Beat the Heart Blocks

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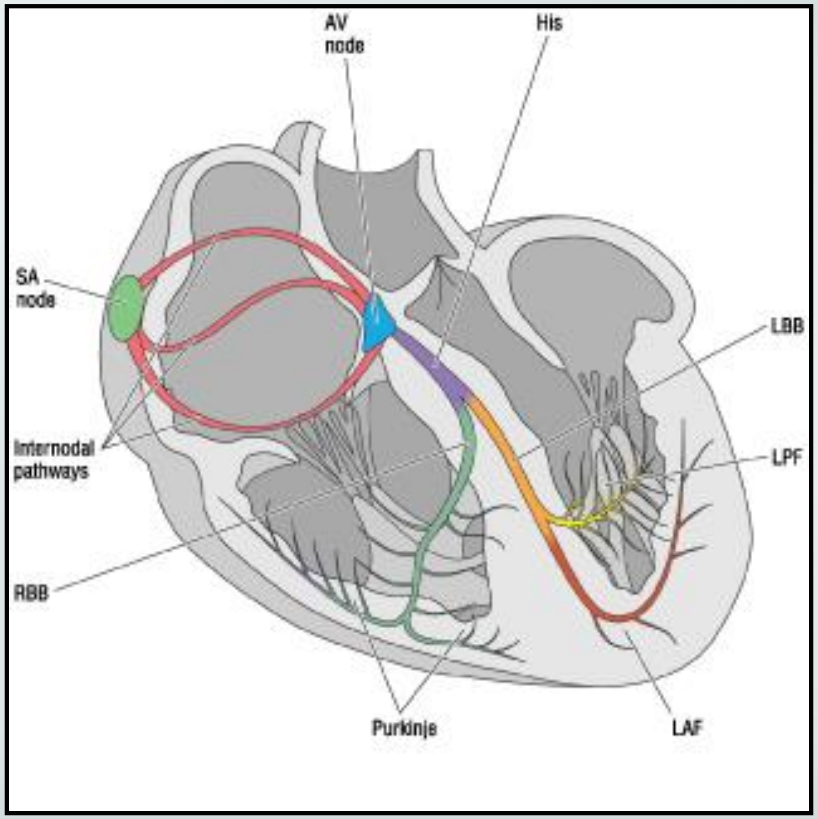
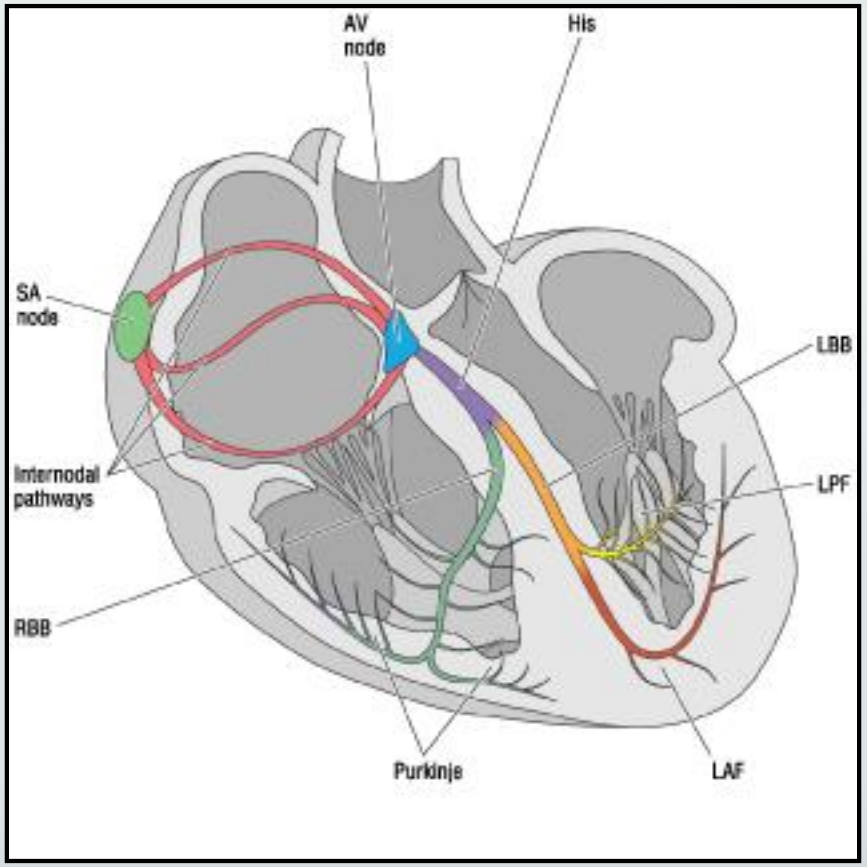
*B*eat the Blocks

- **Complete RBBB**
- **Complete LBBB**
- **Bifascicular, Trifascicular Blocks**
- **1st degree Heart Block**
- **2nd degree Heart Block**
- **3rd degree Heart Block**



The Electrical Conduction System

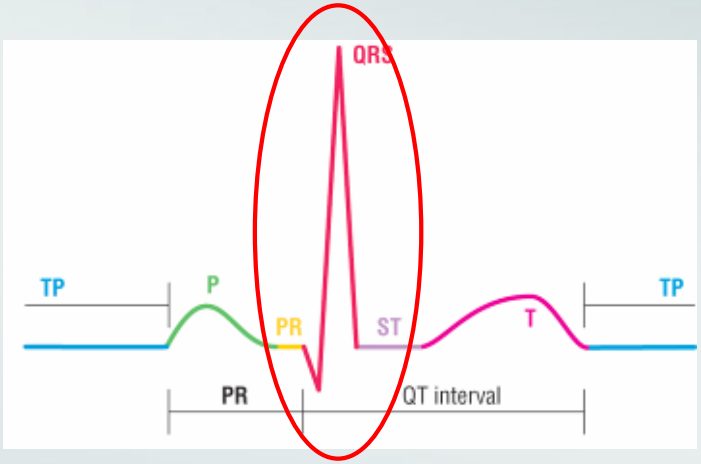
Creates an electrical impulse and transmits it in an organized manner to the rest of the myocardium



SA node	**60-100 BPM**
AV node	**40-60 BPM**
Purkinje cells	**20-40 BPM**

Basic Components of the Complex Deflections & Segments

- **P Wave**
  - Rounded, < 2-3 mm, ↑ in hypertrophy
- **QRS Segment**
  - ≤ .12 sec. & > 5 mm, transition occurs V3 or V4
  - presence of Q normal in children/elderly
  - Q wave sig. > 0.5 mm
- **T Wave**
  - < 5-10 mm, peaked in ↑ K+
- **U Wave**
  - Follows T wave, present in ↓ K+
- **ST Segment**
  - Isoelectric, sig. If > +1.0 above or below baseline
  - Depression = ischemia
  - Elevation = injury



- Bundle Branch Blocks are identified by duration of QRS complex
- Normal QRS duration 60 – 100 msec

Right Bundle Branch Block
RBBB

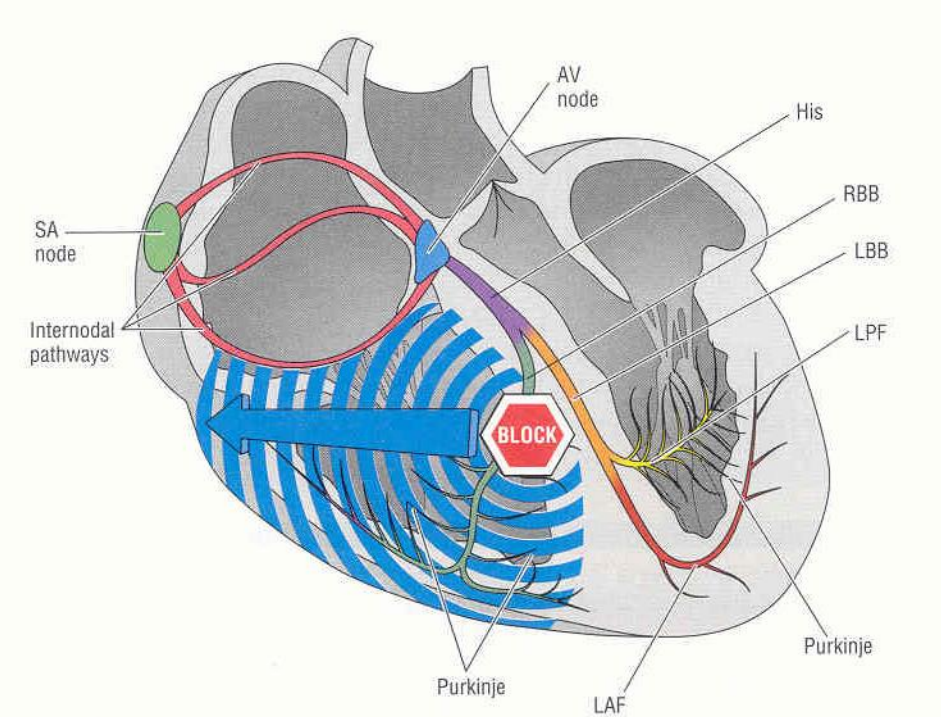
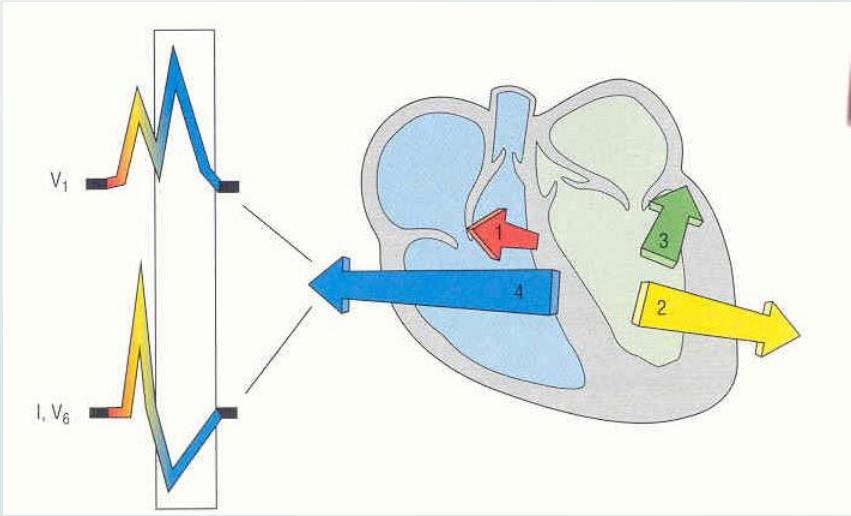


Figure 13-2: Right bundle branch block.



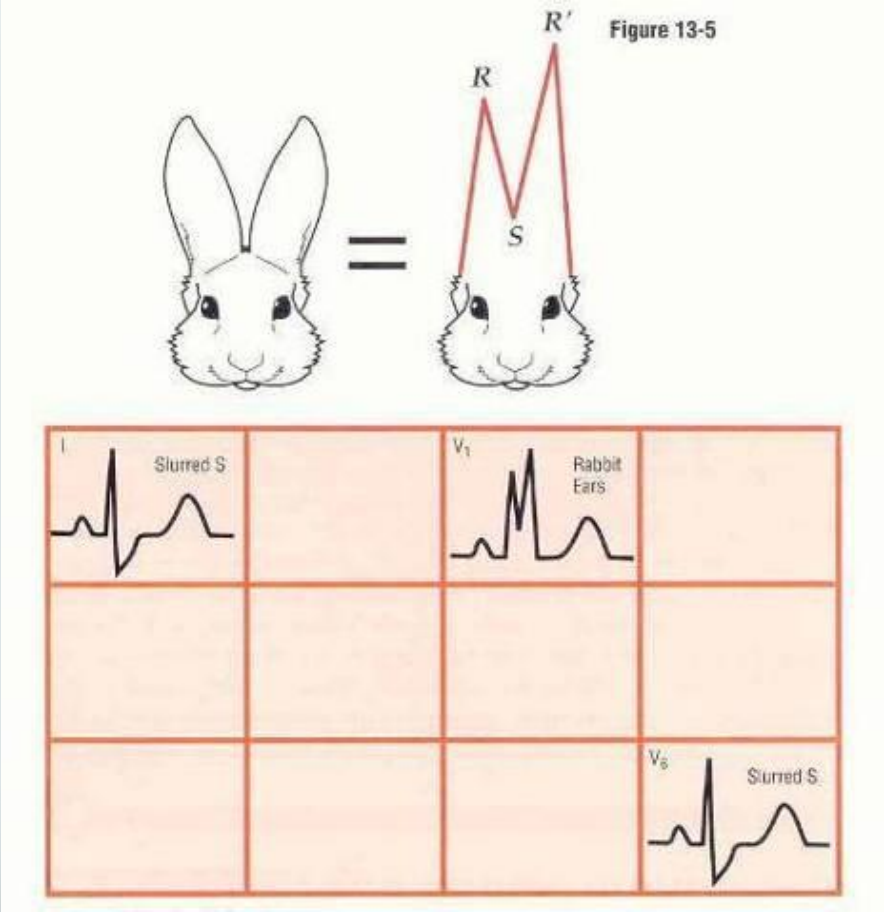
Source: Garcia 12 Lead EKG 13:2 & 13:3

Right Bundle Branch Block
RBBB

Causes

- Chronically increased right ventricular pressure, as in cor pulmonale
- Right ventricular hypertrophy
- A sudden increase in right ventricular pressure with stretch, as in pulmonary embolism.
- Congenital heart disease (atrial septal defect)

RBBB Criteria



- **QRS ≥ 0.12 sec or 120msec**
- **Slurred S wave leads I & V6**
- **RSR' pattern V1**

Easy way:

- **V1 = Positive, QRS ≥ 0.12 sec**
- **Rabbit Ears**

Source: Garcia. 12 Lead ECG

RBBB

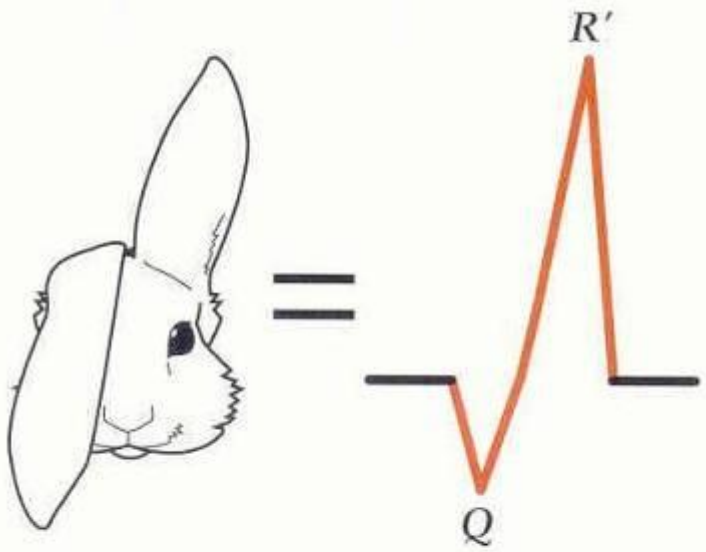


Figure 13-7: If you see a Q wave in lead V_1 in the presence of RBBB, the first positive deflection is called an R′ wave instead of an R wave.

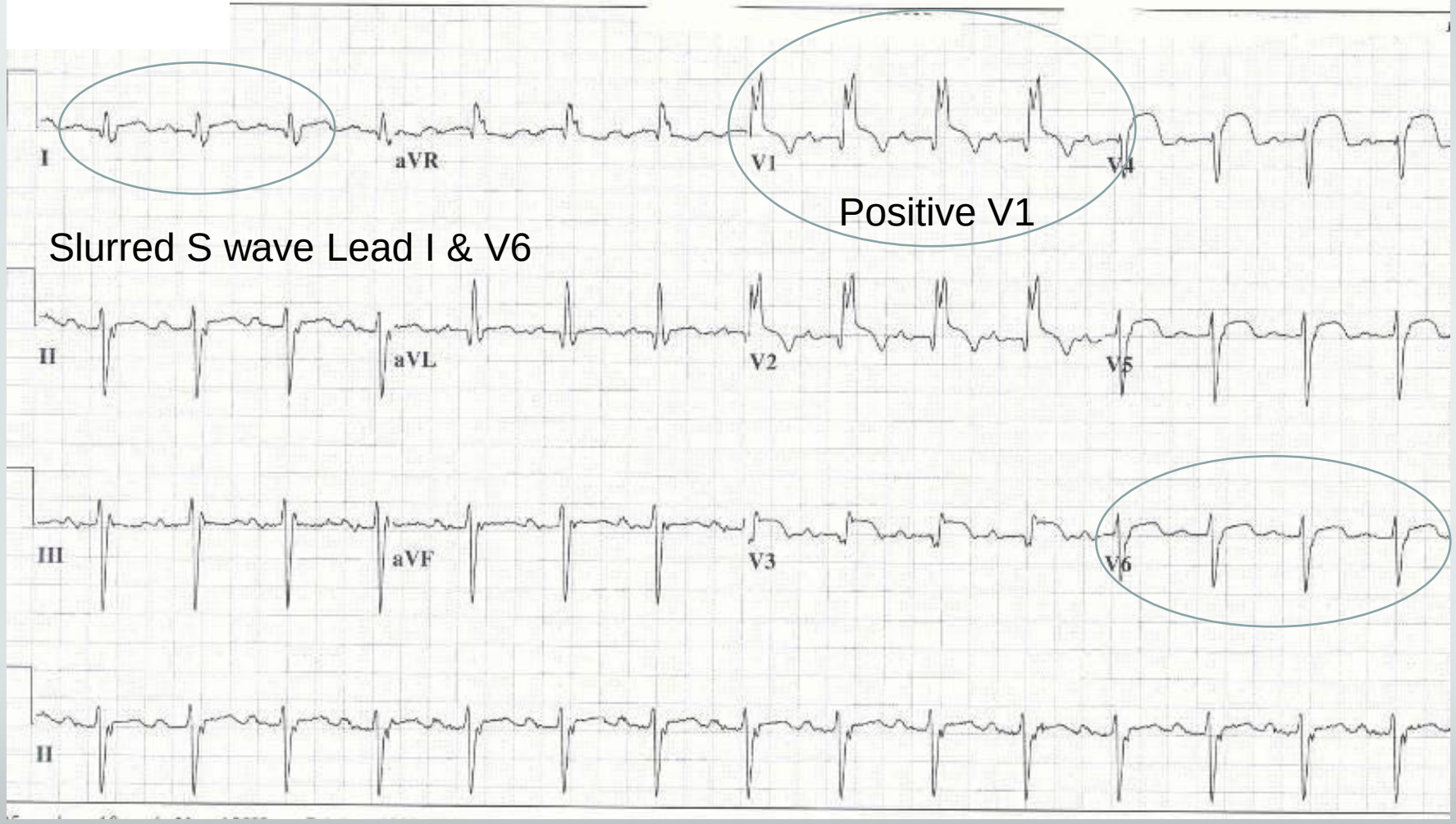
- **Half a rabbit ear**
- **QRS mostly postive**

