ECG Interpretation

Part 1

Interpretation

- First
  - patient's condition must be evaluated
  - all dysrhythmias must be interpreted and evaluated with respect to the patient's clinical presentation
  - signs & symptoms that may be associated with dysrhythmias

chest pain	fine crackles in bases
dyspnea	pale, cool, clammy skin
palpations	dizziness or syncope
nausea	sense of impending doom
hypotension	altered LOC

2

Levels of Interpretation

- 1st level
  - identify the ventricular response
  - contraction of ventricles creates majority of CO and perfusion of blood to tissues
  - evaluated by QRS complex and resulting pulse strength

3

Levels of Interpretation

- 2nd level
  - place dysrhythmia into appropriate category based on origin of the electrical impulse
    -
    -
    -

4

Levels of Interpretation

- 3rd level
  - evaluate the pathway of the conduction disturbance
    - ectopic beats or rhythms
    - escape beats or rhythms
    - AV blocks
    - bundle branch blocks

- To make sure all components are covered, you must adopt a systematic approach
  - avoid assumptions

5

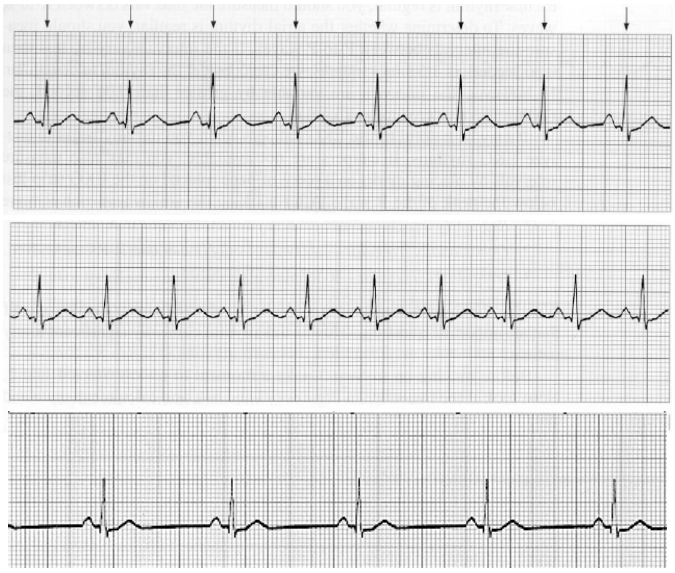
Step 1

- Identify the heart rate
  - most monitors display rate
  - always take patient's pulse to make sure monitor is correct
  - on strip
    - 300 ÷ no. of large boxes between QRS

    - more than _____ large boxes between = _____
    -
    - less than _____ large boxes between = _____

6

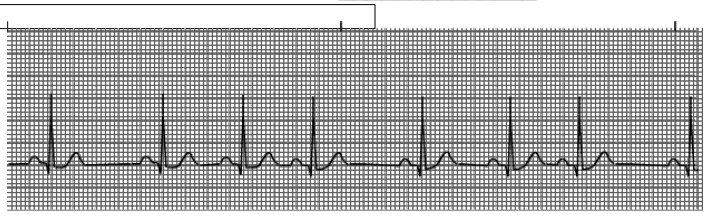
Rate



7

Step 2

- Evaluate the rhythm
  - classified as either _____ or _____
  - establish the pattern of QRS complexes
    - measure ventricular rhythm by measuring interval between R-R waves
    - then measure atrial rhythm by measuring interval between P-P waves
    - if intervals > 0.06 seconds = _____



8

- Irregularity can occur randomly or in patterns
- Irregular rhythms may indicate the following
  - ectopic beats
  - escape beats
  - 2° heart AV blocks
  - atrial fibrillation
  - sinus dysrhythmias

9

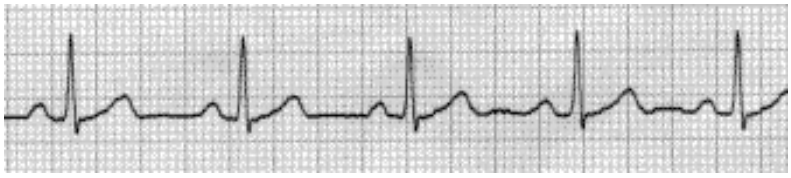
Step 3

- Note the presence of _____ waves
- Generally _____ (depending on lead)
- Rounded shape
- < 0.12 seconds wide & < 2.5 small boxes tall
  - Odd-shaped P waves may indicate _____ enlargement
- Normal rhythms
  - 1 P wave preceding each _____
  - every P wave _____
- If looks like >1 P per QRS -->
  - atrial flutter, atrial fibrillation, 2° AV block, 3° AV block

