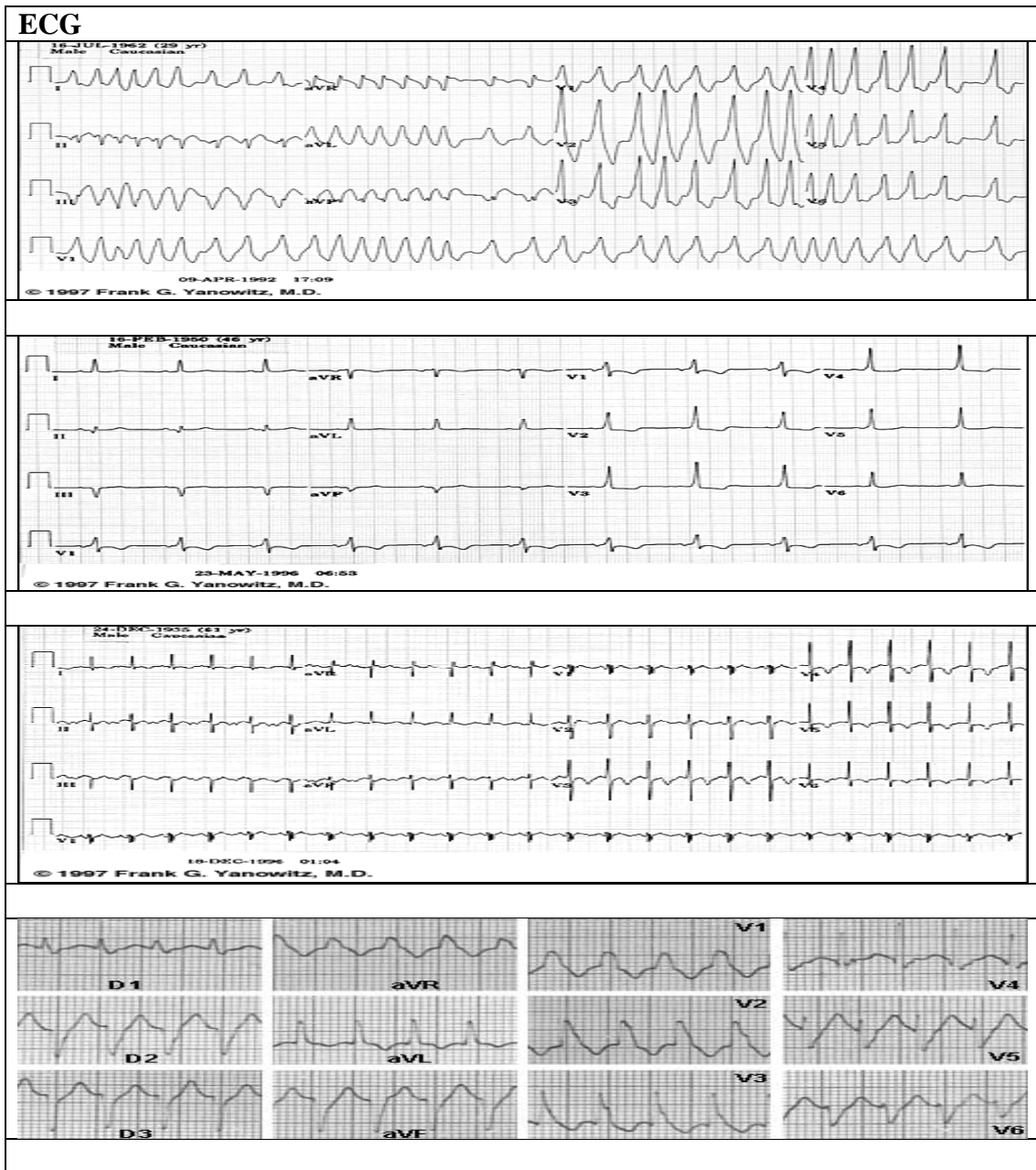


Chapter3

Arrhythmia

ECG Recordings:

Look at these ECG recordings and write the diagnoses, drugs to use and drugs not to use:



Arrhythmia-mdm



Laddergrams

Laddergrams are devised to help have a better view about arrhythmia. The advantage of drawing a laddergram is its ability to simplify the so many shapes of the heart rhythm.

Laddergrams are graphical illustrations, created by EKG interpreters to quickly convey what they believe to be happening in the EKG rhythm strip. Laddergrams are a great educational tool and it allows educators to teach advanced concepts in a much nicer way.