Source: Garcia. 12 Lead ECG

Vent. rate	92	BPM
PR interval	232	ms
QRS duration	136	ms
QT/QTc	376/464	ms
P–R–T axes	48 –82	17

Sinus rhythm with 1st degree A–V block
Right bundle branch block
Left anterior fascicular block
*** Bifascicular block ***
Recent Anterolateral infarct (cited on or before 30–SEP–2009)
** ** ** ** * ACUTE MI * ** ** ** **
Abnormal ECG
When compared with ECG of 02–OCT–2009 04:26,
PR interval has increased

QRS = 136 ms

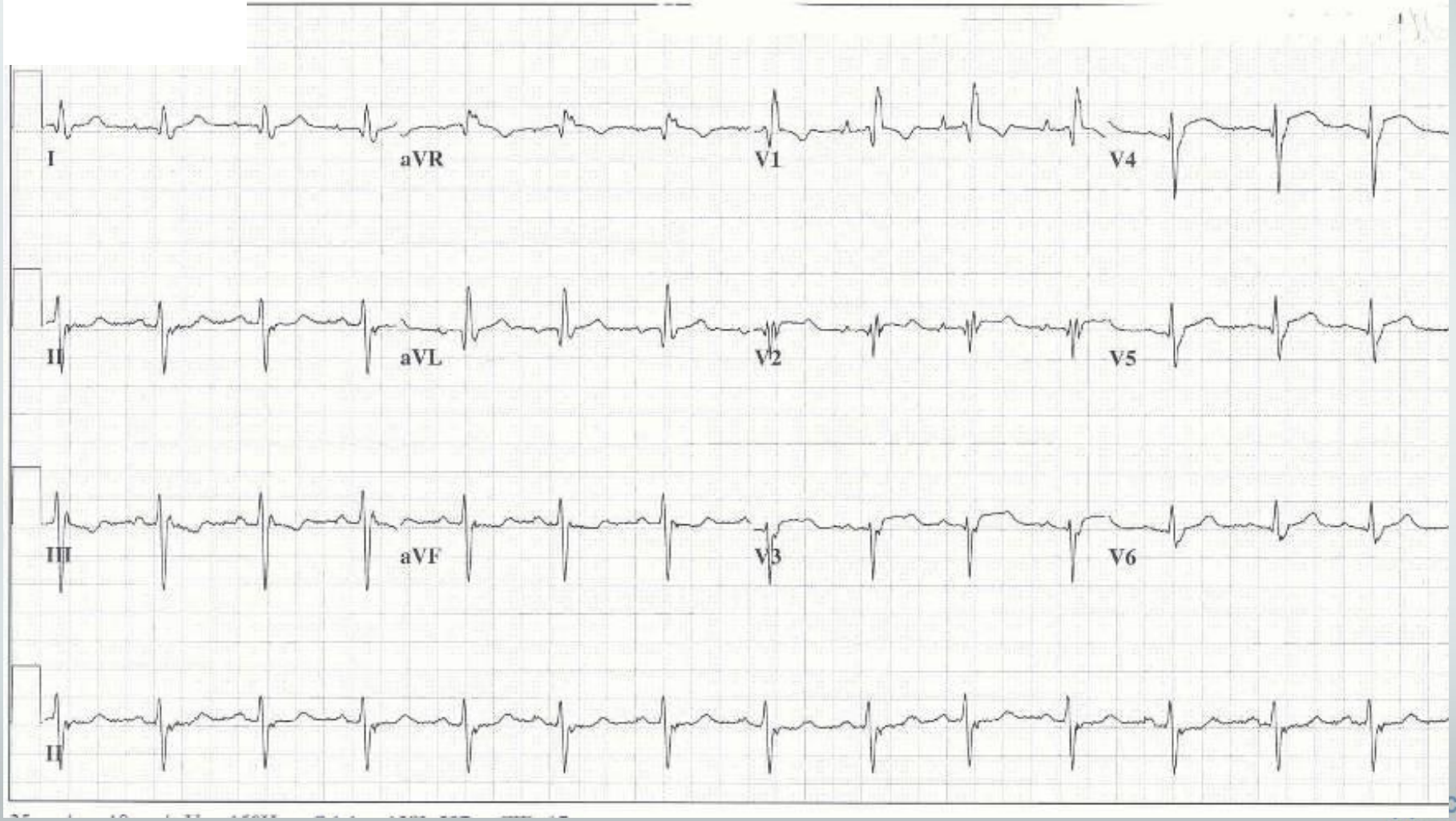


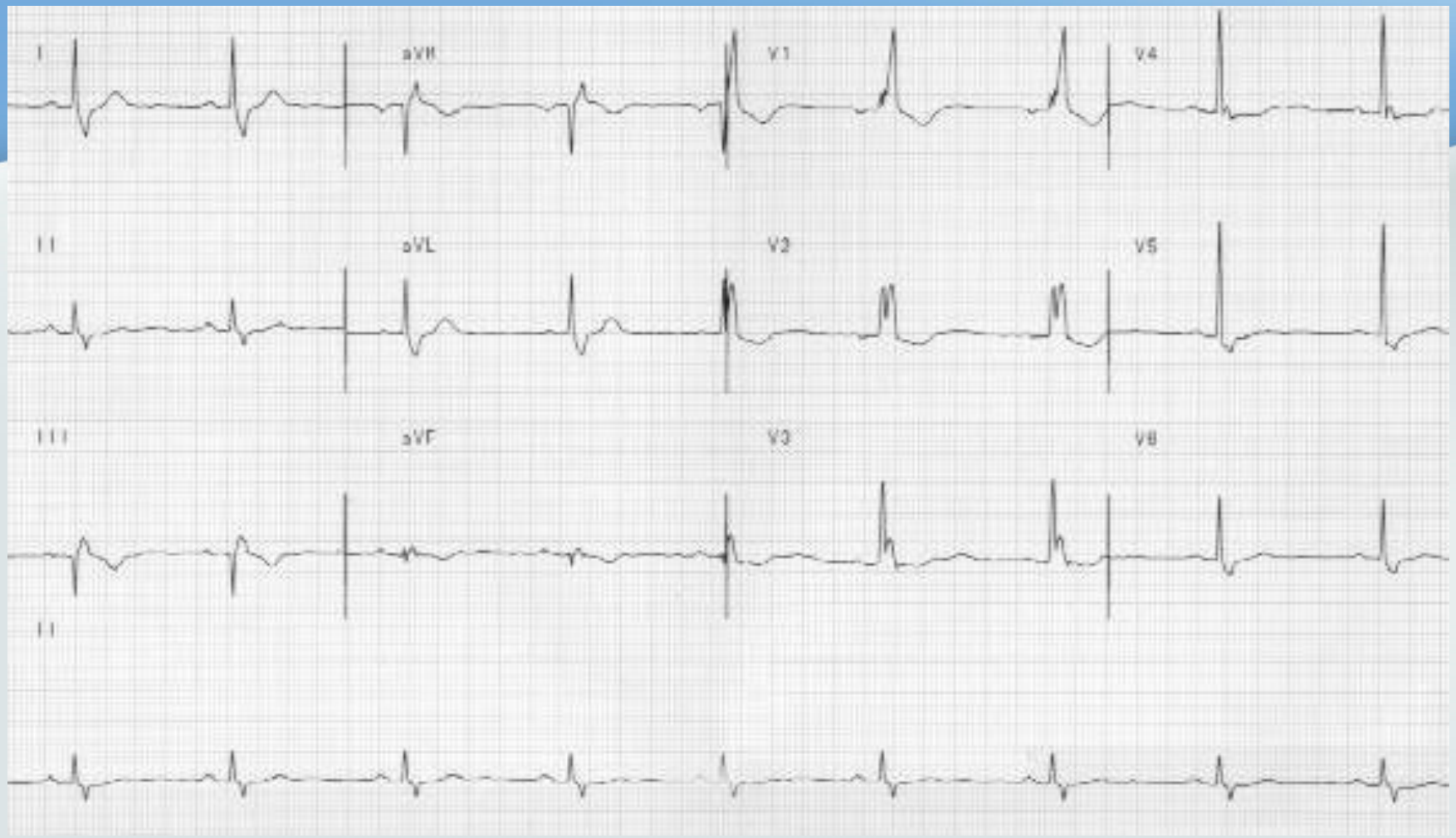
Positive V1

Slurred S wave Lead I & V6

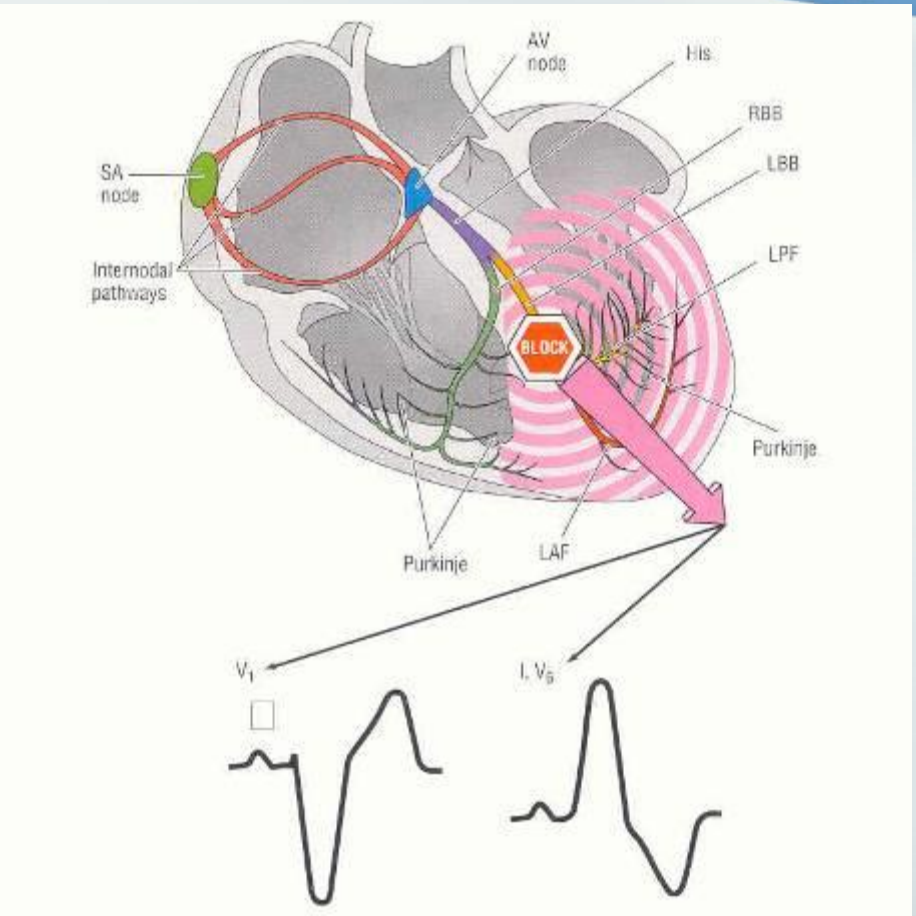
Vent. rate	84	BPM	Normal sinus rhythm
PR interval	168	ms	Right bundle branch block
QRS duration	134	ms	Left anterior fascicular block
QT/QTc	420/496	ms	*** Bifascicular block ***
P–R–T axes	92 –71	5	Abnormal ECG
			No previous ECGs available

QRS = 134 ms





Left Bundle Branch Block
LBBB



Source: Garcia 12 Lead EKG 13:19

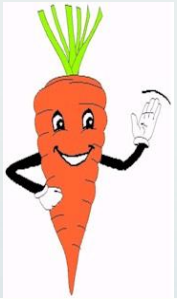
Left Bundle Branch Block
LBBB

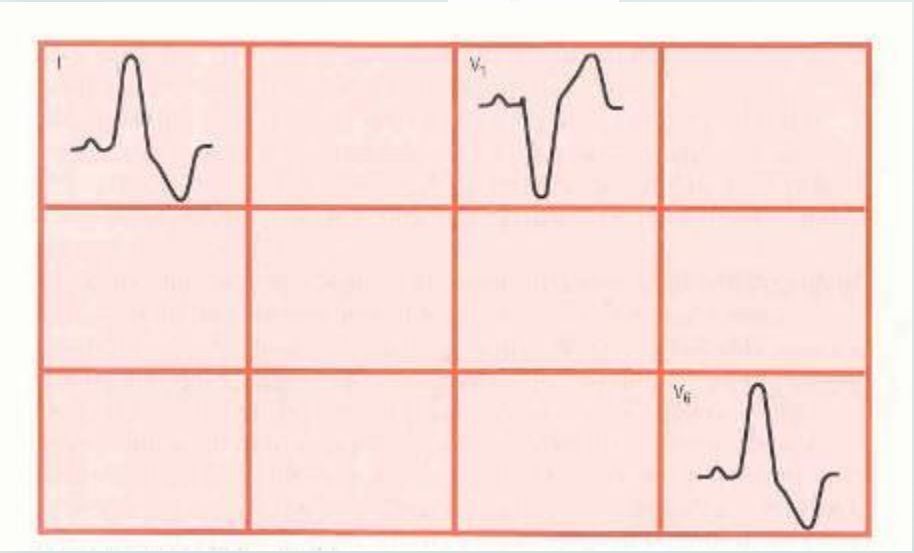
- **Higher mortality than RBBB**
- **Most often seen in large Anterior MIs**
- **Lower EFs**
- **Often seen in later stages of Heart Failure**

Causes

- **Dilated cardiomyopathy**
- **CAD**
- **Hypertension**
- **Infiltrative diseases of the heart**
- **Benign or idiopathic causes**

LBBB Criteria





- **QRS ≥ 0.12 sec or 120msec**
- **Broad, monomorphic R waves in I & V6, with no Q waves**
- **Broad, monomorphic S waves in V1; may have a small r wave**

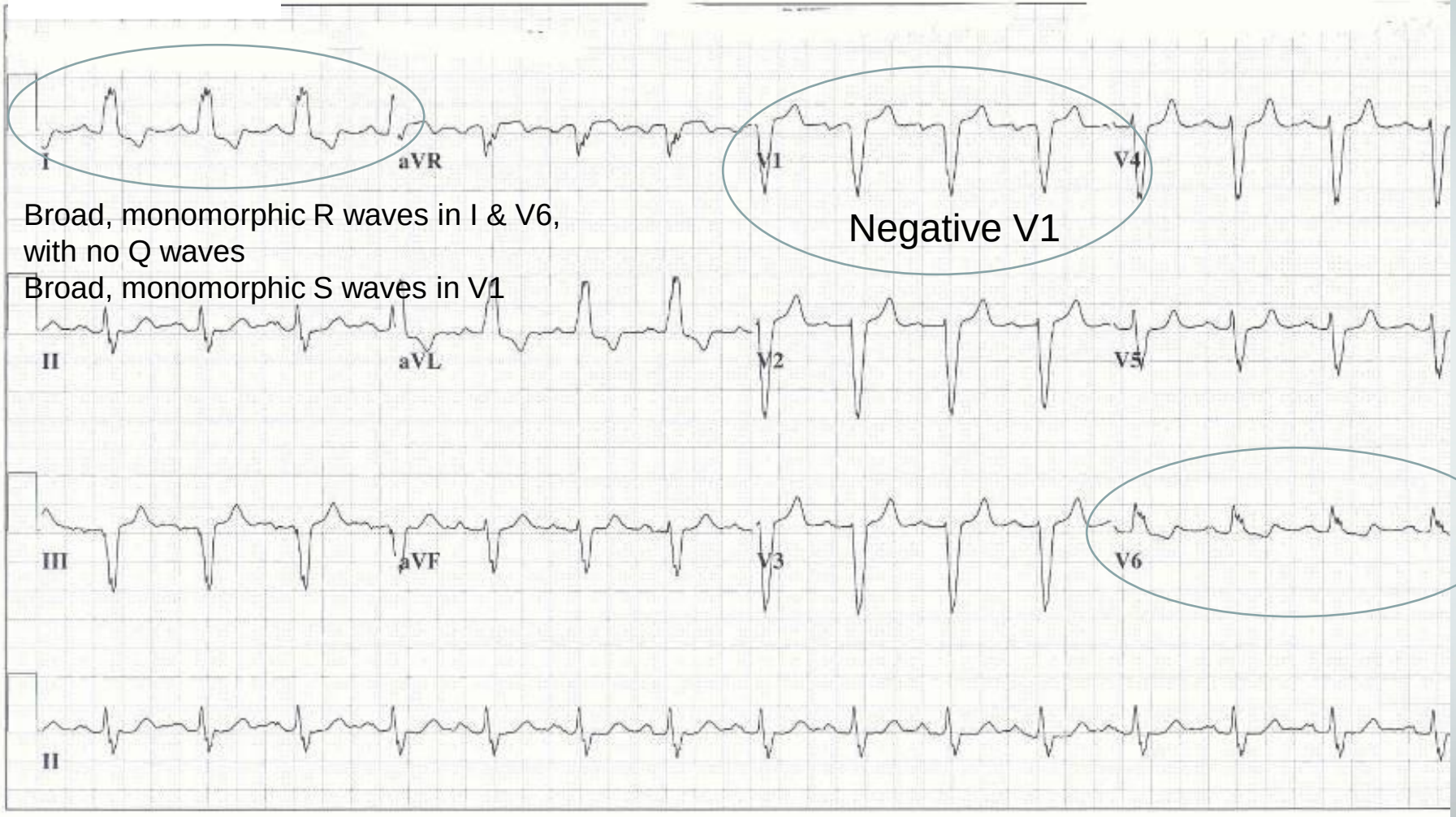
Easy way

- **QRS ≥ 0.12 sec**
- **Negative V1 = Carrot**

Vent. rate	90	BPM
PR interval	180	ms
QRS duration	140	ms
QT/QTc	382/467	ms
P–R–T axes	34 –34	119

Normal sinus rhythm
Left axis deviation
Left bundle branch block
Abnormal ECG
When compared with ECG of 26–NOV–2005 13:21,
Vent. rate has increased BY 31 BPM
T wave inversion no longer evident in Inferior leads
T wave inversion more evident in Lateral leads