10

Step 4

- Measure the _____
- Normal = 0.12 - 0.2 seconds (3-5 small boxes)
- Wider than 0.2 seconds = delay in conduction through the _____



PR interval = 0.16 seconds (4 x 0.04)

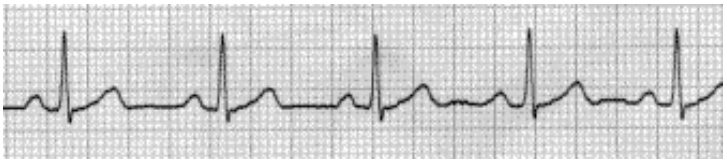
11

PR interval = 0.24 seconds (6 x 0.04)

12

Step 5

- Measure the width of _____
- Normal width = < 0.12 seconds (3 small boxes)

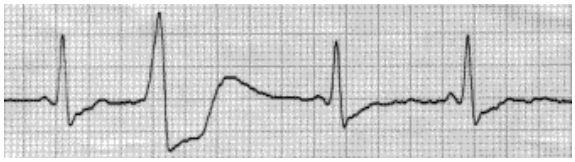


QRS width = 0.04 seconds (1 x 0.04)

13

- > 0.12 seconds = _____ in origin
  - bundle branch blocks
  - ectopic beats originating in the ventricles (PVC)
  - ventricular dysrhythmias (v-tach, idioventricular rhythms)
  - 3° AV blocks

QRS width = 0.32 seconds (8 x 0.04)



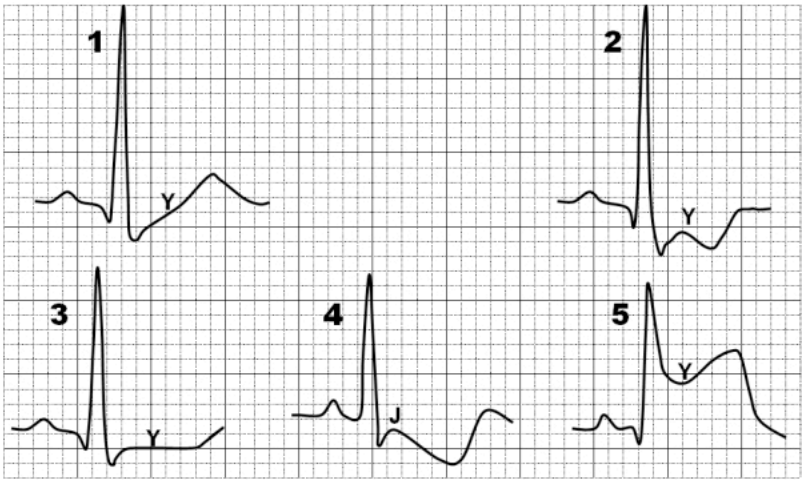
QRS width = 0.4 seconds (10 x 0.04)

14

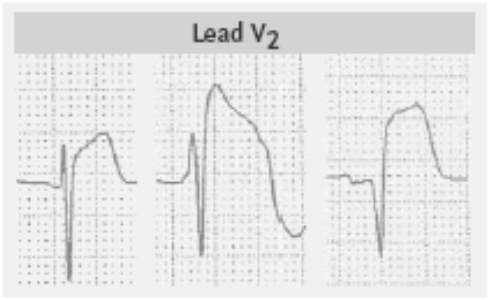
Step 6

- Inspect the _____ *in all leads*
- ST elevation = _____
- ST depression = _____
- Area of ischemia or injury can be determined by which leads are abnormal