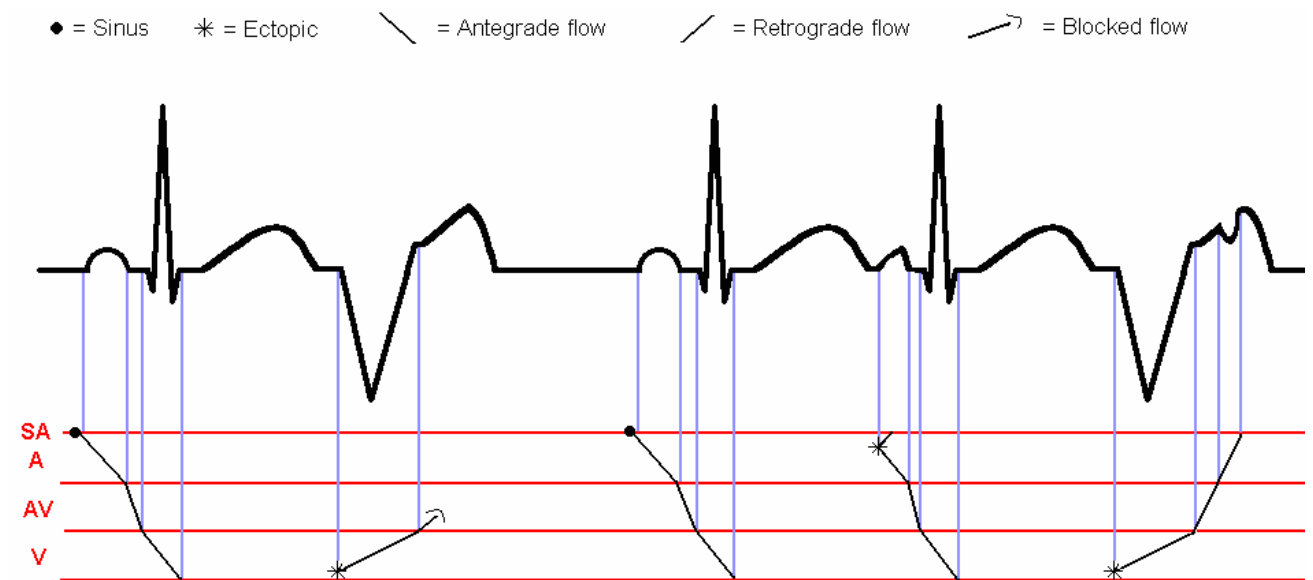
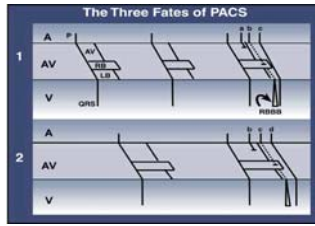
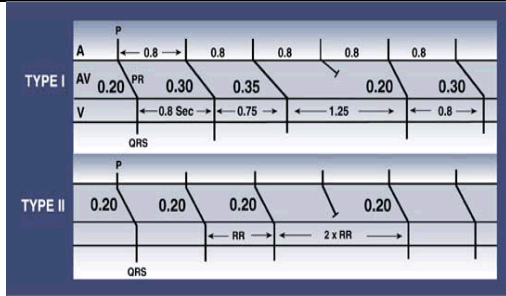


Table3-2: different ECG patterns with the counterpart laddergrams

Laddergram and ECG	Treatment algorithm
<p>Premature junctional complexes (PJC's)</p> <p>Lead V₁</p> <p>J = Junctional escapes</p>	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> MAD SCIENTIST SOFTWARE </div> <h3 style="text-align: center;">Supraventricular Tachycardia</h3> <p style="text-align: center;">General Approach Algorithm (IV, oxygen) Lab, 12-lead ECG <i>Serious signs or symptoms?</i></p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Stable</p> <p>Vagal maneuvers</p> <p>Adenosine 6 mg</p> <p>Adenosine 12 mg</p> <p>→ <i>Shown to be:</i> A-flutter? A-fib algorithm Junctional tach? Amiodarone 150 mg Ectopic atrial tach? Amiodarone 150 mg Exit this algorithm</p> <p>Healthy heart</p> <p>Verapamil 5 mg OR Diltiazem 20 mg</p> <p>15 minutes Verapamil 10 mg, OR Diltiazem 25 mg</p> <p>15 minutes Cardioversion</p> </div> <div style="width: 45%;"> <p>Unstable</p> <p><i>Rate < 150 or borderline?</i> Consider trial of medication</p> <p>Sedation</p> <p>Cardiovert 50 j</p> <p>Cardiovert 100 j</p> <p>Cardiovert 200 j</p> <p>Cardiovert 300 j</p> <p>Cardiovert 360 j</p> <p><i>Not converted?</i> Amiodarone 150 mg OR Diltiazem 20 mg</p> <p>Cardiovert 360 j</p> </div> </div> <p style="text-align: center;"><i>CHF or LV failure</i></p> <p>Digoxin 0.25 mg repeat up to 1 mg OR Amiodarone 150 mg (may repeat) OR Diltiazem 20 mg</p>