QRS = 140 ms



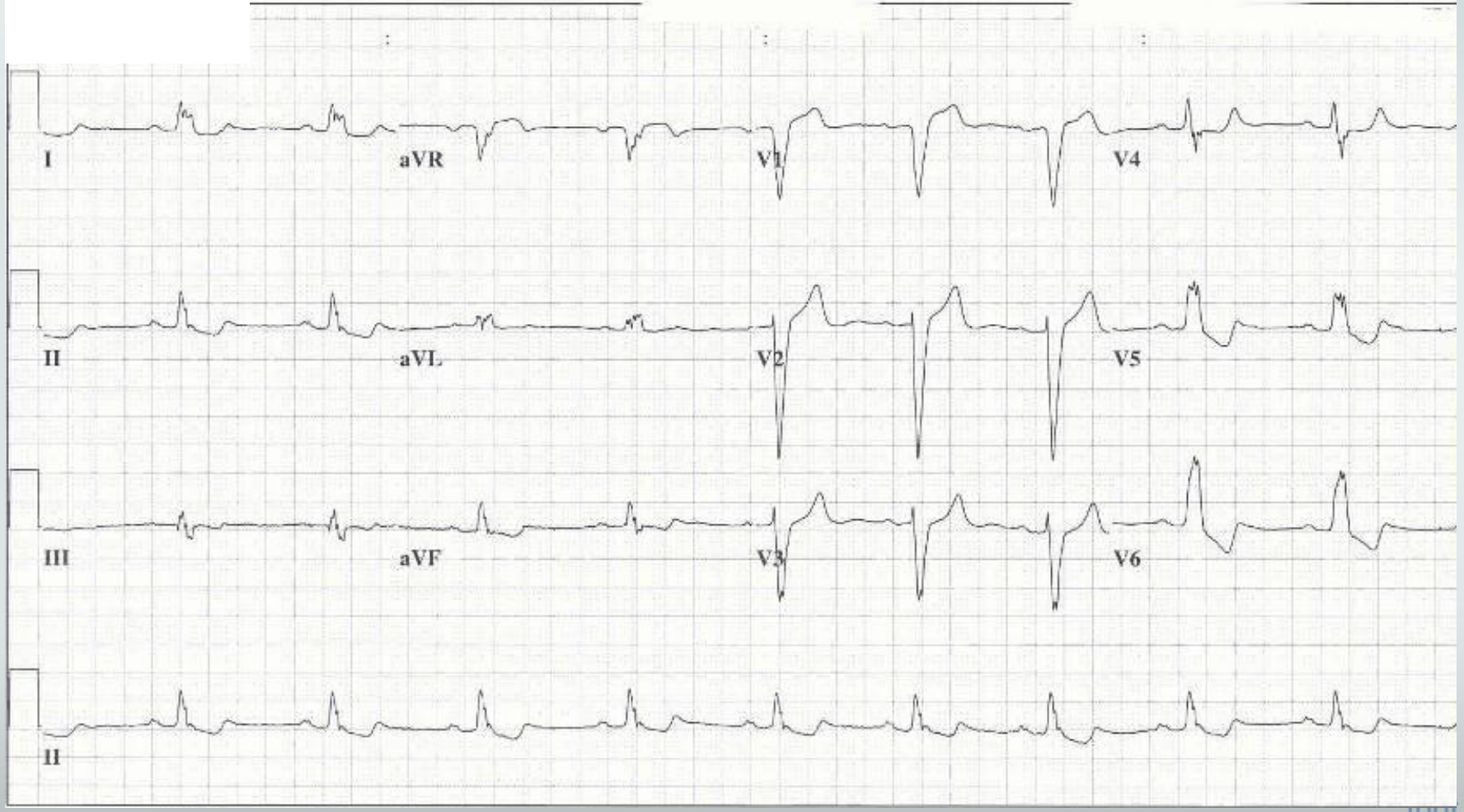
Broad, monomorphic R waves in I & V6, with no Q waves

Broad, monomorphic S waves in V1

Negative V1

Vent. rate	59	BPM	Sinus bradycardia
PR interval	206	ms	Left bundle branch block
QRS duration	144	ms	Abnormal ECG
QT/QTc	442/437	ms	No previous ECGs available
P–R–T axes	37 35	0	

QRS = 144 ms

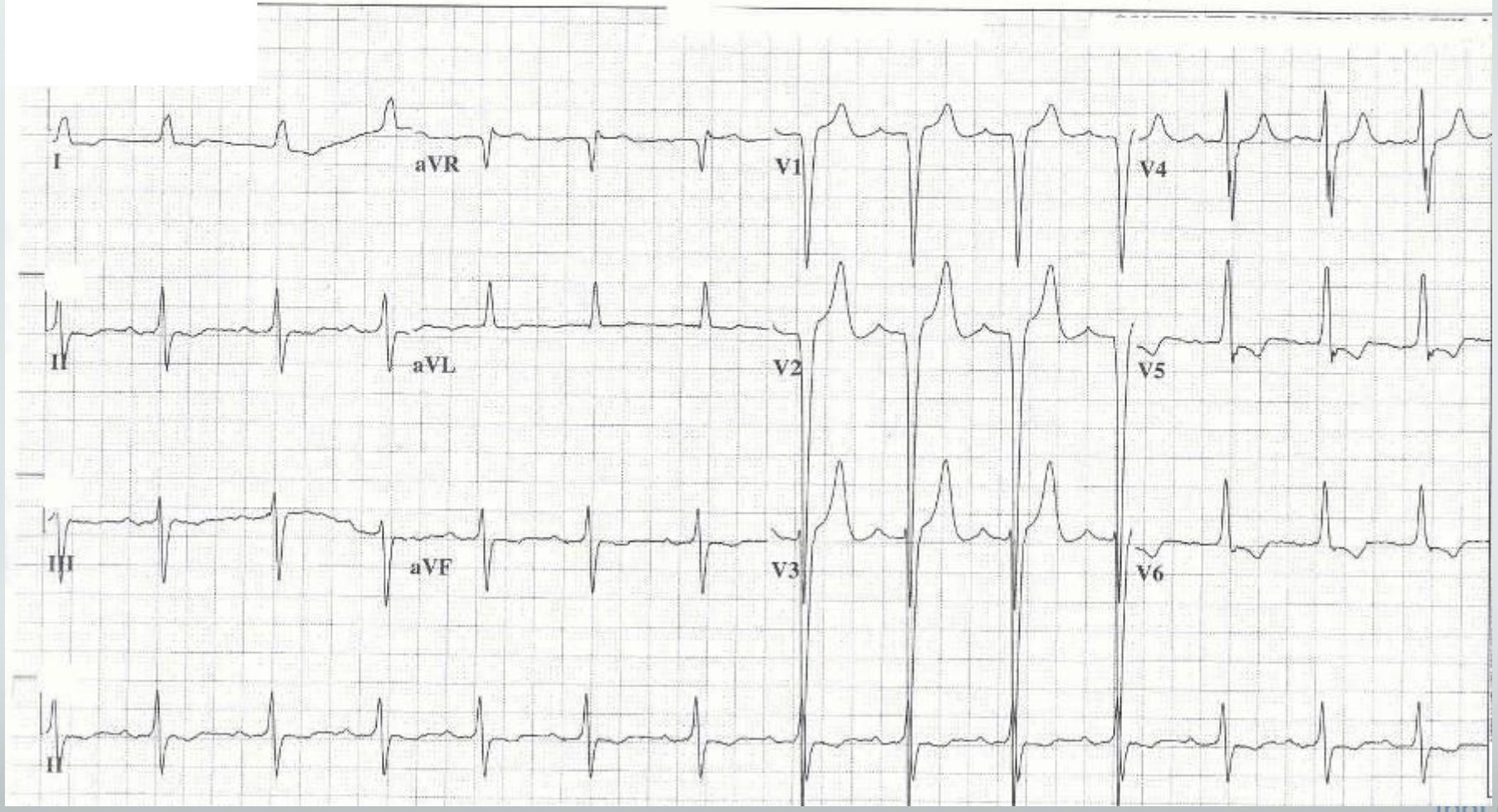


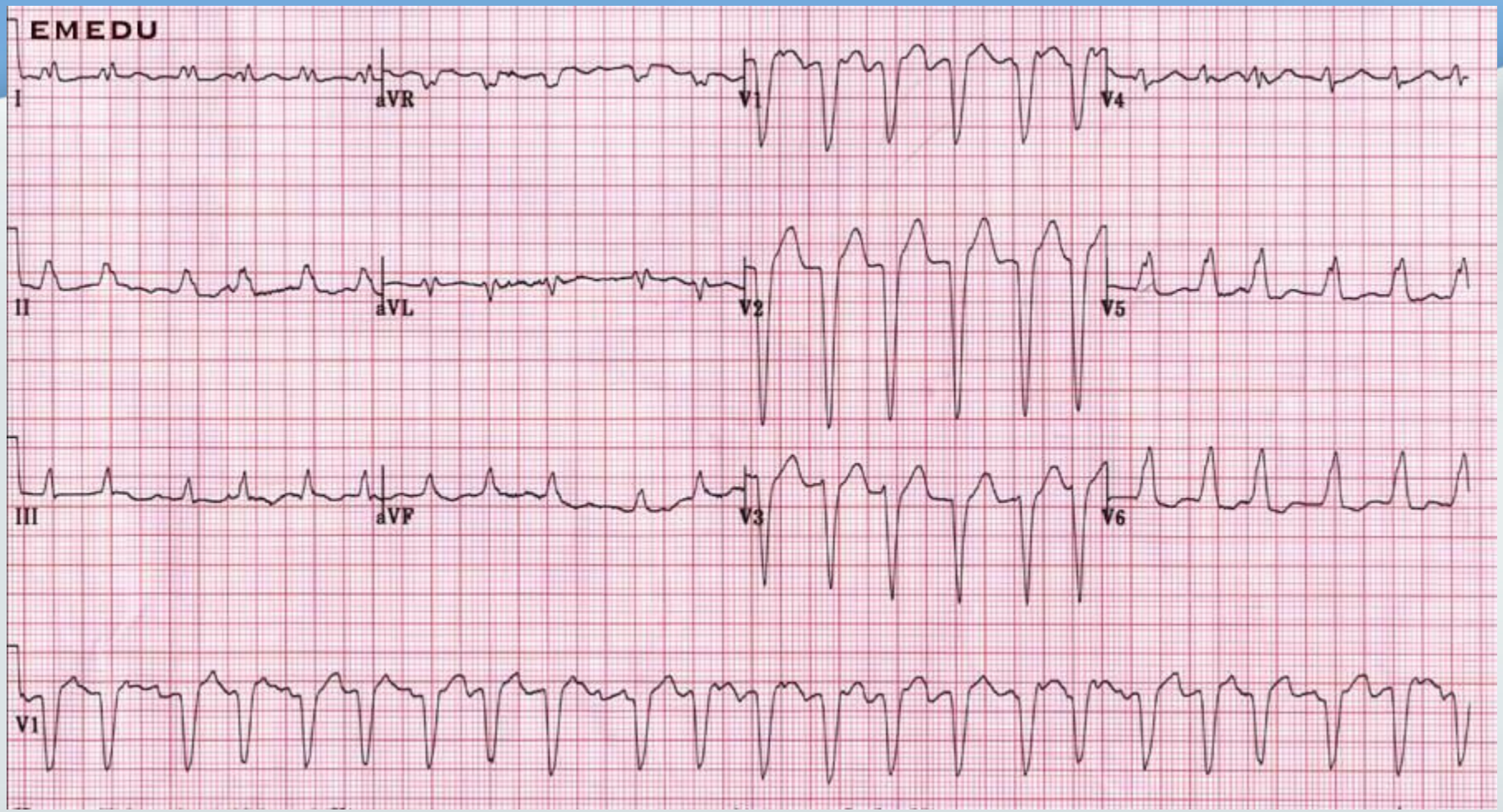
LVH, LBBB, LAD

Vent. rate	83	BPM
PR interval	206	ms
QRS duration	134	ms
QT/QTc	388/455	ms
P–R–T axes	92 –34	218

Normal sinus rhythm
Left axis deviation
Left ventricular hypertrophy with QRS widening and repolarization abnormality
Cannot rule out Septal infarct (cited on or before 29–APR–2005)
Abnormal ECG
No change

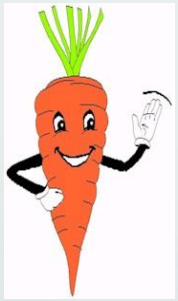
QRS = 134 ms



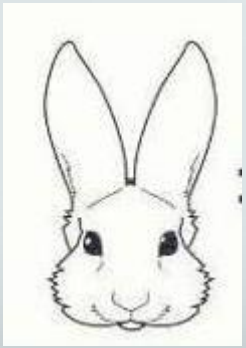


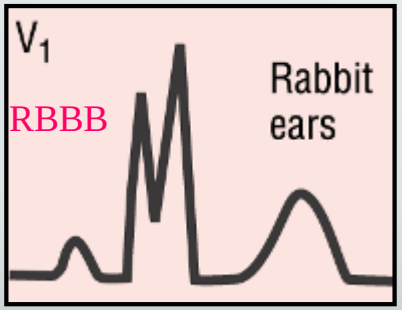
BBB = QRS > 0.12sec or 120msec

- **LBBB = QRS > 0.12 sec, Negative QRS in V1 (carrot)**



- **RBBB = QRS > 0.12sec; Positive QRS in V1 (rabbit ears)**





Incomplete Bundle Branch Block
QRS in no man's land

Incomplete RBBB

- **QRS 100 – 110 msec**
- **RBBB pattern**

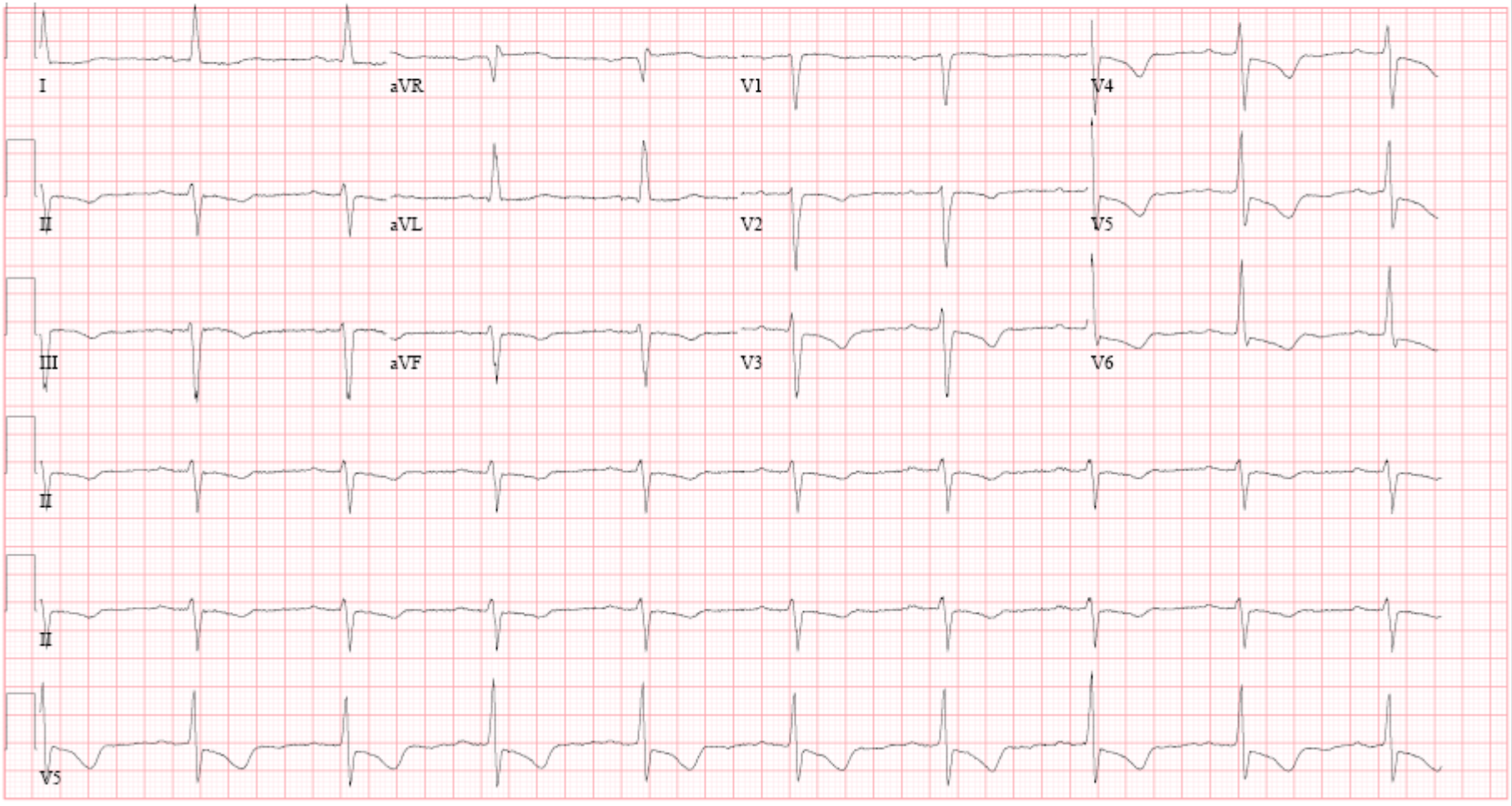
Incomplete LBBB

- **QRS 100 – 110 msec**
- **LBBB pattern**

Vent. rate	56	BPM
PR interval	232	ms
QRS duration	108	ms
QT/QTc	502/484	ms
P-R-T axes	8 -49	257

Sinus bradycardia with 1st degree A-V block
Left axis deviation
Incomplete left bundle branch block
ST & T wave abnormality, consider inferior ischemia
ST & T wave abnormality, consider anterolateral ischemia
Prolonged QT
Abnormal ECG
When compared with ECG of 14-OCT-2009 07:07,
Incomplete left bundle branch block is now Present