15



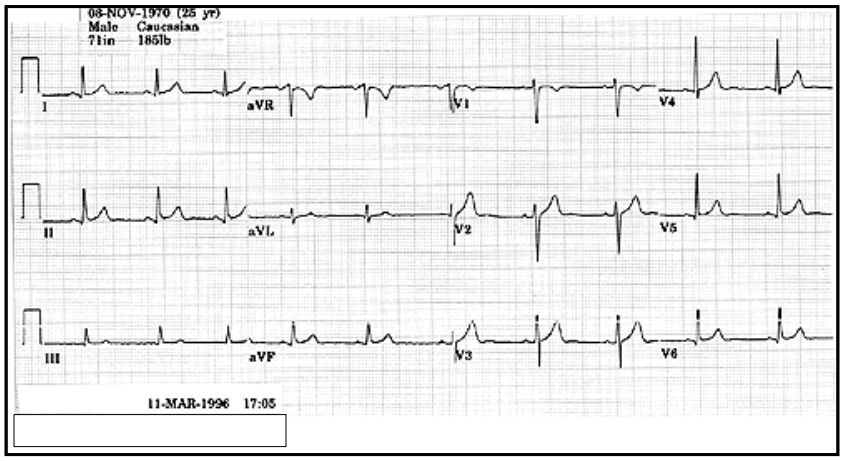
16



17

Step 7

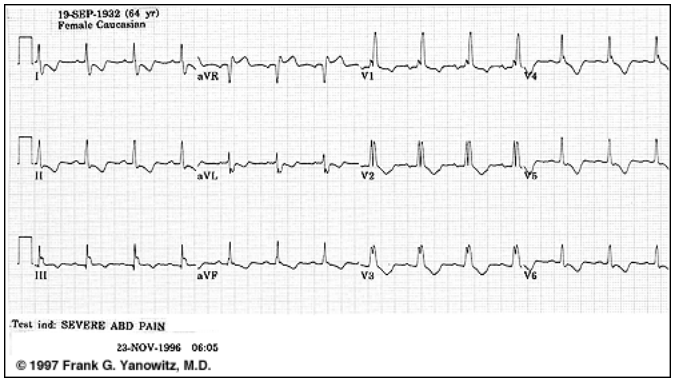
- Identify the _____



18

Step 8

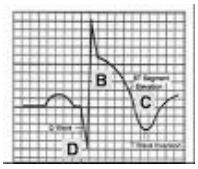
- Assess the _____
  - some QRS complexes have additional deflections
  - if there is a 2nd R or S deflection = R' or S'



19

Step 9

- Evaluate the _____
  - a Q wave is considered normal if it is less than 0.04 seconds (1 small box) wide and less than 1/3 the height of the R wave
  - Q waves that are >0.04 seconds and higher than 1/3 height of R wave = pathologic
    - _____
    - _____



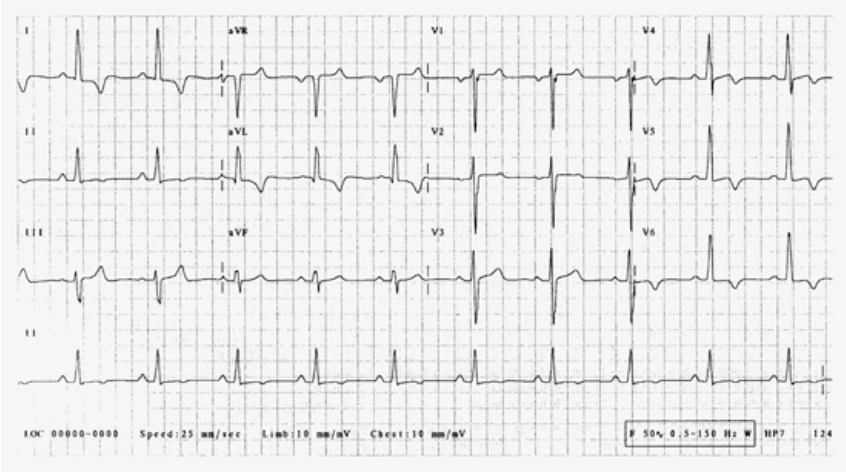
20

Step 10

- Look for signs of _____
  - high-voltage R waves in precordial leads = _____
  - large or abnormally-shaped P waves = _____

