ECG Interpretation

Part 2

Junctional Rhythms

Junctional Escape Rhythm

3

Junctional Escape Rhythm

- AV node or junction is pacemaker
- Atria are depolarized through retrograde conduction
- Ventricles depolarize normally
- Rate _____ (can be accelerated, >60)
- Retrograde P wave can occur before, during, or after QRS complex, depending on its site of origin in the AV node
- PR interval is variable, depending on the site of origin
- QRS _____

4

Junctional Escape Rhythm

REGULAR -

RATE -

P WAVES -

PRI -

QRS -

5

Junctional Escape Rhythm

- Occurs if significant sinus bradycardia or complete heart block is present
- Sometimes exceeds the sinus node rate at a time when the sinus rate would be normal (dig toxicity)
- Heart rate determines presence of symptoms
- Morbidity & mortality related more to cause (sick sinus node or complete heart block)

6

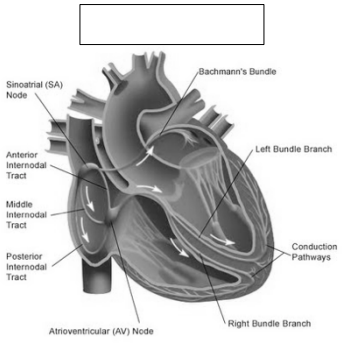
Junctional Escape Rhythm

- Causes
  - Sick sinus syndrome (including drug-induced)
  - Digoxin toxicity
  - Ischemia of the AVN, especially with acute inferior infarction
  - Acutely after cardiac surgery
  - Acute inflammatory processes (eg, acute rheumatic fever), which may involve the conduction system
  - Other drugs (eg, beta-blockers, calcium blockers, most antiarrhythmic agents) that cause sinus bradycardia
- Treatment (depends on cause)
  - permanent pacemaker, if sick sinus or 3° block
  - atropine, if dig toxicity

Bundle Branch Blocks

Bundle Branch Blocks

- Right and left bundle branches send the electrical impulse to the right and left ventricle simultaneously
- When the bundle branches are functioning normally, the right and left ventricles contract at the same time
- BBB occurs when one of the bundle branches becomes diseased or damaged, and stops conducting electrical impulses; that is, a bundle branch becomes “blocked”



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Bundle Branch Blocks

- As the electrical impulse leaves the Bundle of His, it enters good Bundle Branch only, and is carried to the corresponding ventricle
- Then, from that ventricle, the electrical impulse finally makes its way to the other ventricle
- As a result, the two ventricles no longer receive the electrical impulse simultaneously
- First one ventricle receives the electrical impulse, then the other

10

Bundle Branch Blocks

- Rhythm -
- Rate -
- QRS duration –
- P Wave –
- P Wave rate -
- P-R Interval -

11

Right Bundle Branch Block

- Occurs in medical conditions that affect the right side of the heart or the lungs
  - pulmonary embolus
  - chronic lung disease
  - cardiomyopathy
  - atrial and ventricular septal defects
- Observation of RBBB should trigger a screening exam for above conditions
- RBBB is also commonly occurs in normal, healthy individuals

12

Left Bundle Branch Block

- Usually indicates underlying cardiac pathology
  - cardiomyopathy
  - hypertension
  - aortic valve disease
  - coronary artery disease
  - a variety of other cardiac conditions
- Its appearance should trigger a thorough search (as opposed to a simple screening) for underlying cardiac problems

13

Identify BBB

- Diagnosing both kinds of blocks requires looking in the same leads
- However, the QRS will look much different in the 2 blocks
- QRS complex, for both blocks, has to exceed a duration of greater than or equal to 0.12 sec (3 small boxes)