Arrhythmia-mdm

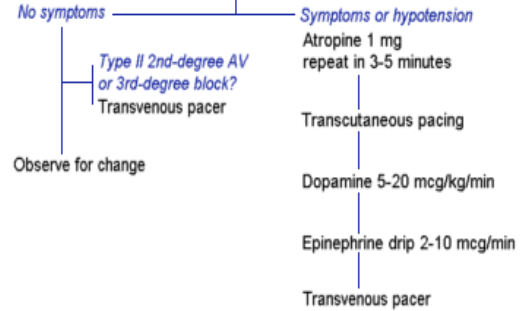


Bradycardia (with pulse)

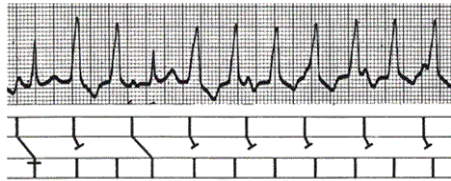
General Approach Algorithm
(IV, oxygen)

Assess for cause (lab, ABG)

Signs or symptoms?



Lead II



Ventricular Tachycardia with fusions (F) and captures (C)

Note: Incomplete AV dissociation



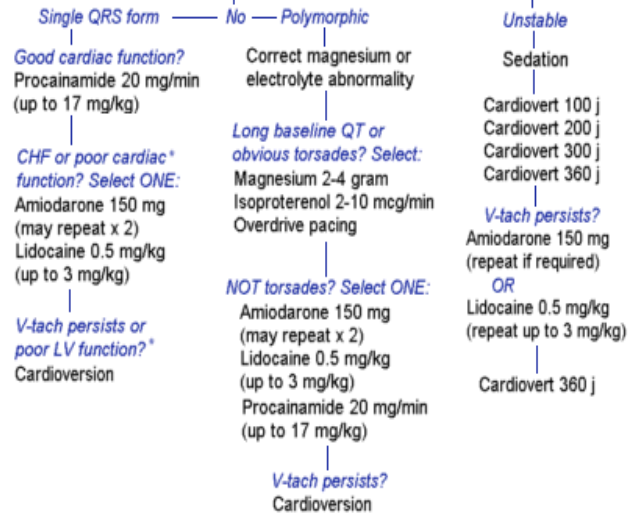
Ventricular Tachycardia (with pulse)

General Approach Algorithm
(IV, oxygen)