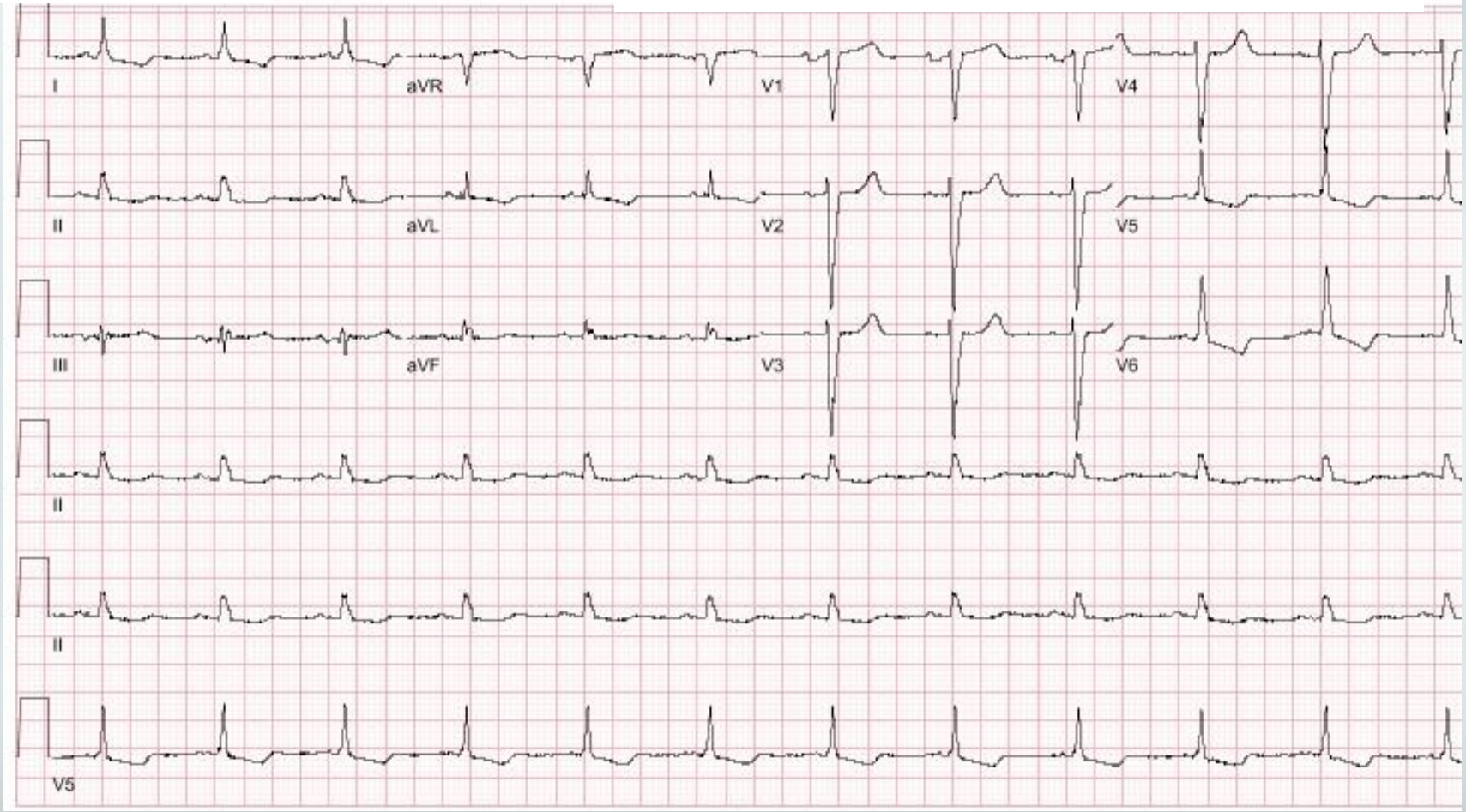
QRS = 108ms



Vent. rate	70	BPM
PR interval	160	ms
QRS duration	110	ms
QT/QTc	432/466	ms
P-R-T axes	29 16	170

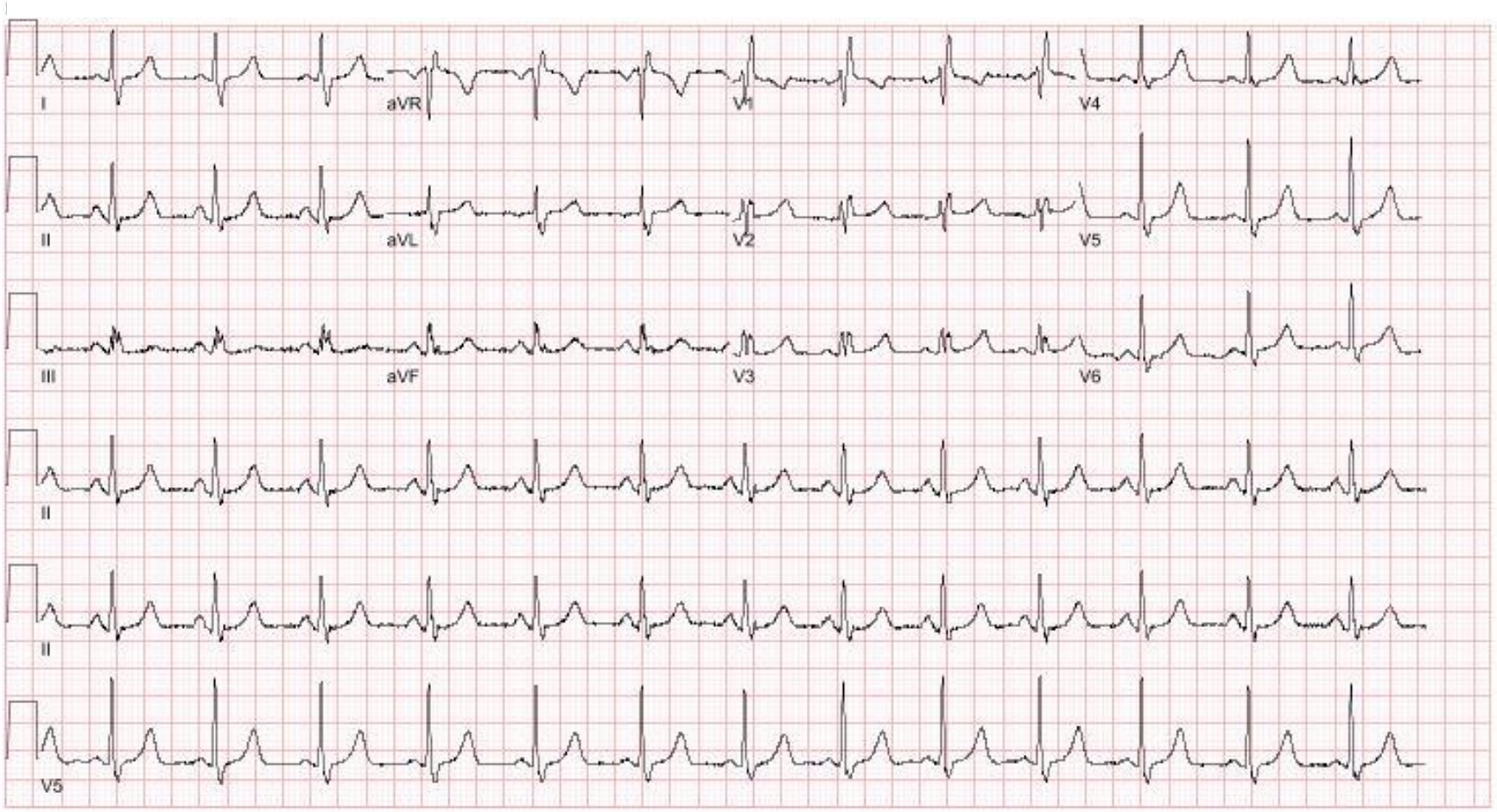
Normal sinus rhythm
Incomplete left bundle branch block
ST & T wave abnormality, consider lateral ischemia
Prolonged QT
Abnormal ECG
When compared with ECG of 08-AUG-2003 10:24,
Incomplete left bundle branch block is now Present
Nonspecific T wave abnormality has replaced inverted T waves in Inferior leads

QRS = 110 ms



Vent. rate	80	BPM	Normal sinus rhythm
PR interval	128	ms	Incomplete right bundle branch block
QRS duration	108	ms	Borderline ECG
QT/QTc	404/465	ms	No previous ECGs available
P-R-T axes	66 60	39	

QRS = 108 ms



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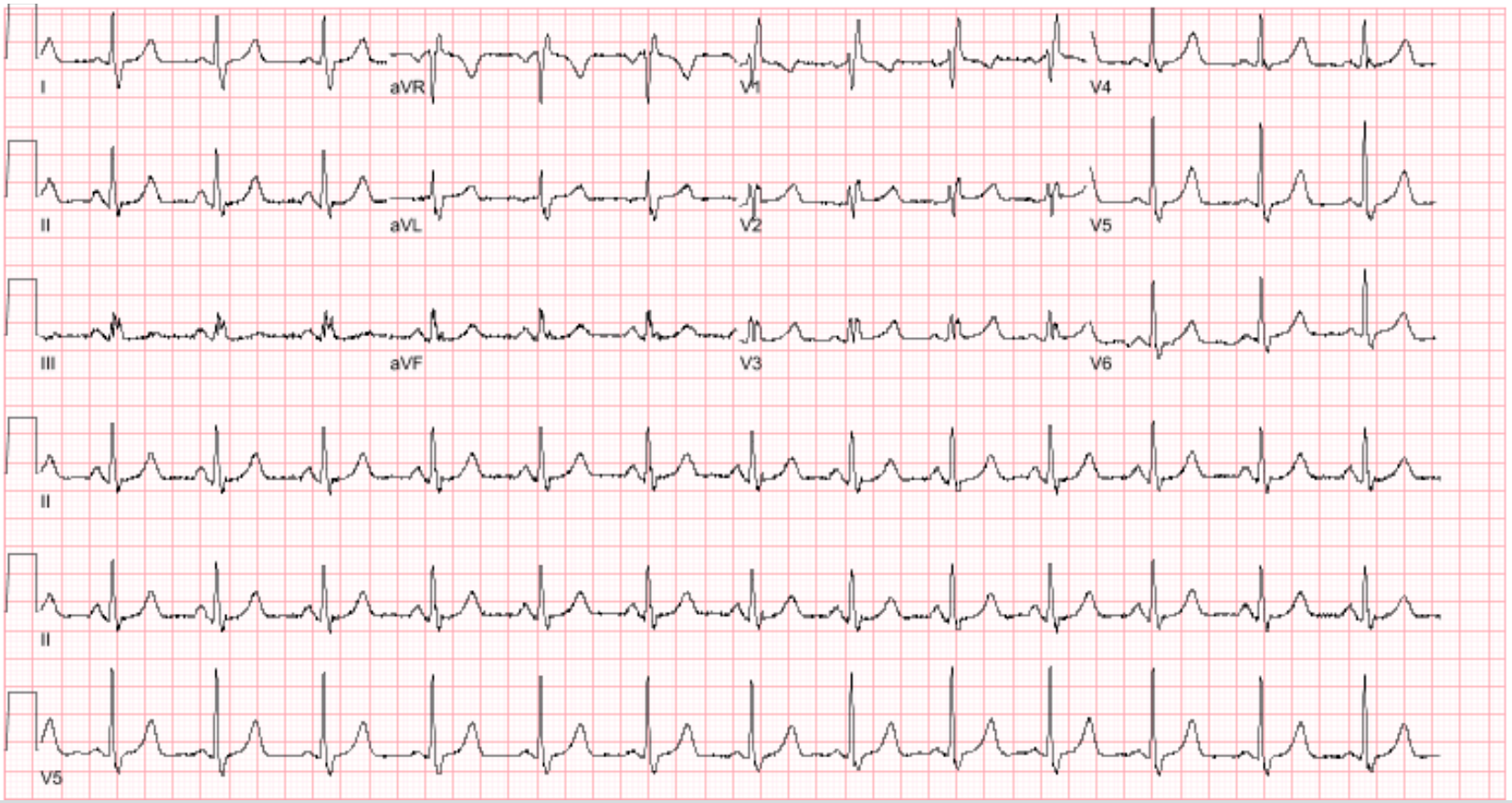
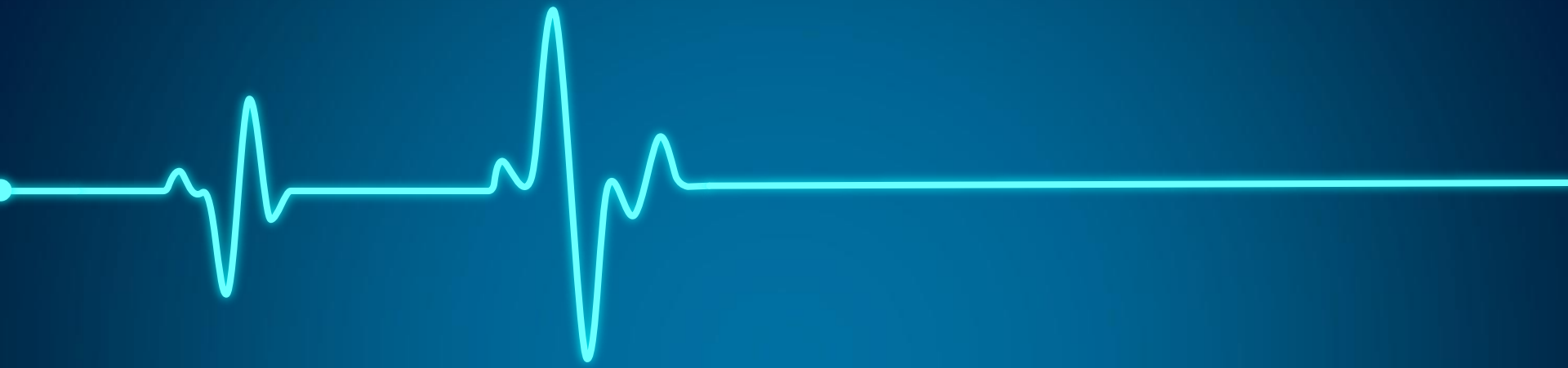
QRS = 106 ms



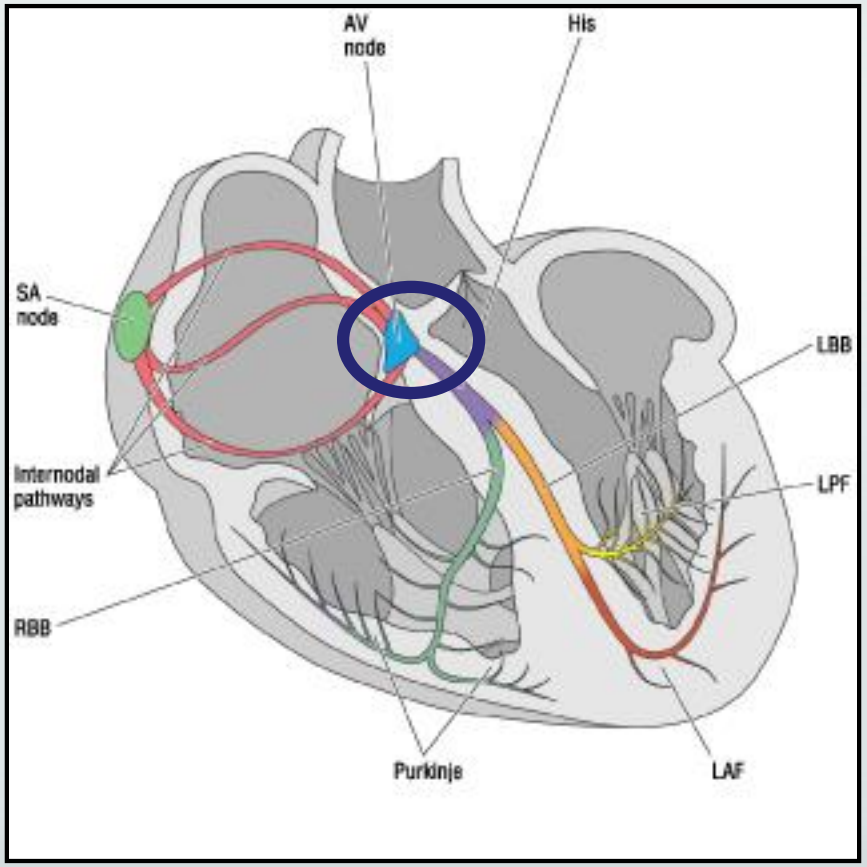
AV Nodal Blocks



First Degree AV Block
Second Degree AV Block Type I
Second Degree AV Block Type II
Third Degree AV Block

The Electrical Conduction System

Creates an electrical impulse and transmits it in an organized manner to the rest of the myocardium



SA node	**60-100 BPM**
AV node	**40-60 BPM**
Purkinje cells	**20-40 BPM**

Heart Blocks occur due to AV node disease

Basic Components of the Complex Deflections & Segments

- **P Wave**
  - Rounded, < 2-3 mm, ↑ in hypertrophy
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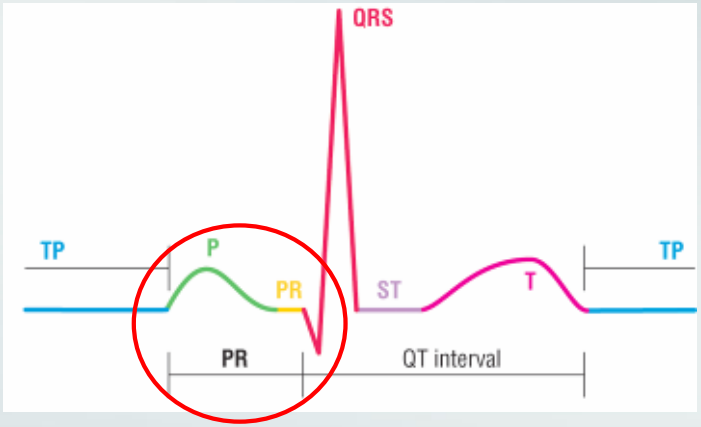


- AV node correlates to the PR Interval
- Normal PR interval 120 – 200 msec

First-Degree AV Block

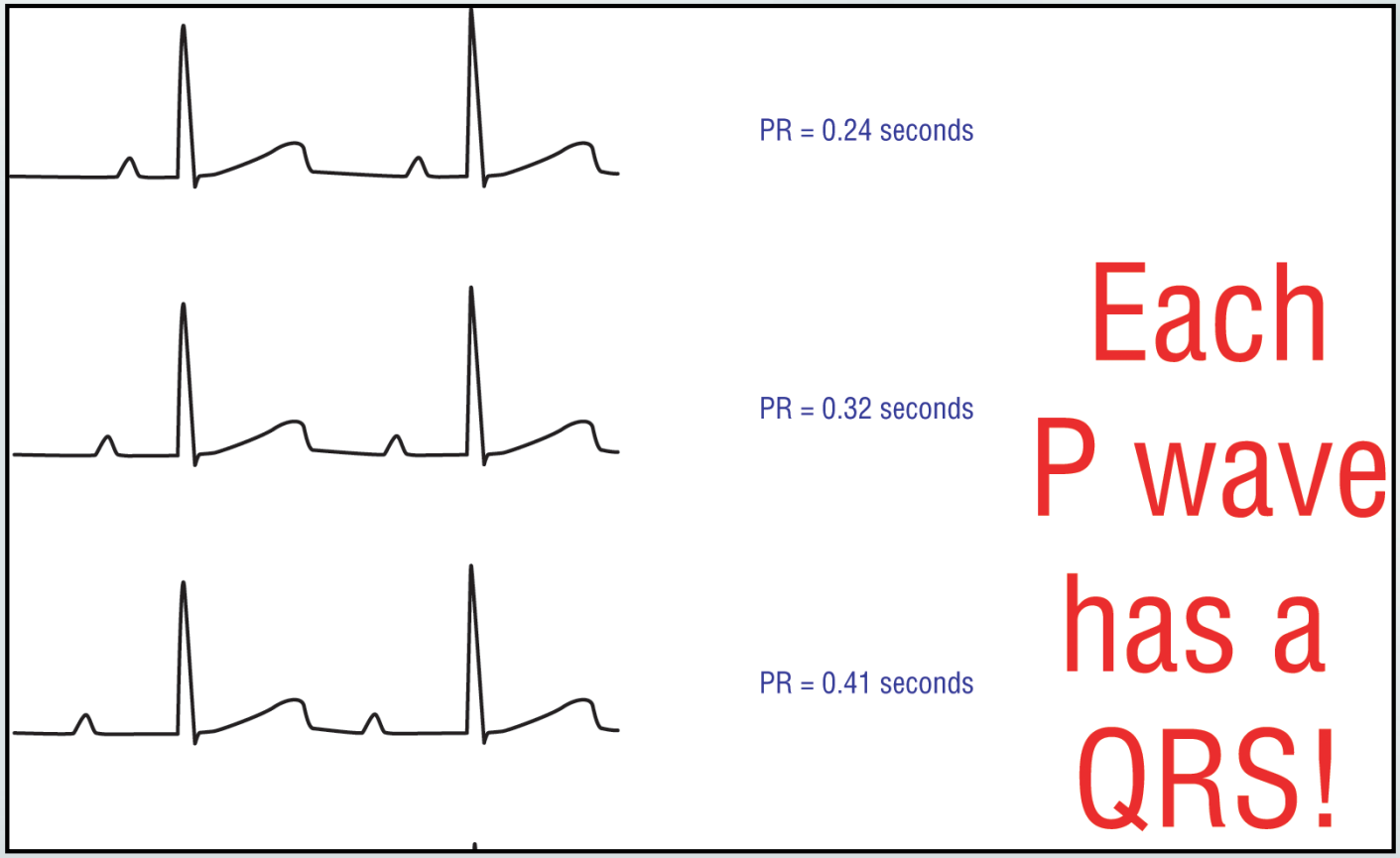
Not really a block- just a delay in conduction

- Atrioventricular (AV) Block occurs when the AV Node fails to properly conduct the impulses from the atria to the ventricles
- Conduction to the ventricles will occur every time……it….will…… just….be…….. delayed.