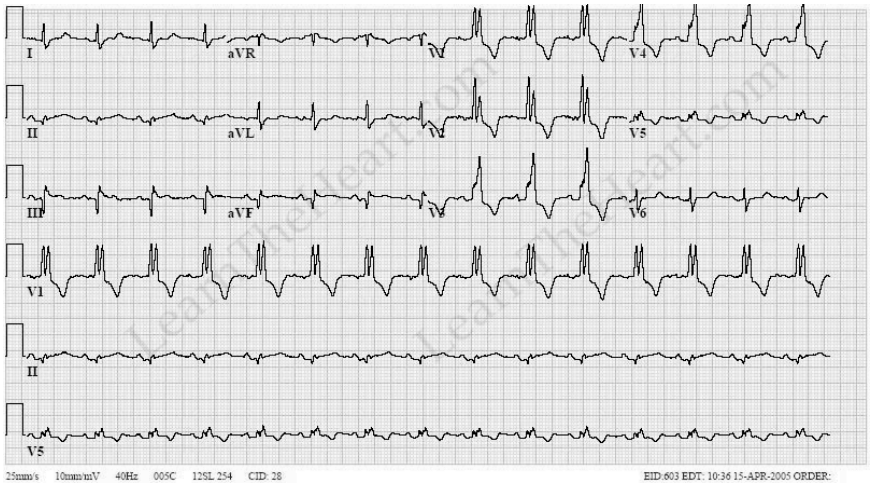
14

RBBB

- First look in leads _____
  - QRS complex has two R-waves → "rabbit ears"
- Next look in leads _____
  - S wave has a "slurred" appearance

15

RBBB



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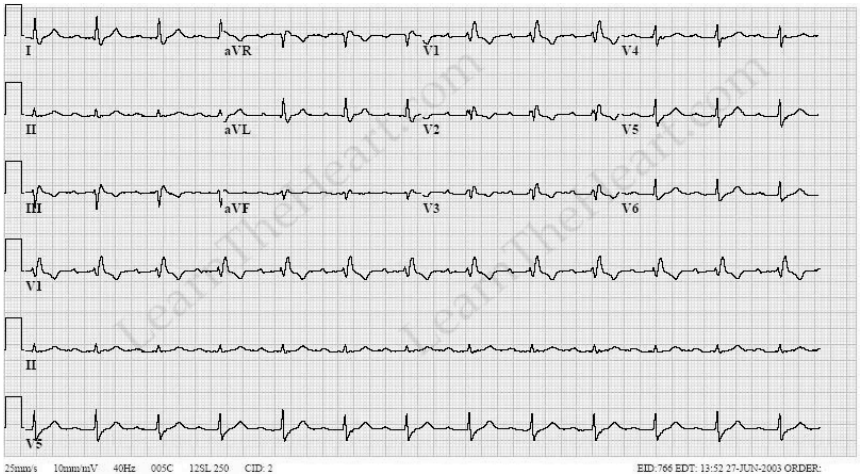
RBBB



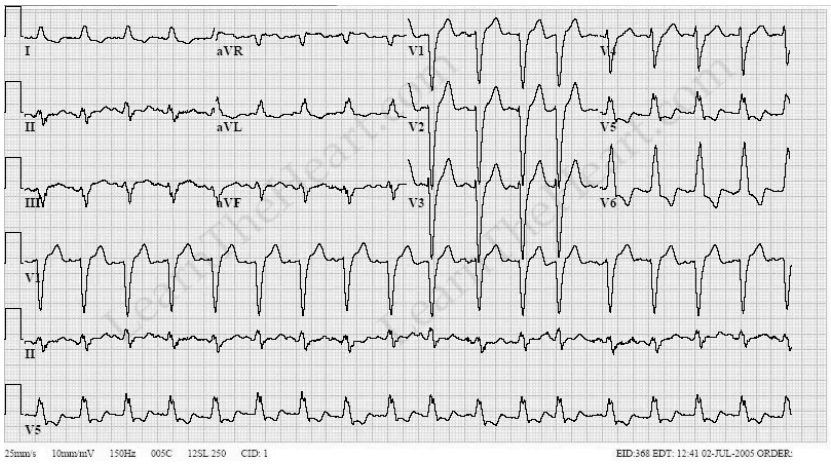
17

LBBB

- First look in leads _____
  - QRS is wide, mostly upright, and the T waves are inverted
- Next look in leads _____
  - if QRS complexes are mostly negative (like big Q waves) and the T waves are upright, then you are for sure looking at LBBB