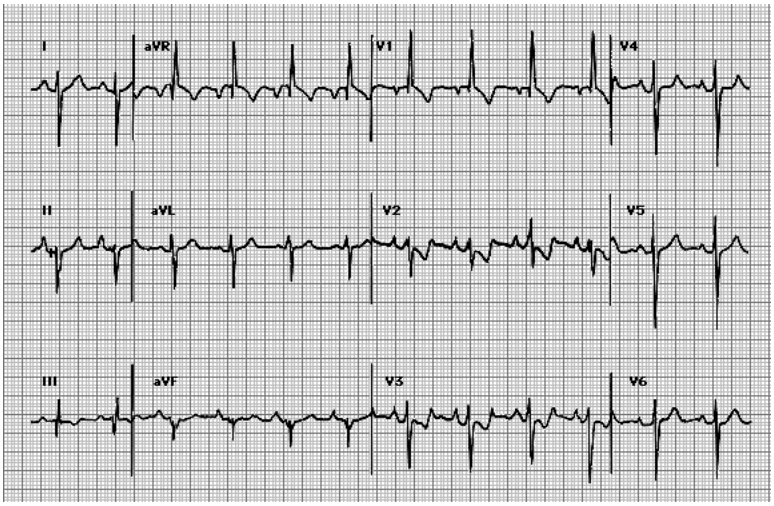
21

Left Ventricular Hypertrophy



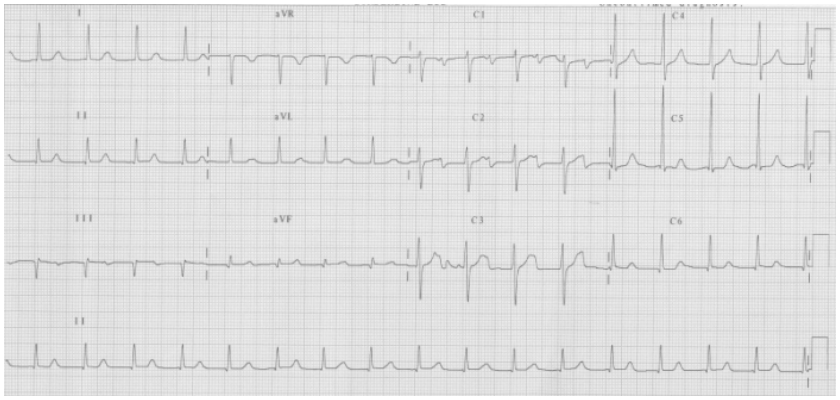
22

Right Ventricular Hypertrophy



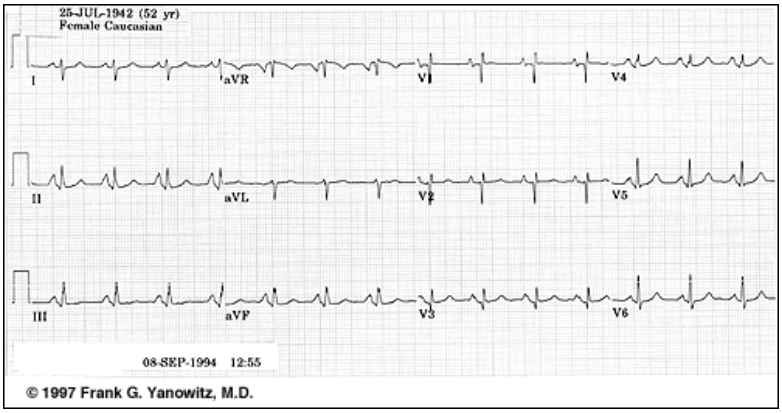
23

Left Atrial Enlargement



24

Right Atrial Enlargement



25

Common Dysrhythmias

Organized Approach

- Use algorithm
- Questions and answers that lead way to interpretation
- Confusing at first
- Rhythms
  - sinus
  - atrial
  - junctional
  - ventricular
  - blocks

27

Main Algorithm

- _____
  - regular, regular but interrupted, irregular?
  - compare P-P and R-R intervals
- _____
  - ventricular and atrial rates?
  - <60, 60-100, >100?
- _____
  - present?
  - normal shape?
  - same shape or varied?
  - relationship to QRS?
    - 1 per QRS? same place to each QRS? QRS without P?

28

Main Algorithm

- _____
  - normal? (0.12-0.20 seconds)
  - constant?
- _____
  - normal? (0.06 to 0.12 seconds)
  - same size and shape?
  - a QRS complex after each P wave?
- Evaluate any other _____
  - ectopics?
  - aberrantly conducted beats?
  - any other abnormalities?

29

Sinus Rhythms

Normal Sinus Rhythm
Sinus Bradycardia
Sinus Tachycardia
Sinus Arrhythmia

Sinus Rhythms

RHYTHM	REGULARITY	RATE	P WAVES	PRI	QRS
Normal Sinus	Regular	60-100	upright, uniform, 1:1	0.12-0.20	<0.12 seconds
Sinus Brady	Regular	<60	upright, uniform, 1:1	0.12-0.20	<0.12 seconds
Sinus Tach	Regular	>100	upright, uniform, 1:1	0.12-0.20	<0.12 seconds
Sinus Arrhythmia	Regular	Depends	upright, uniform, 1:1	0.12-0.20	<0.12 seconds