AV node's function is to slow down the conduction from the SA node to allow the ventricles to fill up with blood.

In 1st degree block, the AV node is slowing down the conduction a bit too much.

First-Degree AV Block
PR interval > 200 msec

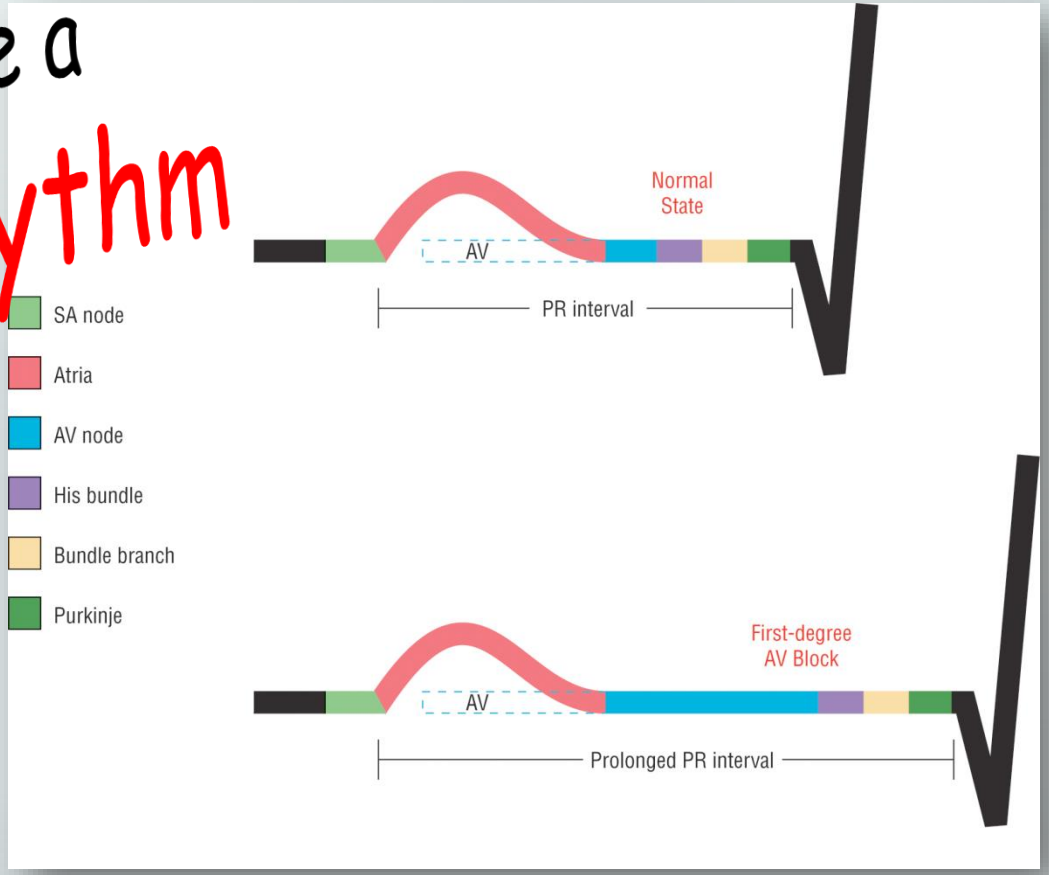


First-Degree AV Block

Looks like a

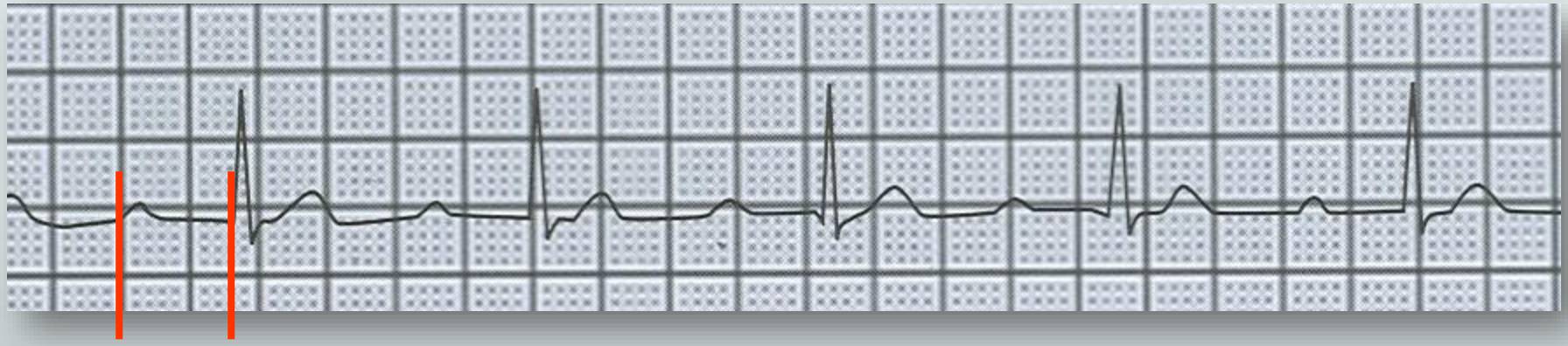
Sinus Rhythm

But PR is elongated



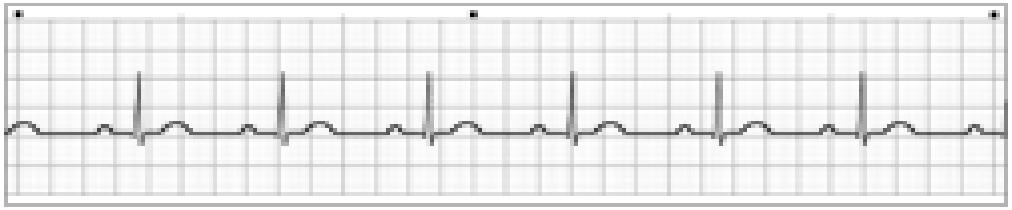
Characteristics: 1st Degree

- ✓ P waves present with same morphology
- ✓ QRS are normal
- ✓ P:QRS has a 1:1 ratio (no missing QRS)
- ✓ Atrial Rate is regular
- ✓ Ventricular Rate is regular
- ✓ PR > 200 msec and remain constant
- ✓ Looks like a normal sinus rhythm

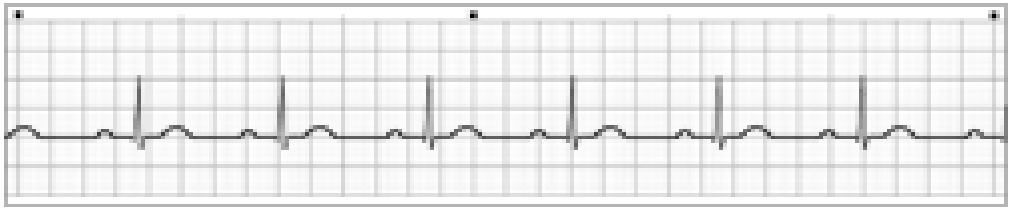


PR 320 msec

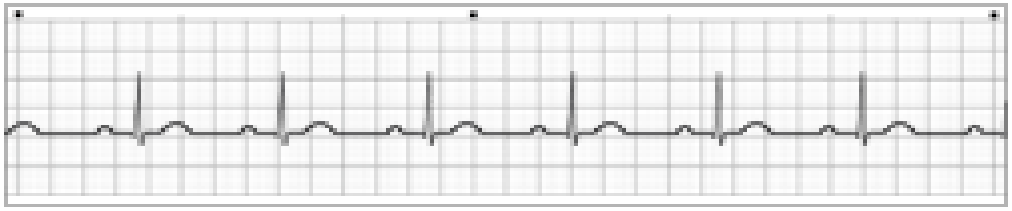
Rate: Approximately 60 per minute



Regularity: Yes; equal R to R Intervals

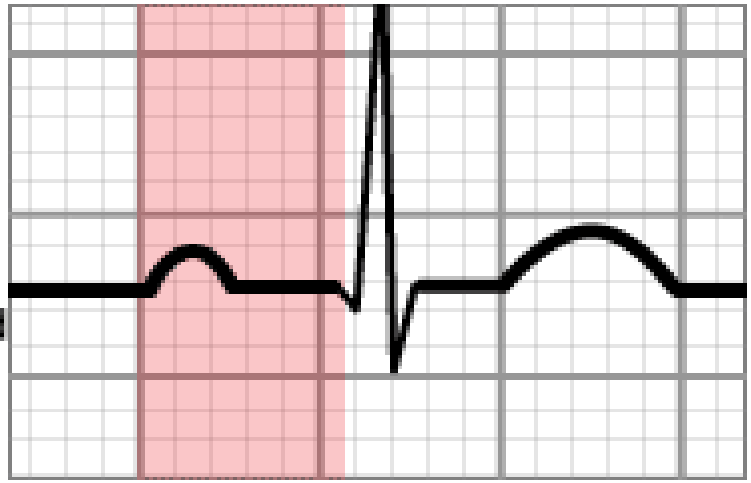


P Waves: Each paired with a QRS, each the same



P-R Interval:
Greater than
0.20 seconds

QRS Interval:
Not prolonged
and each the
same



- ✓ P waves present with same morphology
- ✓ QRS are normal
- ✓ P:QRS has a 1:1 ratio (no missing QRS)
- ✓ Atrial Rate is regular
- ✓ Ventricular Rate is regular
- ✓ PR > 200 msec and remain constant
- ✓ Looks like a normal sinus rhythm

Possible Causes

- Acute myocarditis
- Acute MI
- Cardiomyopathy
- Chronic Aortic Regurgitation
- Acute conduction system disease
- Hypothyroidism
- Hyperkalemia
- Mild digitalis toxicity

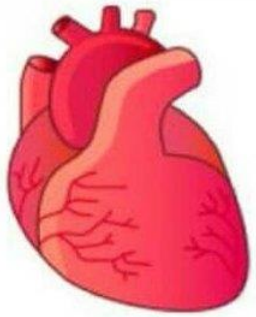
Get a DIG level

Treatment

If pulse is normal, the patient will usually be asymptomatic so no treatment is needed.

Marriage Relationship and the Blocks

KEY:
P wave = Wife
QRS = Husband
Pacer = Counseling



Normal sinus rhythm:
The wife (p wave) waits at home for the husband (qrs). The husband (qrs) come homes on time every night.

1st degree AV block:
The wife (p wave) is waiting at home. The husband (qrs) comes home late every night, but he always comes home and its at the same time every night.

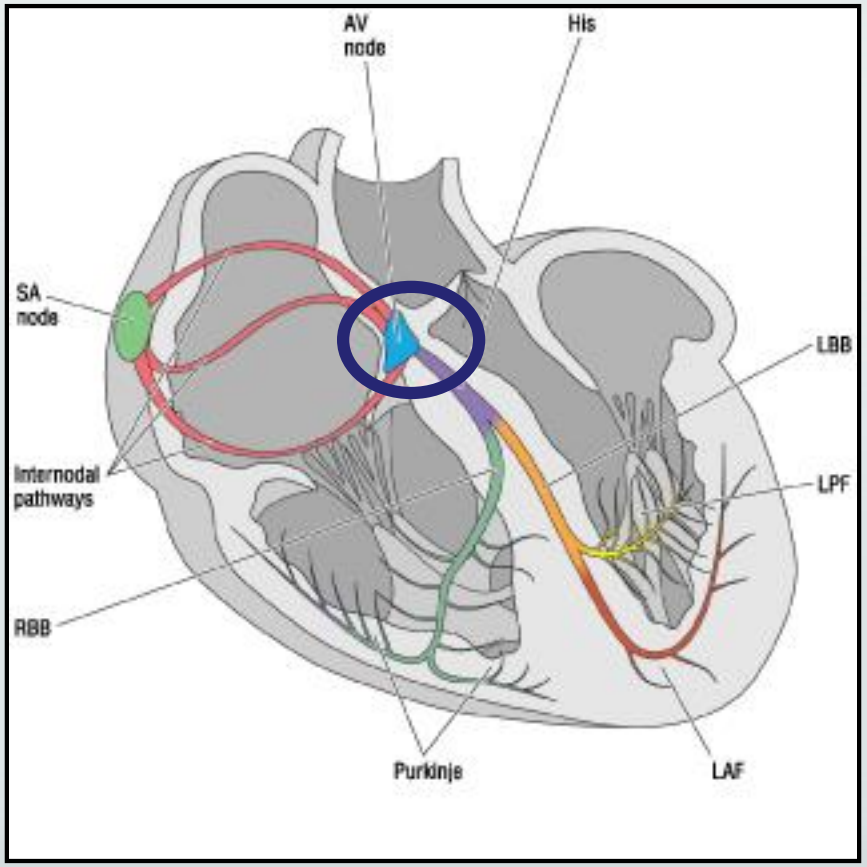
Second-Degree AV Block

Two main types

- Mobitz I or Wenckebach
- Mobitz II

The Electrical Conduction System

Creates an electrical impulse and transmits it in an organized manner to the rest of the myocardium



SA node	**60-100 BPM**
AV node	**40-60 BPM**
Purkinje cells	**20-40 BPM**

Heart Blocks occur due to AV node disease

Second Degree AV Block Type I

=

Mobitz I AV Block

Second Degree Type I

Wenckebach

This block is also

a delay in the AV node/AV junction

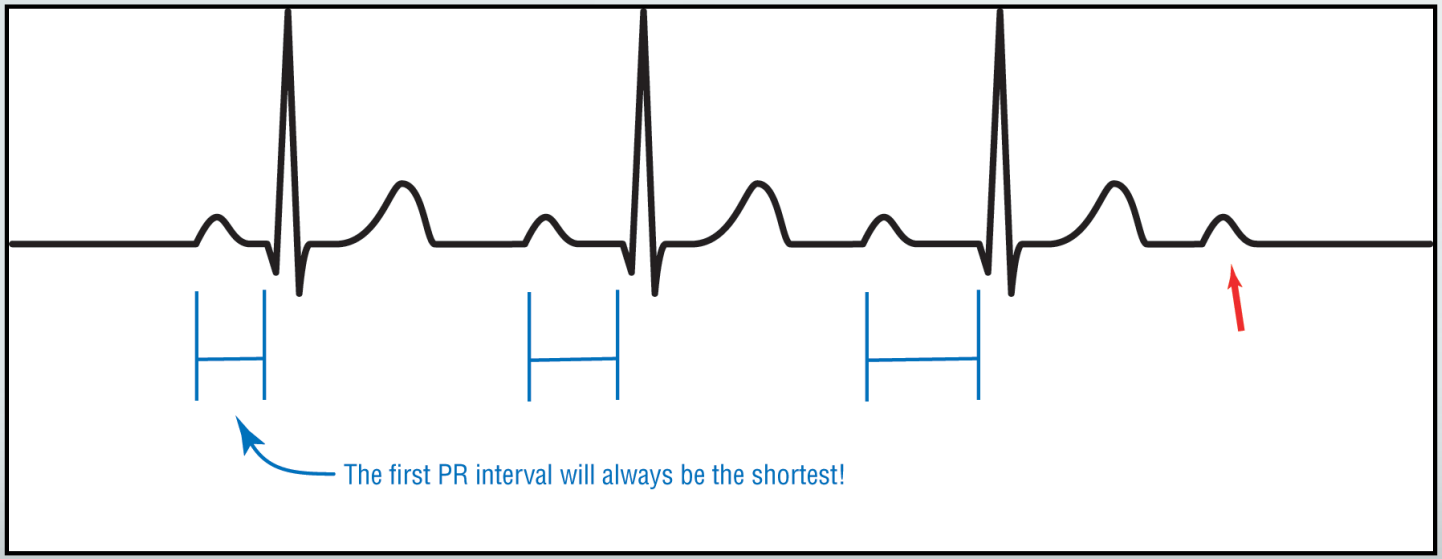
but instead of having the same delay, it gradually gets longer then drops a