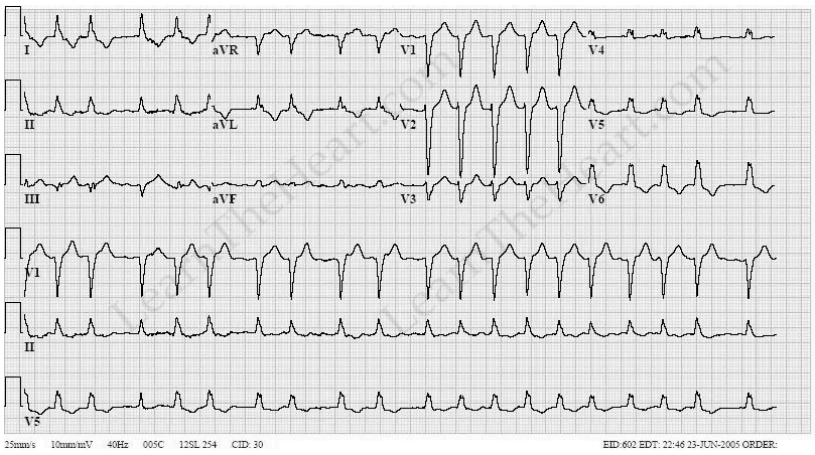
18

LBBB



19

LBBB



20

Bundle Branch Block

- Treatment
  - heart depends on the bundle branches
  - without them, the electrical impulse is not delivered to the ventricles
  - block in both bundle branches, therefore (a condition called complete heart block) can be fatal but is rare
  - if RBBB or LBBB is accompanied by syncope → _____
  - block of both BB → _____

Ventricular Rhythms

Idioventricular Rhythm
Ventricular Tachycardia
Ventricular Fibrillation
Torsade de Pointes
Premature Ventricular Contraction

Ventricular Rhythms

RHYTHM	REGULARITY	RATE	P WAVES	PRI	QRS
Idio-ventricular	regular	20-40	none	none	>0.12 sec wide, bizarre
Vent Tach	usually regular	100-250	none associated	none associated	>0.12 sec wide, bizarre
Vent Fib	no organized rhythm	no organized rhythm	no organized rhythm	no organized rhythm	no organized rhythm
PVC	interrupts underlying rhythm	depends on underlying rhythm	none	none	>0.12 sec wide, bizarre

23

Idioventricular Rhythm

REGULAR -
RATE -
P WAVES -
PRI -
QRS -

24

Idioventricular Rhythm

- _____ sign
- Cause
  - myocardial ischemia (especially inferior wall ischemia or infarction)
  - digoxin toxicity
  - electrolyte imbalance (eg, hypokalemia)
  - hypoxemia
- Treatment
  - _____

25

Ventricular Tachycardia

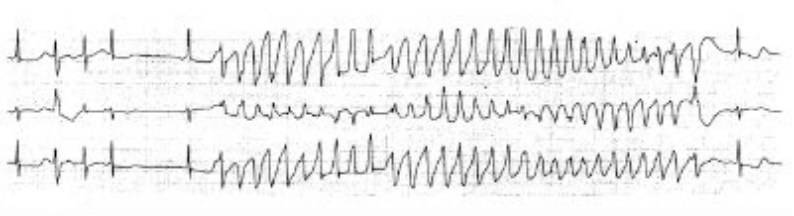
REGULAR -
RATE -
P WAVES -
PRI -
QRS -

26

Ventricular Tachycardia (Monomorphic)

27

Ventricular Tachycardia (Polymorphic)