31

Normal Sinus Rhythm

REGULAR -

RATE -

P WAVES -

PRI -

QRS -

32

Sinus Bradycardia

REGULAR -

RATE -

P WAVES -

PRI -

QRS -

33

Sinus Bradycardia

- Causes
  - increased vagal stimulation
  - damage to SA node (MI)
  - hypothyroidism
  - hypothermia
  - hyperkalemia
  - drugs
- Treatment
  - _____
  - atropine
  - pacing
  - treat cause

34

Sinus Tachycardia

REGULAR -

RATE -

P WAVES -

PRI -

QRS -

35

Sinus Tachycardia

- Causes
  - sympathetic nervous system stimulation
  - fever, hypoxemia, hypovolemia, sepsis, heart failure
  - drugs, caffeine, alcohol
- Treatment
  - _____
  - observation
  - fluid (IV) if hypotension, hypoperfusion present
  - beta-blockers -
    - propranolol (Inderal)
    - metoprolol (Lopressor, Toprol XL)
    - carvedilol (Coreg)
    - atenolol (Tenormin)

36

Sinus Dysrhythmia

REGULAR -

RATE -

P WAVES -

PRI -

QRS -

37

Atrial Rhythms

Atrial Flutter

Atrial Fibrillation

Atrial Tachycardia

Premature Atrial Contraction

Atrial Rhythms

RHYTHM	REGULARITY	RATE	P WAVES	PRI	QRS
Atrial Flutter	Regular or irregular	atrial rate 250-350 vent rate varies	flutter waves present sawtooth pattern	usually constant	<0.12 seconds
Atrial Tach	Regular	150-250	differs from other P waves, may be buried in T wave	<0.12 generally, can vary	<0.12 seconds
Atrial Fib	Irregularly regular	atrial rate 350-750 vent rate varies	none	none	<0.12 seconds

39

Atrial Flutter

REGULAR -

RATE -

P WAVES -

PRI -

QRS -

40

Atrial Flutter

- Caused by
  - _____
    - post-cardiac surgery, MI, myocarditis, pericarditis, cardiomyopathy
- Results in
  - decreased atrial filling time -- _____
  - areas of diminished blood flow near atrial walls --> “mural thrombi” along atrial walls --> break off --> _____
- Short-lived - rapidly deteriorates into atrial fibrillation or spontaneously returns to patient’s previous rhythm
- Symptoms - palpitations, rapid heart rate, chest pain, shortness of breath, light headedness, fatigue, and low blood pressure

41

Atrial Flutter

- Treatment
  - _____
  - control of the ventricular rate (drugs that block AV node)
    - calcium channel blockers (eg, verapamil, diltiazem) or beta-blockers, adenosine, digoxin
  - restoration of sinus rhythm
    - radiofrequency ablation, electrical cardioversion, chemical cardioversion
  - prevention of thromboembolic complications
    - Coumadin

42

Atrial Fibrillation

REGULAR -

RATE -

P WAVES -

PRI -

QRS -

43

Atrial Fibrillation

- Caused by
  - same causes as atrial flutter
  - hyperthyroidism
  - pulmonary disease
  - congenital heart disease
- Results in
  - no help with ventricular filling
  - areas of diminished blood flow near atrial walls --> “mural thrombi” along atrial walls --> break off --> PTE

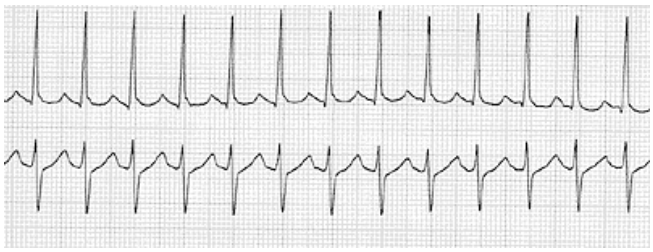
44

Atrial Fibrillation

- Treatment
  - _____
  - anticoagulation - aspirin, Coumadin
  - rate control - calcium channel blockers (eg, verapamil, Cardizem) or beta-blockers, adenosine, digoxin
  - antiarrhythmic meds (quinidine, procainamide, amiodarone)
  - ablation
  - device implants - atrial pacers
  - _____*****