Lab, 12-lead ECG

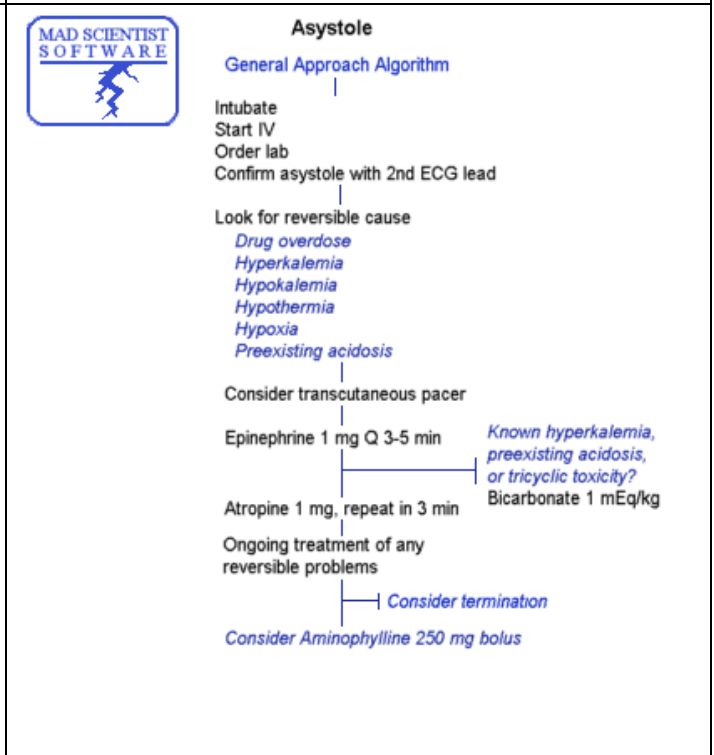
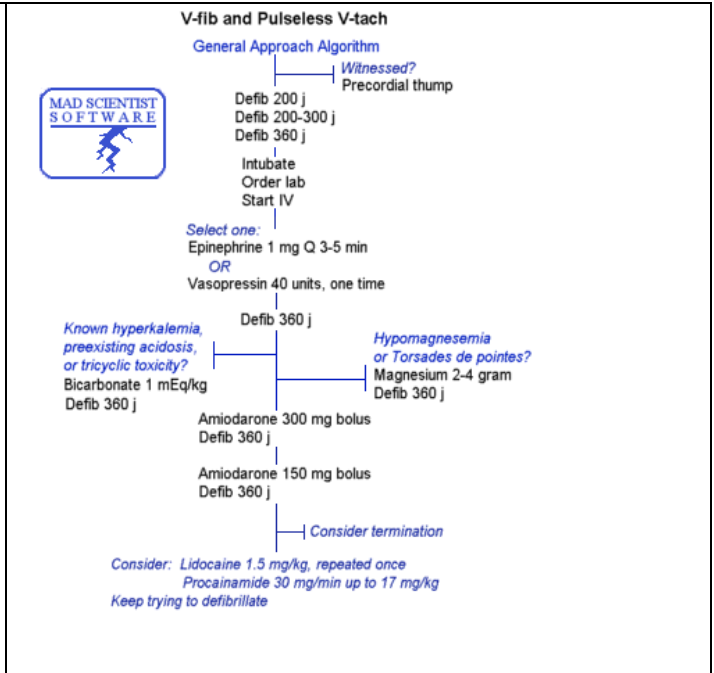
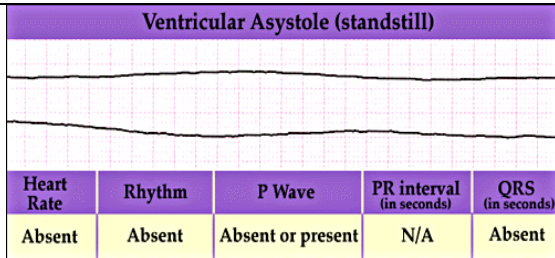
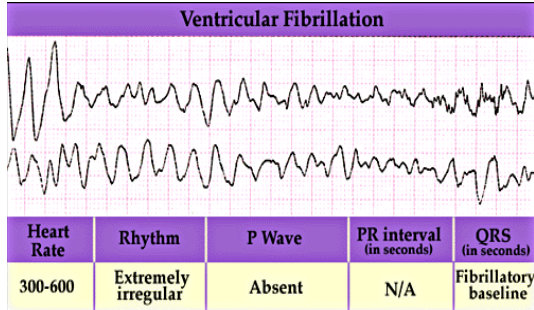
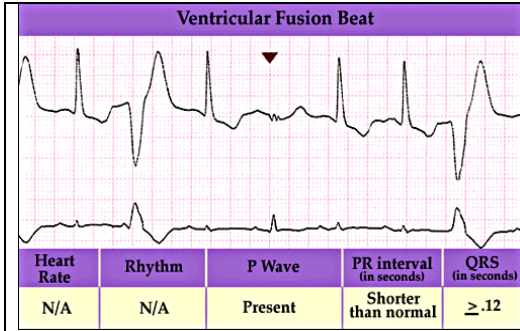
Consider cardioversion

Serious signs or symptoms? — Yes



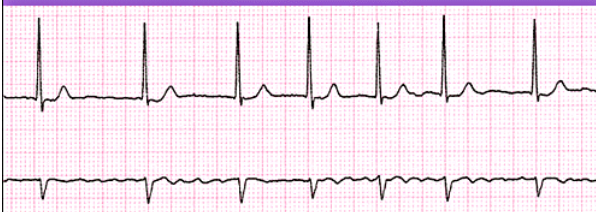
* CHF or LV failure

Arrhythmia-mdm



Arrhythmia-mdm

Atrial Fibrillation



Heart Rate	Rhythm	P Wave	PR interval (in seconds)	QRS (in seconds)
A: 350-650 bpm V: Slow to rapid	Irregular	Fibrillatory (fine to coarse)	N/A	<.12

Rate Control in A-fib and A-flutter

General Approach Algorithm
(IV, oxygen)
Lab, 12-lead ECG
Serious signs or symptoms?