= torsade de pointes

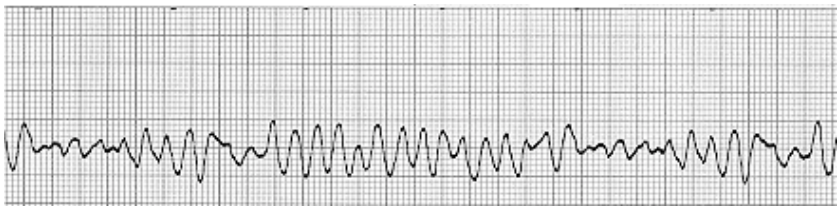
28

Ventricular Tachycardia

- Results from abnormal tissues in the ventricles generating a rapid and irregular heart rhythm
  - coronary artery disease
  - hypokalemia
  - cocaine use
- Poor cardiac output is usually associated with this rhythm thus causing the patient to go into cardiac arrest
- If loss of consciousness, hypotension, no pulse -
  - _____
- If hemodynamic status is stable + no evidence of coronary ischemia or infarction --> rhythm conversion
  - _____

29

Ventricular Fibrillation



REGULAR -
RATE -
P WAVES -
PRI -
QRS -

30

Ventricular Fibrillation

- Causes
  - cardiac
    - myocardial ischemia or infarction due to coronary artery disease
    - cardiomyopathy, myocarditis
    - aortic stenosis
    - pericardial tamponade
    - congenital heart disease
    - electrical accidents
    - heart block
  - respiratory
    - bronchospasm
    - aspiration
    - primary pulmonary hypertension
    - pulmonary embolism
    - tension pneumothorax

31

Ventricular Fibrillation

- Causes (con't)
  - metabolic or toxic
    - electrolyte disturbances and acidosis
    - medications or drug ingestion
    - environmental poisoning
    - sepsis
  - neurologic
    - seizure
    - cerebrovascular accident (intracranial hemorrhage or ischemic stroke)
    - drowning

32

Ventricular Fibrillation

- Treatment
  - prehospital care is vital for arrests due to VF that occur outside the hospital
    - witnessed or early recognition of an arrest
    - early activation of emergency medical services (EMS) system
    - bystander CPR slows the degeneration of VF and improves survival
    - automated external defibrillator (AED) application and defibrillation by trained personnel in the field
    - early access to trained EMS personnel capable of performing CPR, defibrillation, and advanced cardiac life support (ACLS)

33

Ventricular Fibrillation

- Treatment
  - hospital care (ACLS) = **SCREAM**

S	Shock	360J monophasic, 200J biphasic, 1st and subsequent shocks. (Shock every 2 minutes if indicated)
C	CPR	After shock, immediately begin chest compressions followed by respirations (30:2 ratio) for 2 minutes. (Do not check rhythm or pulse)
R	Rhythm	Rhythm check after 2 minutes of CPR (and after every 2 minutes of CPR thereafter) and shock again if indicated. Check pulse only if an organized or non-shockable rhythm is present.

34

Ventricular Fibrillation

E	Epinephrine	1 mg IV/IO q3-5 min. Or vasopressin 40 U IV/ IO, once, in place of the 1st or 2nd dose of epi.
AM	Antiarrhythmic Medications	Consider antiarrhythmics: Amiodarone 300mg IV/IO, may repeat once at 150mg in 3-5 min. if VF/PVT persists or Lidocaine (if amiodarone unavailable) 1.0-1.5 mg/kg IV/IO, may repeat X 2, q5-10 min. at 0.5-0.75 mg/kg, (3mg/kg max. loading dose) if VF/PVT persists, or Magnesium Sulfate1-2 g IV/IO diluted in 10mL D5W (5-20 min. push) for torsades de pointes or suspected/ known hypomagnesemia.