45

Atrial Tachycardia



REGULAR -

RATE -

P WAVES -

PRI -

QRS -

46

Atrial Tachycardia

- Occurs when an ectopic focus in the atrium over-rides the SA node and paces the heart → _____
- Comes and goes spontaneously & abruptly
- Causes
  - emotional stress, mitral valve disease, rheumatic ♥ disease, digitalis toxicity, alcohol, caffeine, nicotine
- Result
  - increases myocardial oxygen demand
  - reduces ventricular filling time
- Symptoms
  - light-headedness
  - palpitations
  - syncope

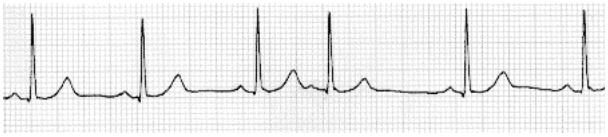
47

Atrial Tachycardia

- Treatment
  - _____
  - _____
  - chemical _____ (adenosine)
  - ca channel blocker drugs (Verapamil), digitalis
  - electric _____
  - ablation
  - _____

48

Premature Atrial Contraction



REGULAR -

RATE -

P WAVES -

PRI -

QRS -

49

Premature Atrial Contraction

- Causes
  - CHF, ischemia and _____
  - Can lead to more serious atrial dysrhythmias
- May feel palpitation
- Are common
- Almost always _____
- No special treatment needed
- Can be exacerbated by certain substances (e.g., alcohol, decongestants, caffeine, nicotine)

50

Heart Blocks

1° Heart Block
2° Heart Block Type I (Wenckebach)
2° Heart Block Type II (Mobitz II)
3° Heart Block

Heart Blocks

RHYTHM	REGULARITY	RATE	P WAVES	PRI	QRS
1°	Usually regular	Depends on underlying rhythm	uniform, upright, 1:1	>0.20 sec	<0.12 sec
2° Type I Wenckebach	Irregular	Normal to slow	uniform, upright, >1:1	increases until a QRS is dropped	<0.12 sec
2° Type II Mobitz	Regular or irregular	Usually bradycardic	uniform, upright, >1:1	constant for conducted beats	normal or widened
3°	Regular	Usually bradycardic	uniform, upright, >1:1, no relation to QRS	no relationship	<0.12 seconds if junctional pacemaker, >0.20 if ventricular

52

1° Heart Block

REGULAR -

RATE -

P WAVES -

PRI -

QRS -

53

1° Heart Block

- Caused by
  - conduction delay through the AV node but all electrical signals reach the ventricles
  - digitalis can slow conduction of the impulse from the atria to the ventricles
  - hyperkalemia
  - well-trained athletes may have it
  - rarely causes any problems
  - treatment _____

54

2° Heart Block Type I (Wenckebach)

REGULAR -

RATE -

P WAVES -

PRI -

QRS -

55

2° Heart Block Type I (Wenckebach)

- May or may not compromised cardiac output
- Can cause _____
- Same causes as 1° heart block
- No specific treatment

56

2° Heart Block Type II (Mobitz)

REGULAR -
RATE -
P WAVES -
PRI -
QRS -

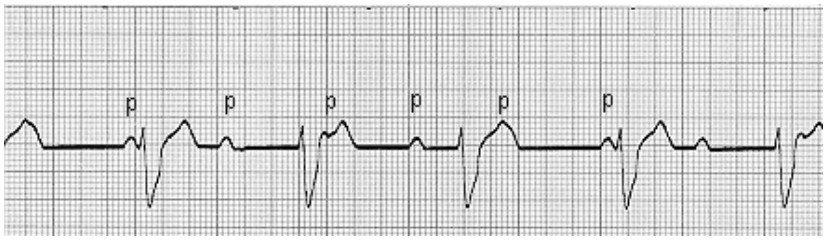
57

2° Heart Block Type II (Mobitz)

- Rarer, but more serious than Wenckebach
- Causes
  - damage to AV node (MI)
  - degenerative disease
- Symptoms
  - light-headedness
  - dizziness
  - syncope
- Treat promptly - can lead to complete heart block
  - _____

58

3° Heart Block (Complete)



REGULAR -

RATE -

P WAVES -

PRI -

QRS -

59

3° Heart Block (Complete)

- None of the P waves are being conducted to ventricles, ventricles doing their own thing (not very well) - complete AV dissociation
- Block occurs at the level of the AV node (20%), the bundle of His (60%), or the bundle-branch Purkinje system(20%)
- Cause
  - acquired
    - overdose AV-nodal, beta-adrenergic, and calcium channel blocking agents
    - anterior wall MI, cardiomyopathy, severe hyperkalemia
  - congenital
- Treatment
  - _____

60