Comfortable
Good B.P.
Rate < 150
Observe

Uncomfortable or rate > 150

Select ONE:

Poor cardiac function and not candidate for cardioversion?
Digoxin 0.25 mg
repeat up to 1 mg

Tight control required?
Esmolol 0.5 mg/kg, then
titrate 0.05-2 mg/min drip

WPW syndrome?
Amiodarone 150 mg

Early conversion to sinus rhythm is desired?
Amiodarone 150 mg

Others:
Diltiazem 20 mg (0.25 mg/kg)
repeat until effective.
Drip 10 mg/hr


Unstable
Rate < 150 or borderline?
Consider trial of medication

Sedation

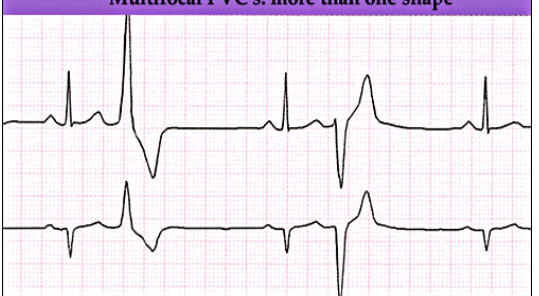
A-flutter?
Cardiovert 50 j

Cardiovert 100 j
Cardiovert 200 j
Cardiovert 300 j
Cardiovert 360 j

Not converted?
Rate control medication

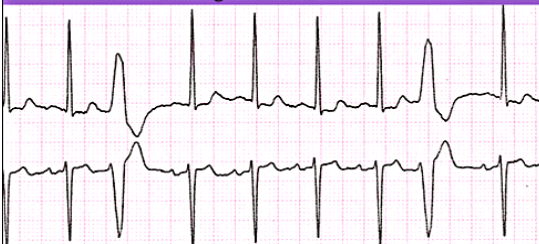


Multifocal PVC's: more than one shape




Unifocal PVC's: identical shapes

Note: A single PVC is labeled isolated



PVC (ventricular ectopy) Treatment



Look for reversible cause

Drugs
Electrolytes
Hypoxemia
Acidosis
Bradycardia

Severe bradycardia?
Bradycardia algorithm

Due to acidosis, tricyclic toxicity, or hyperkalemia?
Bicarbonate 1 mEq/kg

Are the ectopic beats dangerous?

Select

Lidocaine 1 mg/kg bolus
repeat 0.5 mg/kg until PVCs suppressed
or total dose of 3 mg/kg
If successful
Base drip rate on total given:
1 mg/kg, drip 2 mg/min
1-2 mg/kg, drip 3 mg/min
2-3 mg/kg, drip 4 mg/min

Procainamide 20 mg/min
until PVCs suppressed or 17 mg/kg total
If successful
Procainamide 1-4 mg/min