35

Premature Ventricular Contractions

- Odd QRS waveforms = ventricles depolarizing prematurely in response to increased automaticity within the ventricles
- Electrical impulse does not pass over the ventricles in the regular, organized way --> result may be a heart beat that is less effective in pumping blood
- In addition, since the PVC comes early, the left ventricle is not properly filled, so the cardiac output from these premature beats is lower than a normal sinus beat

36

Premature Ventricular Contractions

- Occur in normal heart
  - anxiety
  - excessive use of alcohol, caffeine, tobacco, cocaine
  - meds (epinephrine, theophylline)
- Occur in diseased heart
  - ischemia
- Other causes
  - acidosis, electrolyte imbalance
  - CHF, MI
  - hypoxia

37

Premature Ventricular Contractions

- Single PVC poses no problems, but may signal serious problems
- Causes for concern
  - increased frequency (> 6/minute)
  - multifocal
  - couplets
  - salvos
  - R-on-T phenomenon

38

Premature Ventricular Contractions

REGULAR -
RATE -
P WAVES -
PRI -
QRS -

39

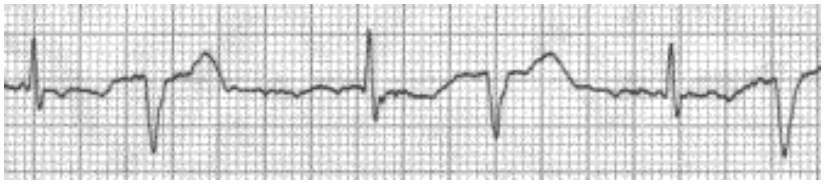
Premature Ventricular Contractions

- _____

40

Premature Ventricular Contractions

- _____



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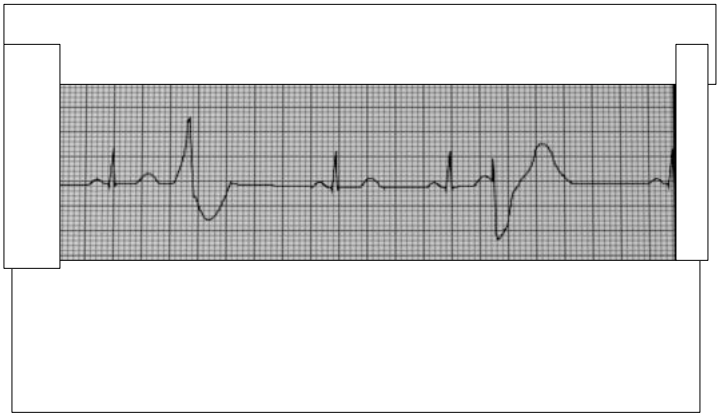
Premature Ventricular Contractions

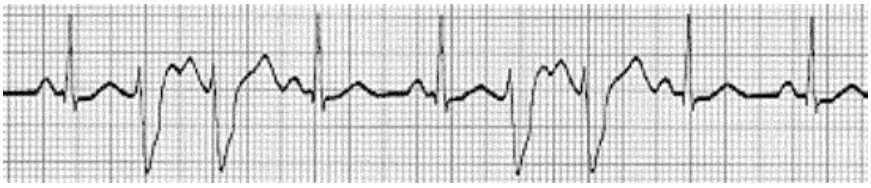
- _____



42

Premature Ventricular Contractions

- _____



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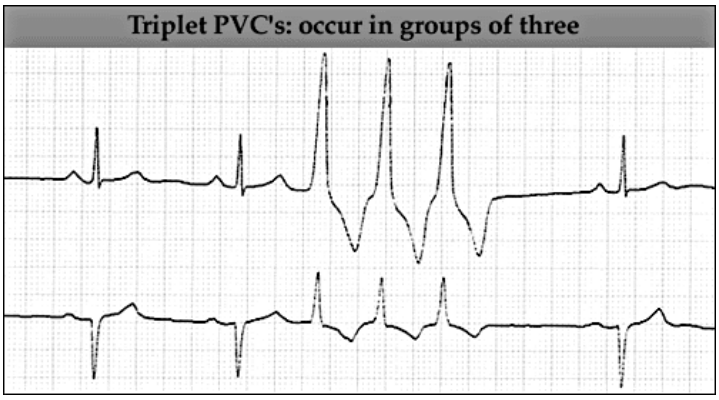
Premature Ventricular Contractions