QRS

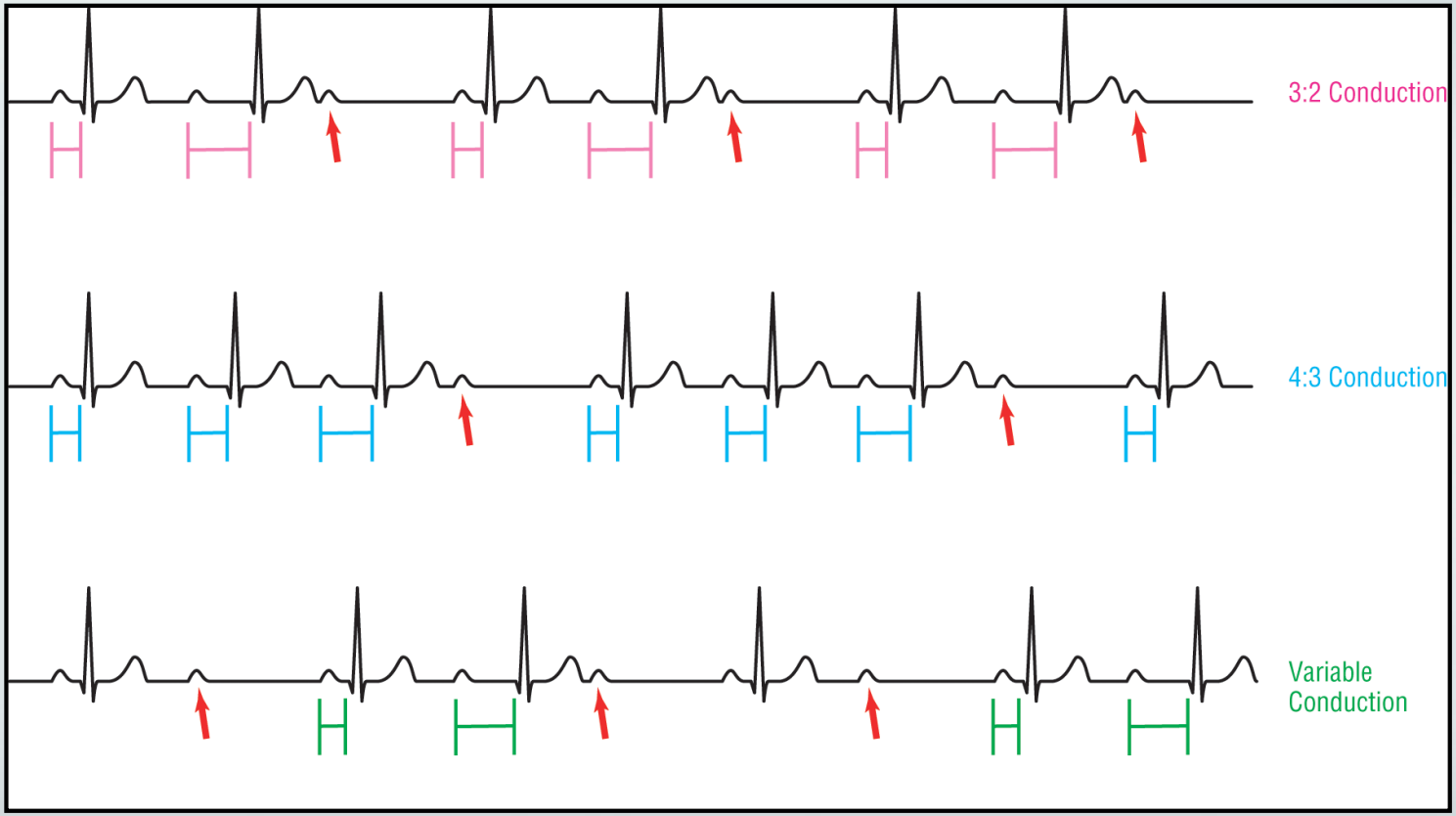
longer…..longer……drop!
it's a Wenckebach!

Mobitz I: 2nd Degree AV Block or Wenckebach

- PR interval progressively lengthens until a P wave is eventually blocked.
- PR interval after dropped QRS is the shortest
- Irregular Regular --- pattern



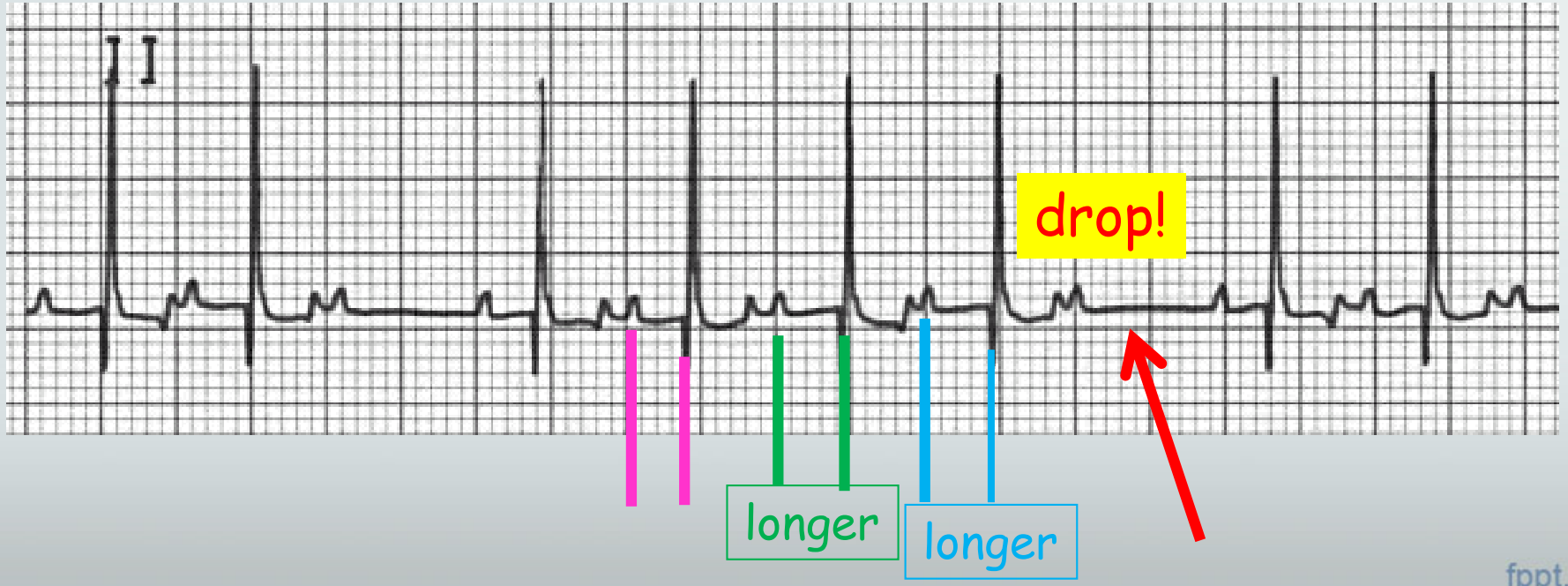
Examples of Mobitz I Second-Degree AV Block Wenckebach



Characteristics Wenckebach

- P waves present with same morphology
- QRS are normal and narrow
- Not a 1:1 ratio (missing QRS complexes)
- Atrial Rate is regular
- Ventricular Rate is irregular
- PR not constant (gets progressively longer)

Look for the pattern



Occurs when the impulses from the SA Node are progressively delayed at the AV Node until …

the impulse fails to get through at all.

P-R Interval gets progressively longer until there is a **P Wave without a QRS**

the cycle begins again with a series of P Waves followed by a QRS

Possible Causes

- Primary conduction system disease
- Ischemic heart disease
- Inferior wall MI
- Cardiomyopathy
- Rheumatic Fever
- Intense vagal stimulation
- Electrolyte imbalance
- Beta or Calcium channel blockers
- ***Digitalis toxicity

Treatment

Usually benign – no treatment needed

Treat Only if patient is symptomatic

SOB, hypotension, weakness, dizziness

Atropine

First dose: 0.5mg bolus
Repeat Q3-5 min
Max 3mg

Transcutaneous Pacing

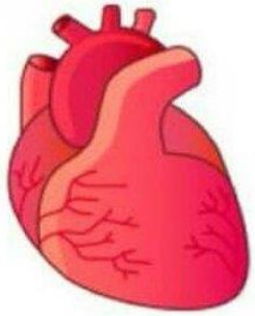
Consider the ACLS Bradycardia Algorithm

Atropine

- Blocks vagal effects on the SA & AV nodes
- Enhances conduction through AV node

Marriage Relationship and the Blocks

KEY:
P wave = Wife
QRS = Husband
Pacer = Counseling



Normal sinus rhythm:
The wife (p wave) waits at home for the husband (qrs). The husband (qrs) come homes on time every night.

1st degree AV block:
The wife (p wave) is waiting at home. The husband (qrs) comes home late every night, but he always comes home and its at the same time every night.

2nd degree block type I (weinkebach):
The wife (p wave) is waiting at home. The husband (qrs) come home later and later every night until one night he doesn't come at all.
Note: *Husband (qrs) must come home at least 2 nights in a row to see this pattern.*

Second Degree AV Block Type II

=

Mobitz II AV Block

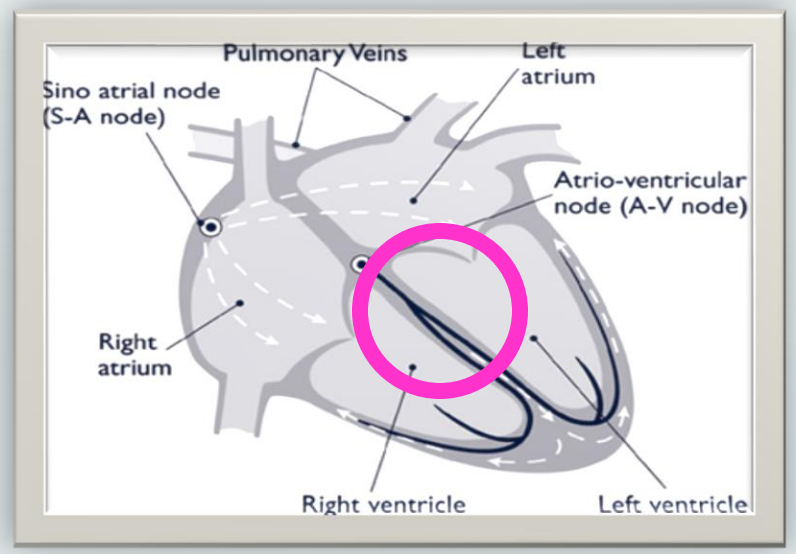
Second Degree Type II

Classical

It is less common than TYPE I but **more serious**

Indicates a problem below AV node/junctional area

Bundle of His or **Bundle Branches**



It is **more serious** than TYPE I because the ventricular rate tends to be slower which causes

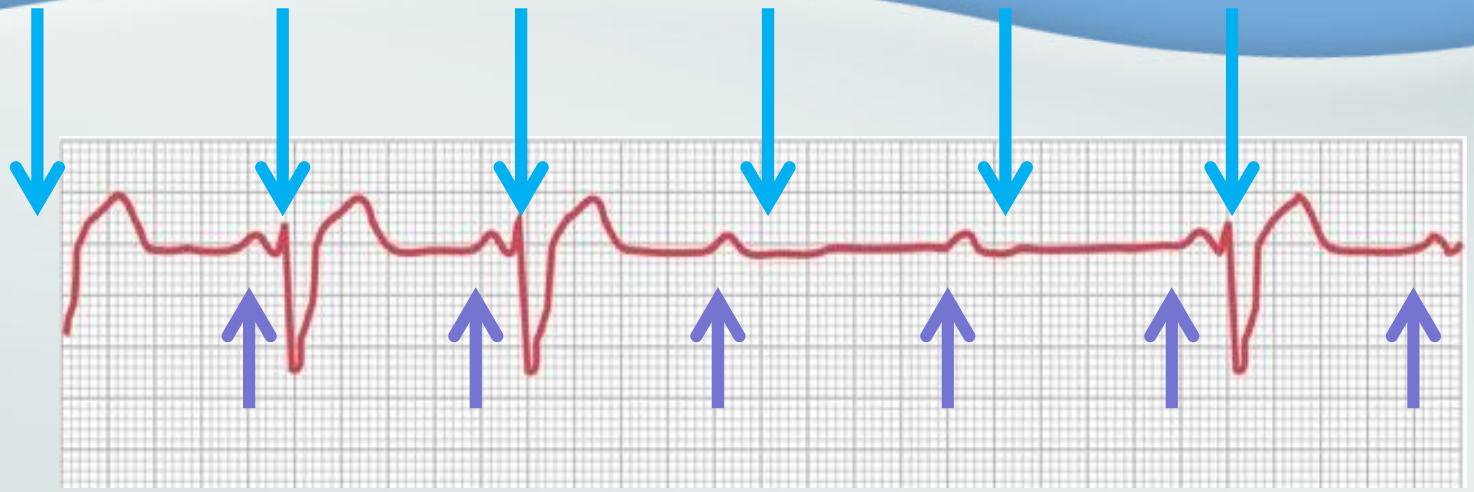
Decreased CO

more serious because…

There's no warning!

can proceed to
Complete
Heart Block

Mobitz II Second-Degree AV Block



- One or more P waves are blocked
- PR intervals are constant throughout the strip.
- Dropped QRS will march out with the p waves

Mobitz II Second-Degree AV Block

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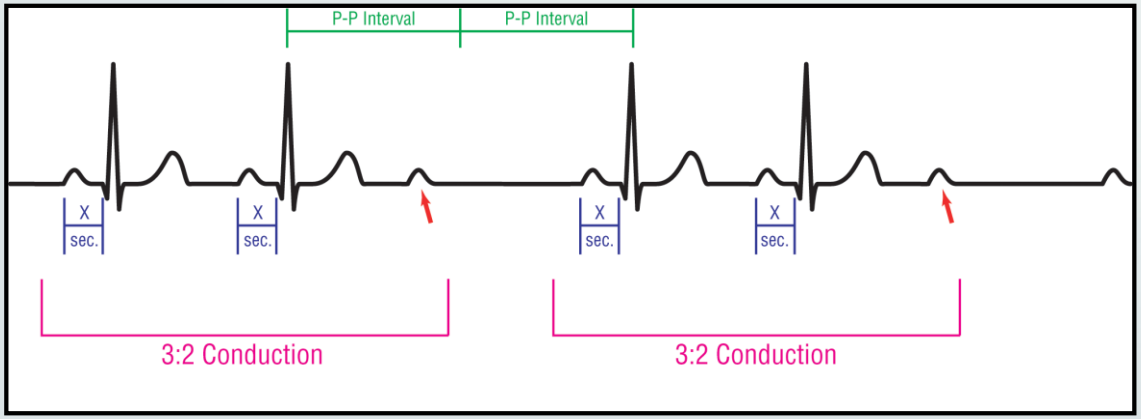
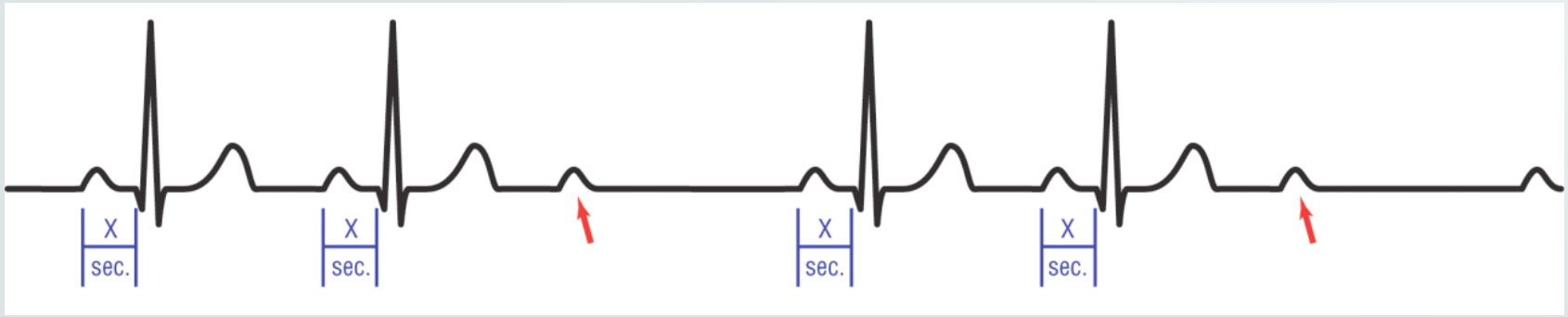


Examples of Mobitz II Second-Degree AV Block

Characteristics Mobitz Type II

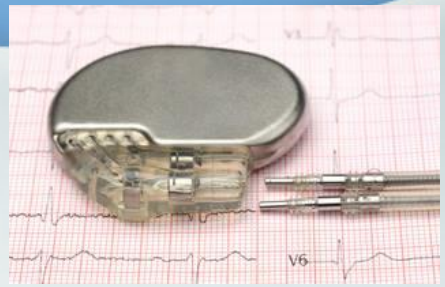
- P waves present with same morphology
- QRS are normal and narrow
- Not a 1:1 ratio
- Atrial Rate is regular
- Ventricular rate is irregular (missing QRS complexes)
- PR is **constant** and complex is the same



Possible Causes

- Primary conduction system disease
- Ischemic heart disease
- Inferior wall MI
- Cardiomyopathy
- Rheumatic Fever
- Intense vagal stimulation
- Electrolyte imbalance
- Beta or Calcium channel blockers
- ***Digitalis toxicity

Treatment



- Transcutaneous Pacing or at bedside
- Stop Beta Blockers, Digoxin and Calcium Channel Blocker
- Stop narcotics
- Prepare for temporary or permanent pacer

If patient is symptomatic

SOB, hypotension, weakness, dizziness

Atropine

First dose: 0.5mg bolus

Repeat Q3-5 min

Max 3 mg

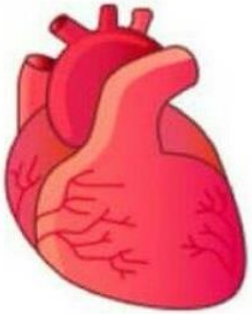
Consider the ACLS Bradycardia Algorithm

Atropine

- Blocks vagal effects on the SA & AV nodes
- Enhances conduction through AV node

Marriage Relationship and the Blocks

KEY:
P wave = Wife
QRS = Husband
Pacer = Counseling



Normal sinus rhythm:
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1st degree AV block:
The wife (p wave) is waiting at home. The husband (qrs) comes home late every night, but he always comes home and its at the same time every night.