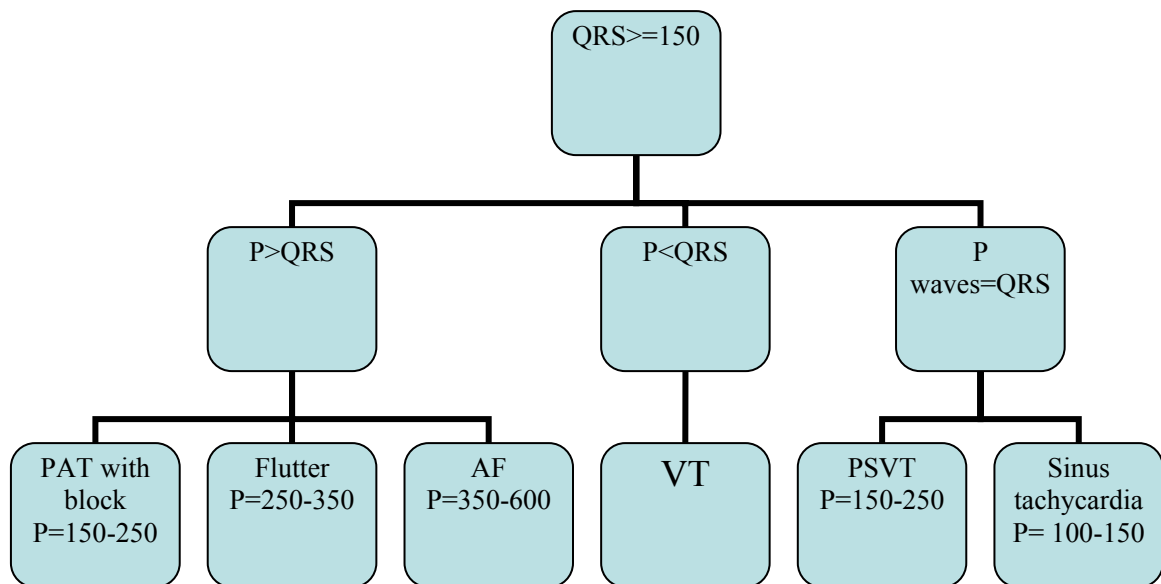


Figure3-1: Algorithm to summarize the arrhythmia patterns (signs like = / < / > or numbers refer to beats per minute)

Table3-3: drugs of this chapter

Drug	Dosage	Explanation
Adenosine	(6mg/2cc vial) 6 mg	
Amiodarone*	150 mg	See "a word on Amiodarone"
Atropine	(1 mg/10cc syringe) 1mg	Repeat in 3 minutes
Bicarbonate	(50Eq/50cc syringe) 1 meq/kg	
Digoxin	0.25 mg	
Diltiazem	25 mg	
Dopamine	(400mg/10cc syringe) 5-20 mcg/kg/min	
Epinehrine	(1mg/cc ampule) 2-10mcg/min	
Esmolol	0.5 mg/kg	Then titrate to 0.05-2 mg/min drip
Isoprotrenol	2-10mcg/min	
Lidocaine 2%	(100mg/5cc syringe) 0.5mg/kg	1 mg/kg bolus Repeat 0.5mg/kg until PVC suppressed If successful: Base drip rate on total given: 1 mg/kg, drip 2mg/min 1-2 mg/kg, drip 3 mg/min 2-3 mg/kg, drip 4 mg/min
Magnesium	(5 gram/10 cc vial) 2-4 gram	
Procainamide	(1 gram/2cc vial) 20mg/min	20mg/min until PVC suppressed then 1-4 mg/min
Verapamil	(10 mg/2cc vial) 5 mg	

How to work with semi Automatic External Defibrillator:

- . Take appropriate body substance isolation precautions.
- . Question the rescuers about the arrest details.
- . Instruct the rescuers to stop CPR.
- . Verify that the patient is in cardiac arrest by checking for the presence of breathing and a carotid pulse.
- . Instruct the rescuers to resume CPR.
- . Position the defibrillator on the side of the patient opposite the rescuer performing chest compressions.
- . Open the defibrillator pads and attach them to the cables.
- . Prepare the patient's chest by opening the shirt, shaving off excess hair and/or drying the chest with a towel or dressing if necessary. If the patient has nitroglycerin paste or a nitroglycerin patch on his/her chest, you must remove it assuring not to get any nitroglycerin on you or other rescuers.
- . Dispose of the nitroglycerin along with any material used to remove it from the patient in a biohazard container.
- . Apply the sternum pad or white cable pad to the right side of the patient's chest with the top edge of the pad touching the bottom of the clavicle and the side of the pad to the right border of the sternum.

Apply the apex pad or red cable pad to the patient's left lateral chest at the anterior axillary line above the lower rib margin. When the pads are properly positioned the heart should be between the two pads.

Arrhythmia-mdm

- Turn on the power to the defibrillator. Make sure that the recording device is running (if applicable). If in a moving ambulance stop the ambulance in a safe location.
- Instruct the rescuer to stop CPR and make sure no one is in contact with the patient. Loudly verbalize “Clear the patient” and assure no one is touching the patient.
- Press the analyze button on the AED. Assure no one is touching the patient or performing CPR while the AED is analyzing.
- If the AED determines that the patient is in a “shockable” rhythm, it will charge to the pre-selected energy setting. When ready, it will alert you to “press to shock” button. Insure that no one is touching the patient or touching anything that is in contact with the patient by looking up and down the patient and saying loudly, “clear”. Keep your eyes on the patient while depressing the button.

The first shock should be delivered within 90 seconds of the AED reaching the patient.