- _____



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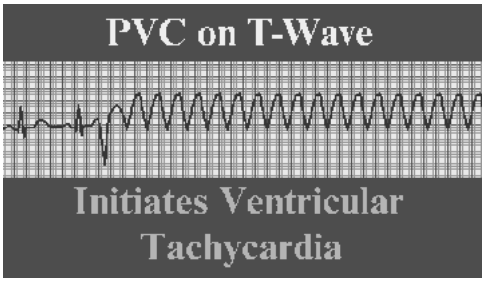
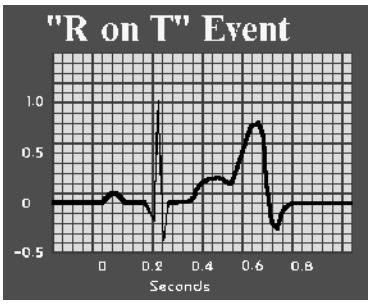
Premature Ventricular Contractions

- _____





Premature Ventricular Contractions

- Treatment
  - if asymtomatic - no specific treatment
  - cut down on use of alcohol, caffeine, tobacco, cocaine
  - treat underlying cause
  - there is little scientific evidence that suppressing PVCs with anti-arrhythmic medications (lidocaine, procainamide, amiodarone) prevent ventricular tachycardias and ventricular fibrillations and sudden death

Premature Ventricular Contractions

- Treatment (if symtomatic)
  - normal hearts
    - calcium channel blockers - reduce the amount of Ca^{++} that enters the smooth muscle in blood vessel walls and heart muscle --> cause muscle cells to relax and blood vessels to dilate, reducing BP as well as reducing the force and rate of the heartbeat (negative inotropic/chronotropic agent)
    - beta blockers - block some of the effects of the sympathetic nervous system, which stimulates particular involuntary functions at times of stress, increasing the heart rate and raising BP --> lower BP in part by decreasing the rate and force at which the heart pumps blood(negative inotropic/chronotropic agent)
    - radiofrequency catheter ablation

Premature Ventricular Contractions

- Treatment (with structural heart disease)
  - PVCs may be a sign of an oncoming dangerous heart rhythm, loss of consciousness, or even cardiac arrest
  - treatment strategy depends upon the severity of the underlying heart disease
  - if heart muscle function is severely decreased (due to prior heart attack, cardiomyopathy or significant hypertrophic cardiomyopathy), an implantable cardioverter defibrillator (ICD) may be recommended

Others

49

Pulseless Electrical Activity

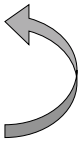
- Formerly - electromechanical dissociation (EMD)
- Dissociation of electrical & mechanical activity = electrical activity --> _____
- Is rare
- Causes - _____

Hypovolemia	**T**oxins (OD)
Hypoxia	**T**amponade, cardiac
Hydrogen ion (acidosis)	**T**ension pneumothorax
Hypo-/Hyperkalemia	**T**hrombosis, pulmonary
Hypoglycemia	**T**rauma
Hypothermia	

50

Pulseless Electrical Activity

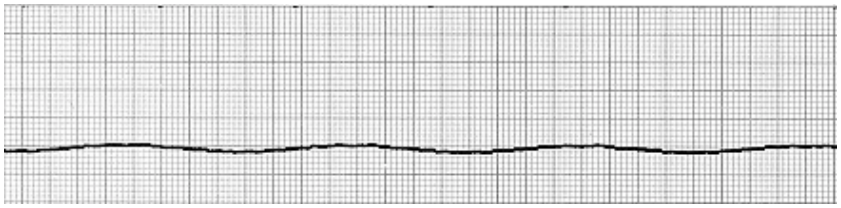
- Treatment
  - CPR (intubate), monitor, IV
  - confirm in another lead
  - consider possible causes & treatments
  - epinephrine
    - 1 mg IV every 3-5 minutes
  - atropine
    - 1 mg IV every 3-5 minutes to a total of 0.04 mg/kg
  - consider termination of efforts