2nd degree block type I (weinkebach):
The wife (p wave) is waiting at home. The husband (qrs) come home later and later every night until one night he doesn't come at all.
Note: *Husband (qrs) must come home at least 2 nights in a row to see this pattern.*

2nd degree AV block type II:
The wife (p wave) is waiting at home. Sometimes the husband (qrs) comes home, sometimes he doesn't. When he does come home, its always at the same time.
Note: *This is usually more serious than type I (weinkebach) and will sometimes require counseling (pacing).*

Third-Degree or Complete AV Block

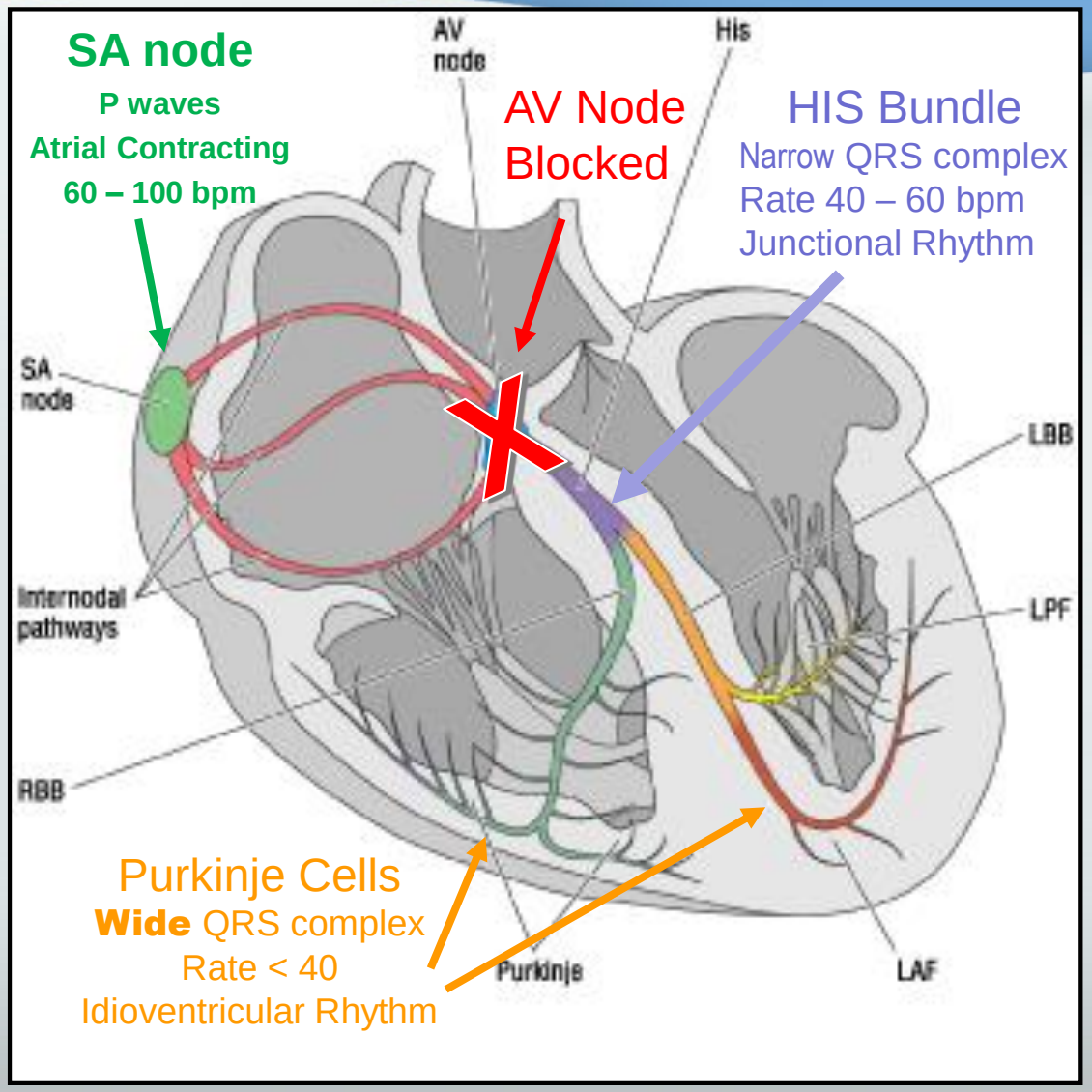
...makers by definition:

- One
- One

Total Block

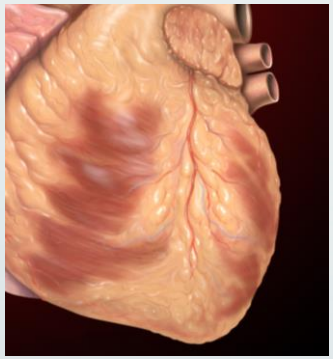
***No communication between atria and ventricles

Third Degree AV Block
Complete Heart Block



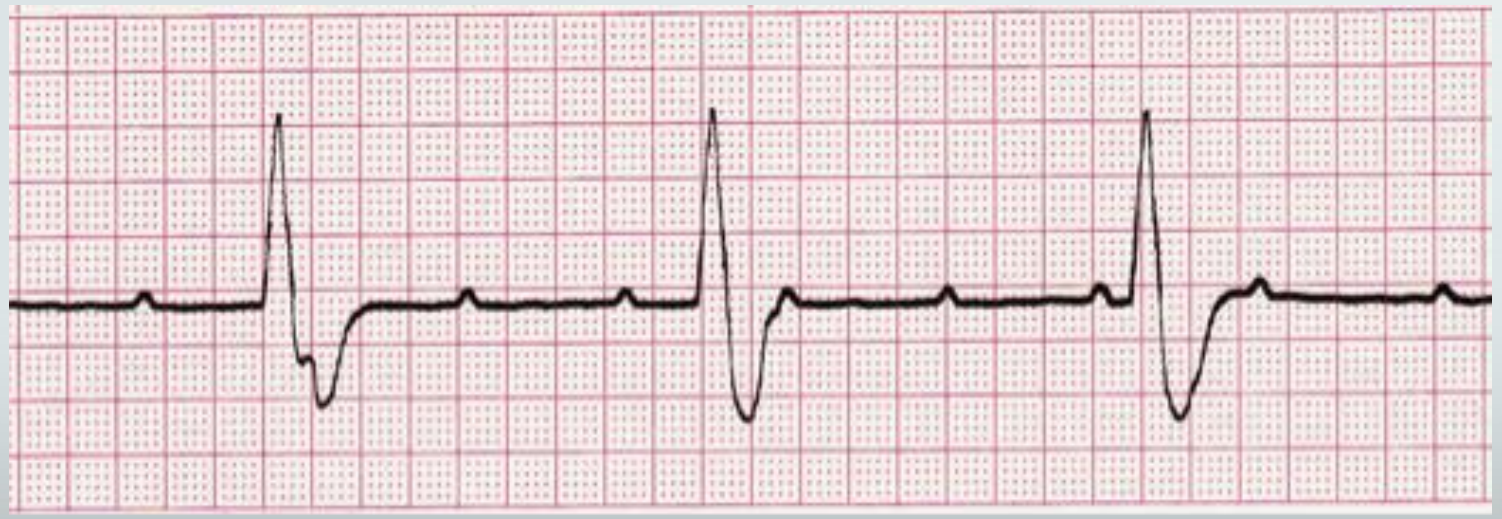
The **most serious** block because no impulses are reaching the ventricles

ventricles



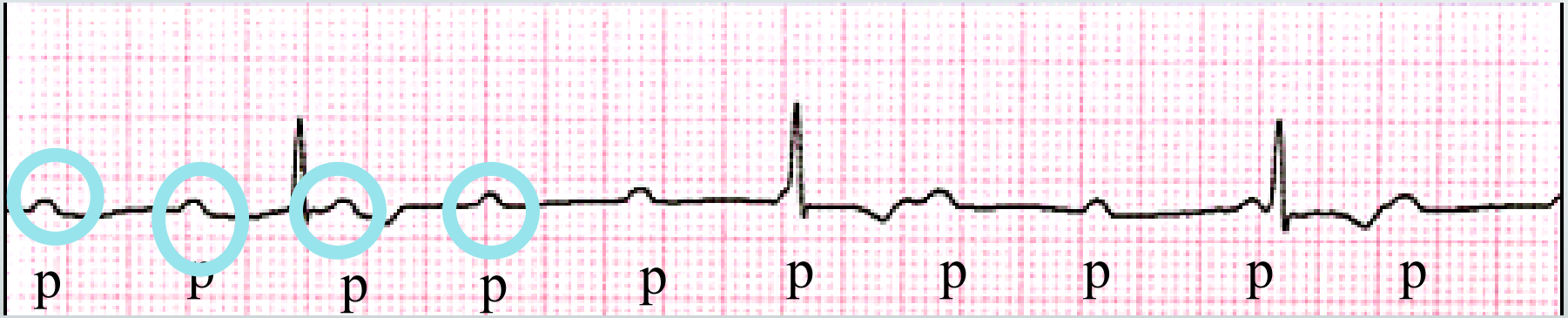
Third-Degree or Complete AV Block

- No communication whatsoever between atria and ventricles
- Two pacemakers by definition:
  - One supraventricular, one ventricular
- Atrial and ventricular rates are typically different.
- Key feature is that PR intervals are completely changing and have no effect on the ventricular rate.



Characteristics Complete Heart Block

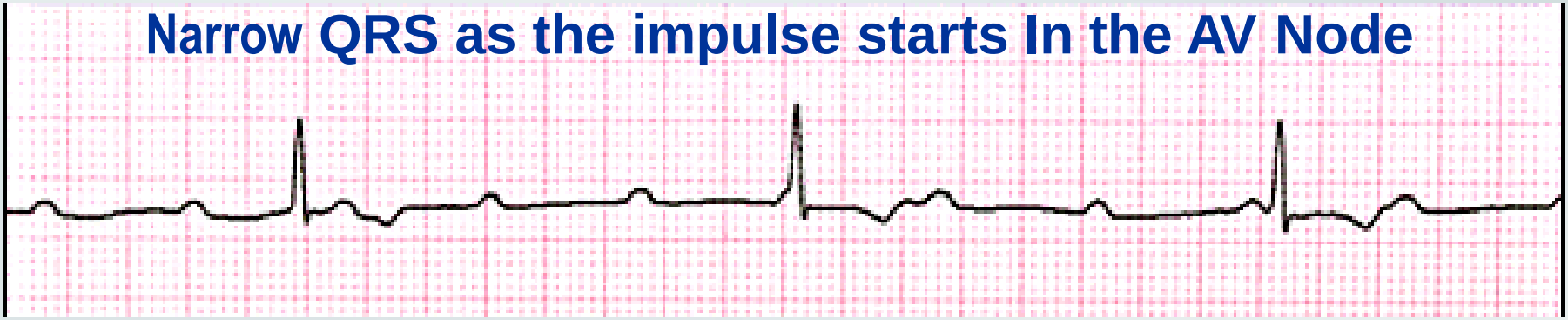
- P waves present with same morphology
- QRS are narrow or wide
- Not a 1:1 ratio
- Atrial Rate is regular (p waves march out)
- Ventricular Rate is regular (QRS march out)
- PR is **not constant**



To compensate HIS bundle or Purkinje Fibers kick in

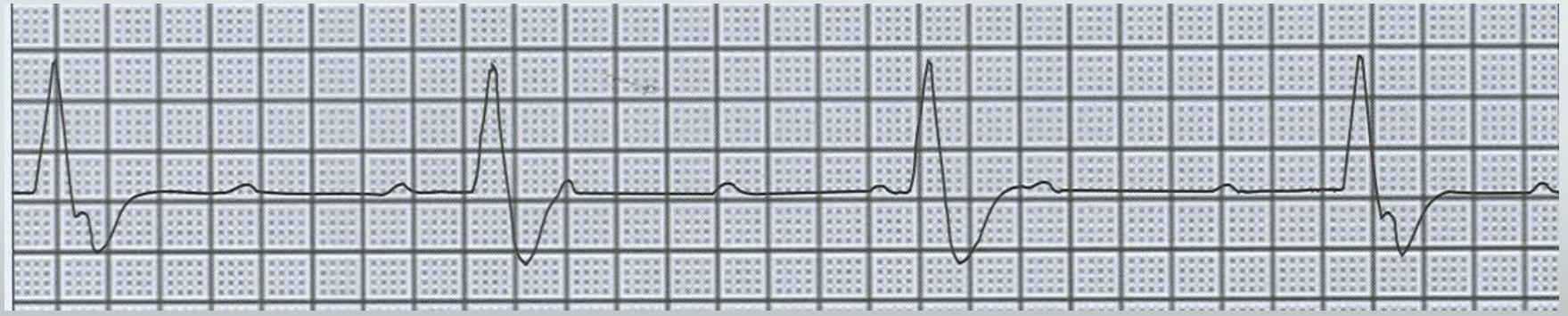
Junctional Escape Rhythm Rate > 40

Narrow QRS as the impulse starts In the AV Node

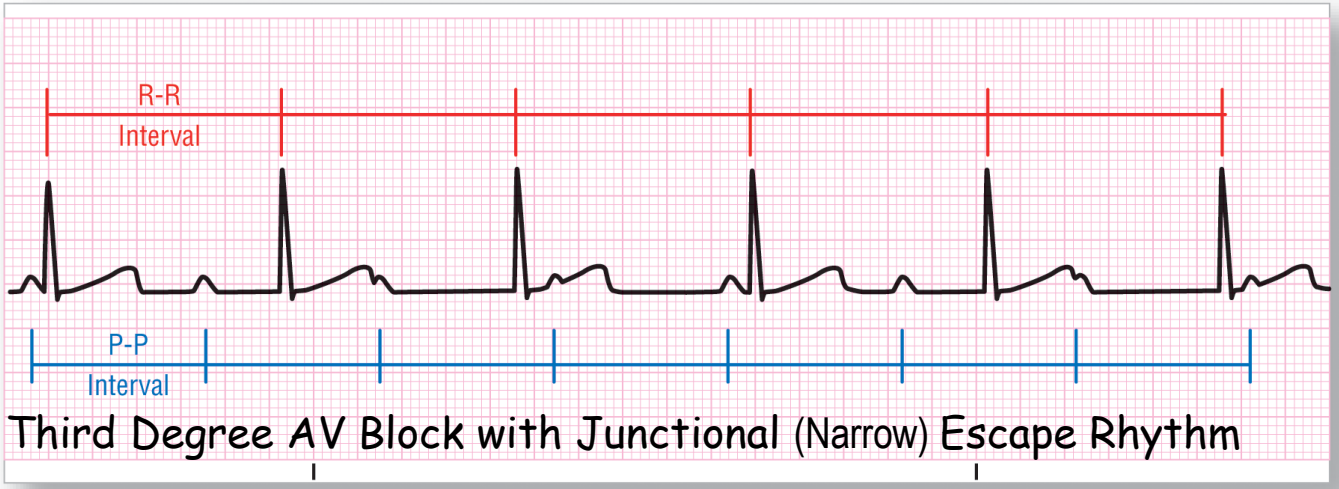


Ventricular Escape Rhythm Rate < 40

Wide QRS as the impulse starts In the Purkinje fibers



Examples Third Degree AV Block



Third Degree AV Block with Junctional (Narrow) Escape Rhythm

Third Degree AV Block with Ventricular **(Wide)** Escape Rhythm

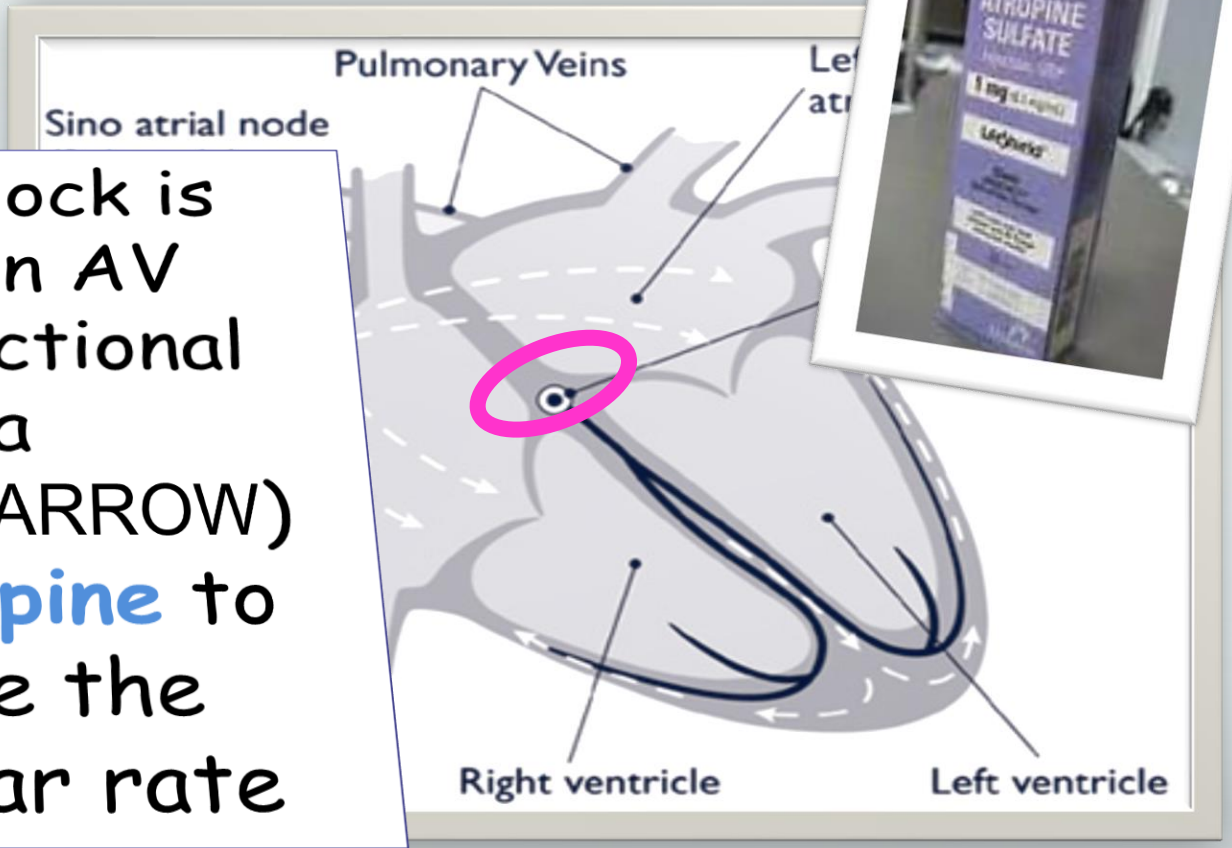
Possible Causes

- Anterior or Inferior MI
- Myocardial ischemia
- Cardiomyopathy
- AV nodal damage
- Rheumatic Fever
- Electrolyte imbalance
- Digitalis/beta blocker/calcium channel blocker toxicity
- Mitral or Aortic valve replacement complications
- Cardiac cath/angioplasty

Treatment

Depends on location of the block

If the block is **higher** in AV node/junctional area (QRS is NARROW) give **Atropine** to increase the ventricular rate