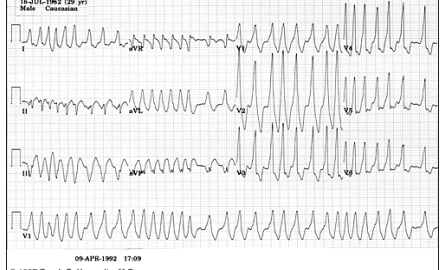
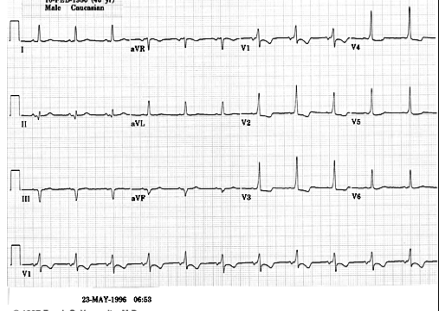
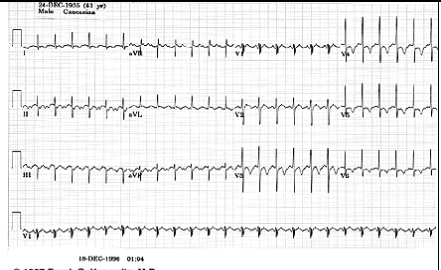
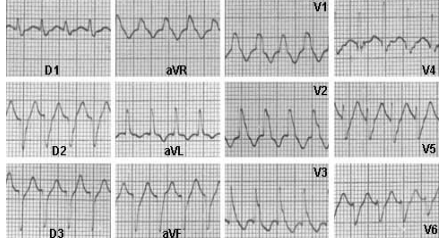
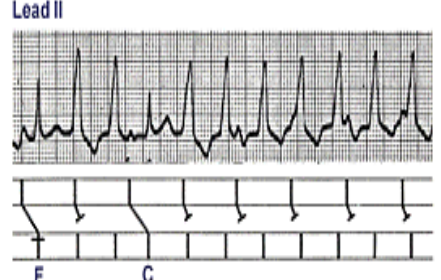
- After the shock has been delivered, reanalyze the patient’s rhythm assuring there is no one touching the patient. If the patient is still in a “shockable” rhythm, repeat the shock sequence. Complete this sequence one more time for a total of three shocks without interruption.
- After the third shock has been delivered, check for the presence of a carotid pulse. If the pulse is absent, perform CPR (2 rescuer) for one minute and verify the effectiveness of CPR (compressions and ventilations). Check for a

Arrhythmia-mdm




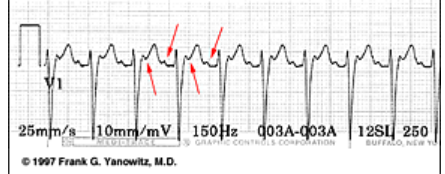
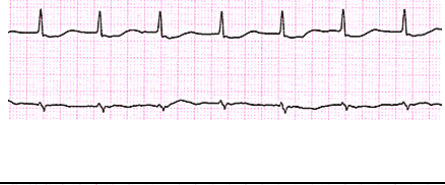

pulse at the end of one minute. If the pulse is still absent, reanalyze the patient's rhythm.

- . If the patient is still in a “shockable” rhythm, repeat the 3 shock sequence again.
- . After the second set of three shocks have been delivered, check for a pulse. If the pulse is absent, perform CPR, begin to package and transport the patient to the hospital.
- . If there is a short transport time, continue to transport the patient to the hospital. If there is a long transport or ALS backup is close, repeat another set of three (3) stacked shocks. If the patient is still in a shockable rhythm after 9 shocks, repeat sets of three (3) stacked shocks with one (1) minute of CPR between each set of shocks until the patient regains a pulse or you receive the message “**no shock indicated**”.

Table3-4: Answers of ECG recordings:

ECG	Diagnosis	Treatment	Avoid
 <p>12-JUL-1962 120 371 Male - Caucasian 09-APR-1992 17:09 © 1997 Frank G. Yanowitz, M.D.</p>	<p>Atrial Fibrillation in Patient with WPW Syndrome</p>	<p>Direct Cardioversion +Lidocaine or Procainamide or Ibutilide</p>	<p>Digoxin Amiodarone* Verapamil</p>
 <p>18-FEB-1966 044 997 Male - Caucasian 23-MAY-1996 06:55 © 1997 Frank G. Yanowitz, M.D.</p>	<p>WPW and Pseudo-Inferior MI (Q wave is a negative Delta – wave in Lead III)</p>	<p>Betablocker CCB Quinidine Flecainide</p>	<p>Pace-maker Digoxin Verapamil</p>
 <p>12-DEC-1965 011 300 Male - Caucasian 18-DEC-1996 01:04 © 1997 Frank G. Yanowitz, M.D.</p>	<p>Atrial Flutter with 2:1 Av Conduction</p>	<p>Digoxin 0.25 Esmolol 0.5 Mg/Kg Amiodarone 150mg</p>	<p>Quinidine</p>
 <p>D1 aVR V1 V4 D2 aVL V2 V5 D3 aVF V3 V6</p>	<p>V- Tach</p>	<p>Procainamide 20mg/Min Amiodarone 150 Mg Lidocain 1 Mg/Kg</p>	<p>Verapamil Adenosine</p>
 <p>Lead II F C</p>	<p>V-Tach</p>	<p>Magnesium-Sulphate Procainamide Amiodarone Lidocaine If failed: Cardioversion</p>	<p>Verapamil Adenosine</p>