51

Asystole

- Is an arrhythmia, not a dysrhythmia
- = _____
- Usually fatal unless rhythm rapidly restored
- Straight or almost straight line



52

Asystole

- Causes
  - _____

Hypovolemia	**T**oxins (OD)
Hypoxia	**T**amponade, cardiac
Hydrogen ion (acidosis)	**T**ension pneumothorax
Hypo-/Hyperkalemia	**T**hrombosis, pulmonary
Hypoglycemia	**T**rauma
Hypothermia	

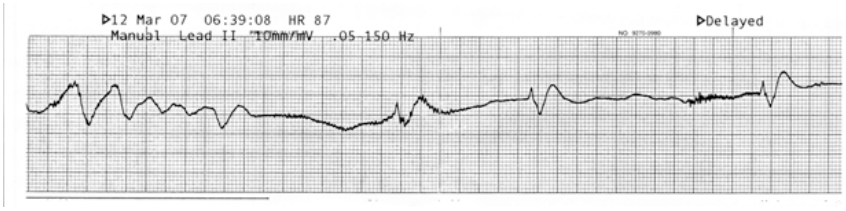
Asystole

- Treatment
  - CPR (intubate), monitor, IV
  - confirm in another lead
  - consider possible causes & treatments
  - epinephrine
    - 1 mg IV every 3-5 minutes
  - atropine
    - 1 mg IV every 3-5 minutes to a total of 0.04 mg/kg
  - consider termination of efforts

Agonal Rhythm

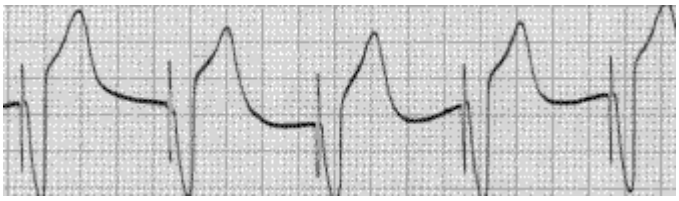
Agonal Rhythm

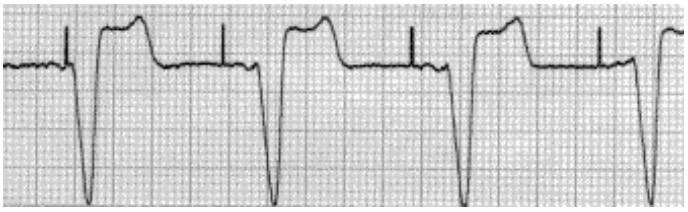
- QRS complexes are ventricular escape beats as noted by the severe bradycardia (inherent ventricular rate in the 40s), wide complex indicating origin is in the ventricle, and lack of a preceding p-wave



Paced Rhythm

57





58

AV Sequential Pacemaker (dual chamber)

One spike followed by an abnormal P (atrial capture) followed by a Second spike producing a wide QRS (ventricular capture).

COPD

COPD

- COPD patients typically have ECG abnormalities
- Right axis deviation
  - due to hyperinflation of lungs & flattening of diaphragms --> more vertical position of heart
- Right ventricular hypertrophy
  - due to pulmonary hypertension --> right heart enlargement (cor pulmonale)
- Dysrhythmias often seen
  - tachycardia
  - multifocal atrial tachycardia
  - PVCs
  - RBBB

- practice strips
  - http://monroecc.edu/Depts/pstc/backup/prandekg.htm
  - http://www.skillstat.com/Flash/ECGSim531.html
  - http://sprojects.mmi.mcgill.ca/heart/puz990914r1.html
- ACLS
  - http://www.acls.net/aclsalg.htm