Arrhythmia-mdm

 <p>ECG showing Unifocal PVC. The rhythm is regular with a single premature, wide, and bizarre QRS complex (V1 lead) that is not preceded by a P wave.</p>	Unifocal PVC	Lidocaine Procainamide	
 <p>ECG showing PAC. The rhythm is regular with a premature narrow QRS complex (V1 lead) preceded by a P wave.</p>	PAC	Sedatives Betablocker	
 <p>ECG showing PVC. The rhythm is regular with a single premature, wide, and bizarre QRS complex (V1 lead) that is not preceded by a P wave.</p>	PVC	Lidocaine Procainamide	
 <p>ECG showing Atrial Flutter with 2:1 Av Conduction. The rhythm is regular with a narrow QRS complex (V1 lead) and a regular rate. Red arrows point to the narrow QRS complexes.</p> <p>25mm/s 10mm/mV 150Hz Q03A-Q03A 12SLI 250 © 1997 Frank G. Yanowitz, M.D.</p>	Atrial Flutter with 2:1 Av Conduction	Digoxin 0.25 Esmolol 0.5 Mg/Kg Amiodarone 150mg	Quinidine
 <p>ECG showing Junctional Accelerated (60-100 bpm). The rhythm is regular with a narrow QRS complex (V1 lead) and a regular rate.</p>	Junctional Accelerated (60-100 bpm)	Stop Digoxin Give: Lidocaine Betablocker Phenytoin	Cardioversion
 <p>ECG showing AF. The rhythm is irregularly irregular with a narrow QRS complex (V1 lead).</p>	AF	Digoxin Esmolol Amiodarone	

***A word on Amiodarone**

Amiodarone is a class III antidysrhythmic (potassium channel blocker) with some additional class I (sodium channel blocking), class II (beta adrenergic blocking), and class IV (calcium channel blocking) effects. This potpourri of physiologic effects has led amiodarone to be effectively used in managing a variety of dysrhythmias, including stable VT, atrial fibrillation, and other types of SVTs. Treatment of patients with AF-WPW depends on hemodynamic stability. Unstable patients should be treated with electrical cardioversion. Unlike patients with chronic AF, these patients respond well to cardioversion. Hemodynamically stable patients can be treated either with sedation and electrical cardioversion, or they can be treated with intravenous procainamide. Procainamide, a type IA antidysrhythmic, selectively suppresses conduction in the accessory pathway, reduces the ventricular rate, and leads to cardioversion. ACLS 2000 lists amiodarone as an equivalent choice. However, there is little data to support this recommendation. On the contrary, there are case reports documenting adverse effects and hemodynamic decompensation in AF-WPW patients that receive amiodarone. Some authorities, therefore, advise against using amiodarone in this condition.

References:

- 1- Argyle, Bruce. Madscientist Software. **Arrhythmia Management**. 2006
- 2- Braunwald Eugene, et al. **Harrison's Principles of Internal Medicine**. 16th edition. McGrawHill; 2005
- 3- Iranian Council for Graduate Medical Education. **Exam questions**
- 4- Katzung Bertram G. **Pharmacology: Examination & Board Review**. 7th edition McGrawhill. 2005
- 5- Mattu, Amal. **Myths and Pitfalls in Advanced Cardiac Life Support**. University of Maryland School of Medicine. www. EMedHome.com. 2006
- 6- Monroe Community College. Rochester. **Laddergrams.**, New York, Updated: May 10, 1999
URL: /depts/pstc/paraldr1.htm
- 7- **Regional ALS Treatment Protocols and Procedures**. EMT-Paramedics, 1998
- 8- Semiautomatic **External Defibrillator**. www.health.state.ny.us /nysdoh/ems/pdf/srgpsaed.pdf
- 9- www. **emedicine.com/med/topic3552.htm**. 2006
- 10- Yanowitz, Frank. **ECG Learning Center**. 2006

Arrhythmia-mdm