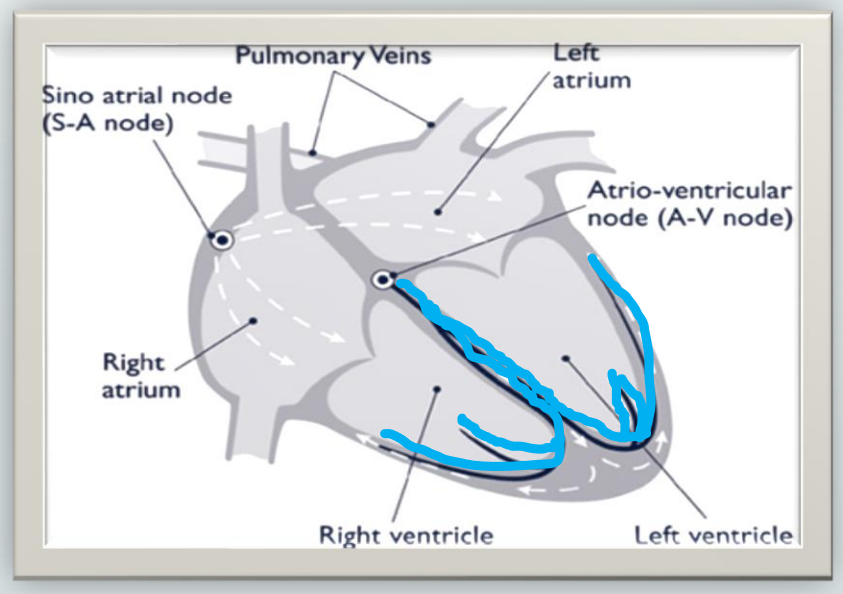


Treatment

If the block is **lower** in Purkinje System area (QRS is **WIDE)**

- If *Asymptomatic*
  - Observe and treat causes
  - External pacer at bedside
- If *Symptomatic*

  SOB, Dizziness, Hypotension
  - Increase ventricular rate
  - External pacing
  - Prepare for temporary or permanent pacing
  - Dopamine 2-10mcg/kg/min
  - Epinephrine 2-10 mcg/min



Marriage Relationship and the Blocks

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P wave = Wife
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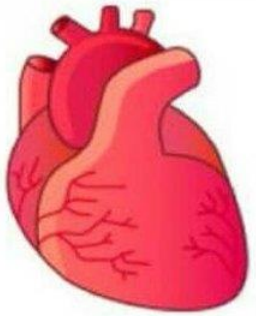
Pacer = Counseling



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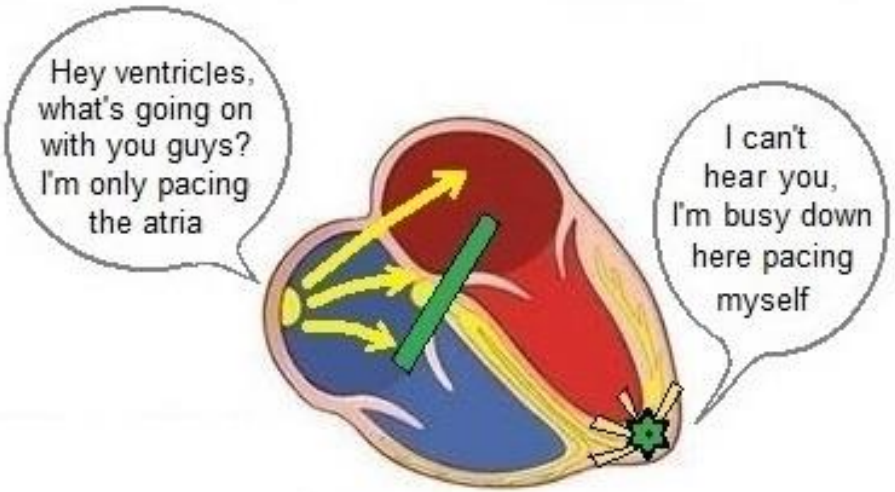
2nd degree block type I (weinkebach):
The wife (p wave) is waiting at home. The husband (qrs) come home later and later every night until one night he doesn't come at all.
Note: *Husband (qrs) must come home at least 2 nights in a row to see this pattern.*

2nd degree AV block type II:
The wife (p wave) is waiting at home. Sometimes the husband (qrs) comes home, sometimes he doesn't. When he does come home, its always at the same time.
Note: *This is usually more serious than type I (weinkebach) and will sometimes require counseling (pacing).*

3rd degree AV block:
Wife (p wave) is no longer waiting at home. She and her husband (qrs) are now both on separate schedules and have no relationship and they are no longer talking. Each spouse has a regular, individual schedule.
Note: *This frequently requires counseling in the form of a temporary or permanent pacer.*

3rd Degree Heart Block



The SA node only paces the atria, seperate from the ventricles. A blockage at the AV node cuts off communication to the ventricles. The ventricles initiate a slower escape rhythm. Thus like two rhythms in one, the atria (p-waves) and ventricles (QRS) run seperately.

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Review

- 1st DEGREE – not actually a block/merely a delay in conduction. Appears to be a NSR with a PR interval >0.20
- 2nd DEGREE TYPE I – each beat is progressively delayed until one is blocked. PR gets longer and longer until a QRS complex is dropped.
- 2nd DEGREE TYPE II –the AV node selectively lets some beats through and blocks others. MORE SERIOUS of the two.
- 3rd DEGREE – complete block at the AV node. 2 separate pacemakers

1st Degree AV block

- P waves present with same morphology
- QRS are normal and narrow
- P:QRS has 1:1 ratio
- Both atrial/vent rate is regular/looks like SR with longer PR
- PR > 0.20 and **constant**

2ND Degree Type I

- P waves present with same morphology
- QRS are normal and narrow
- Not a 1:1 ratio
- Atrial Rate is regular
- Ventricular Rate is irregular
- PR **not constant** (gets progressively longer)

2nd Degree Type II

- P waves present with same morphology
- QRS are normal and narrow
- Not a 1:1 ratio
- Atrial Rate is regular
- Ventricular rate is irregular
- PR is **constant** with Dropped QRS

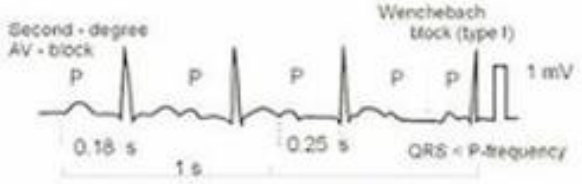
3rd Degree

- P waves present with same morphology
- QRS are narrow or wide
- Not a 1:1 ratio
- Atrial Rate is regular
- Ventricular Rate is regular
- PR is **not constant**

"THE HEART BLOCK POEM"

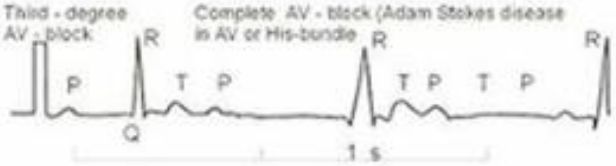
If the R is far from P,
then you have a FIRST DEGREE.

Longer, longer, longer, drop!
Then you have a WENCKEBACH.



If some Ps don't get through,
then you have MOBITZ II.

If Ps and Qs don't agree,
then you have a THIRD DEGREE.



Practice

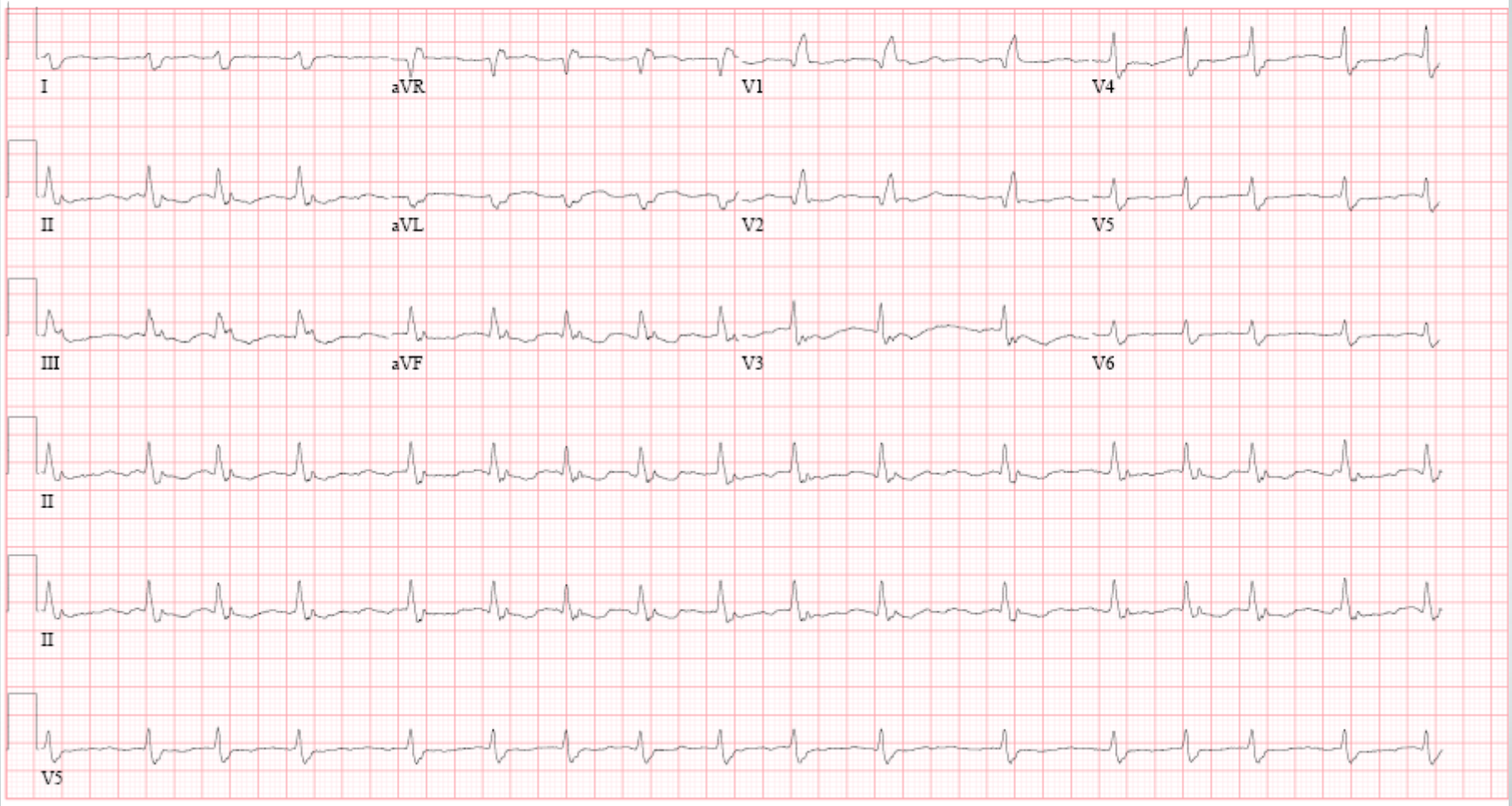
Practice & Application Time

For each EKG

- **Identify any BBB present**
- **Identify any heart blocks**

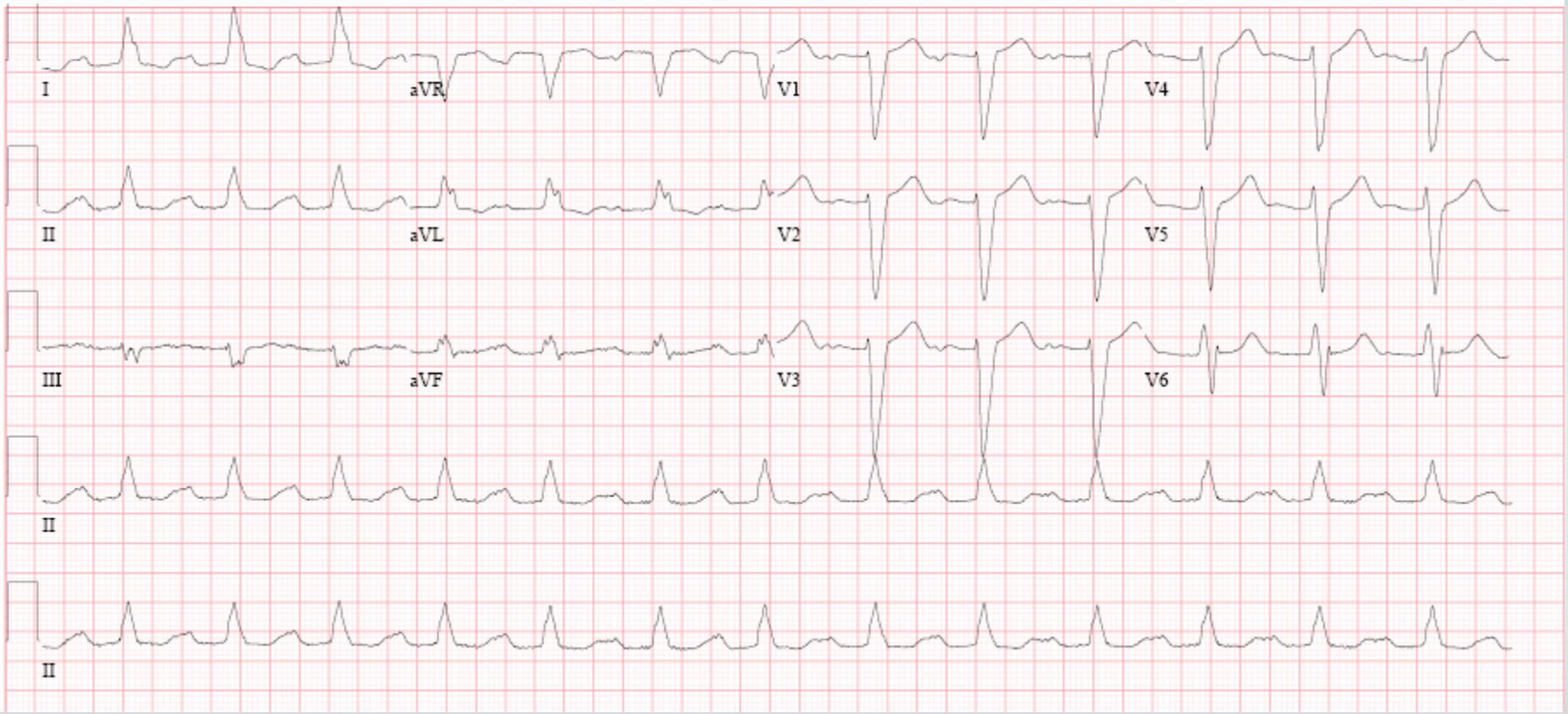
EKG 1

Vent. rate	99	BPM
PR interval	*	ms
QRS duration	144	ms
QT/QTc	384/492	ms
P-R-T axes	* 104	-79

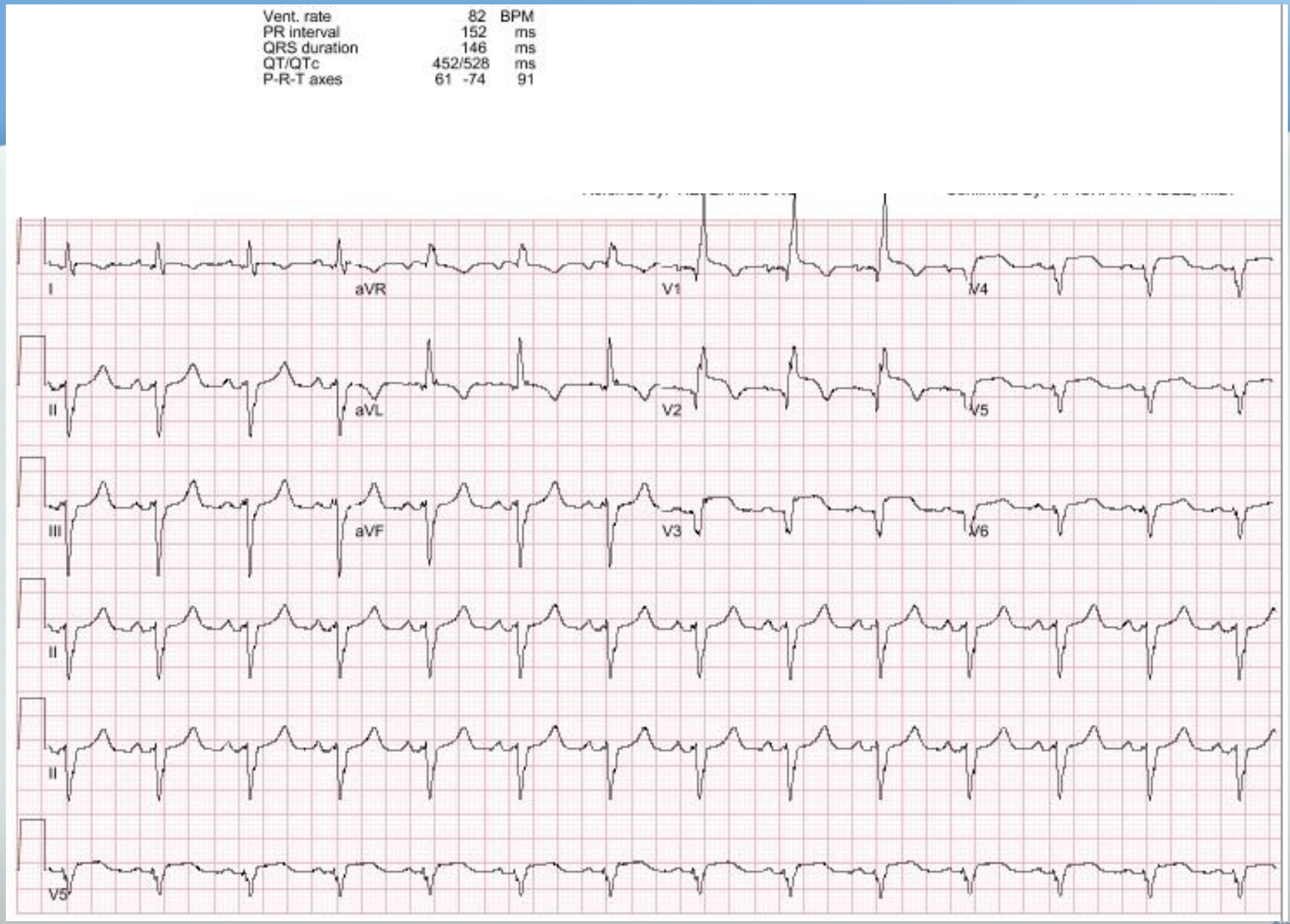


EKG 2

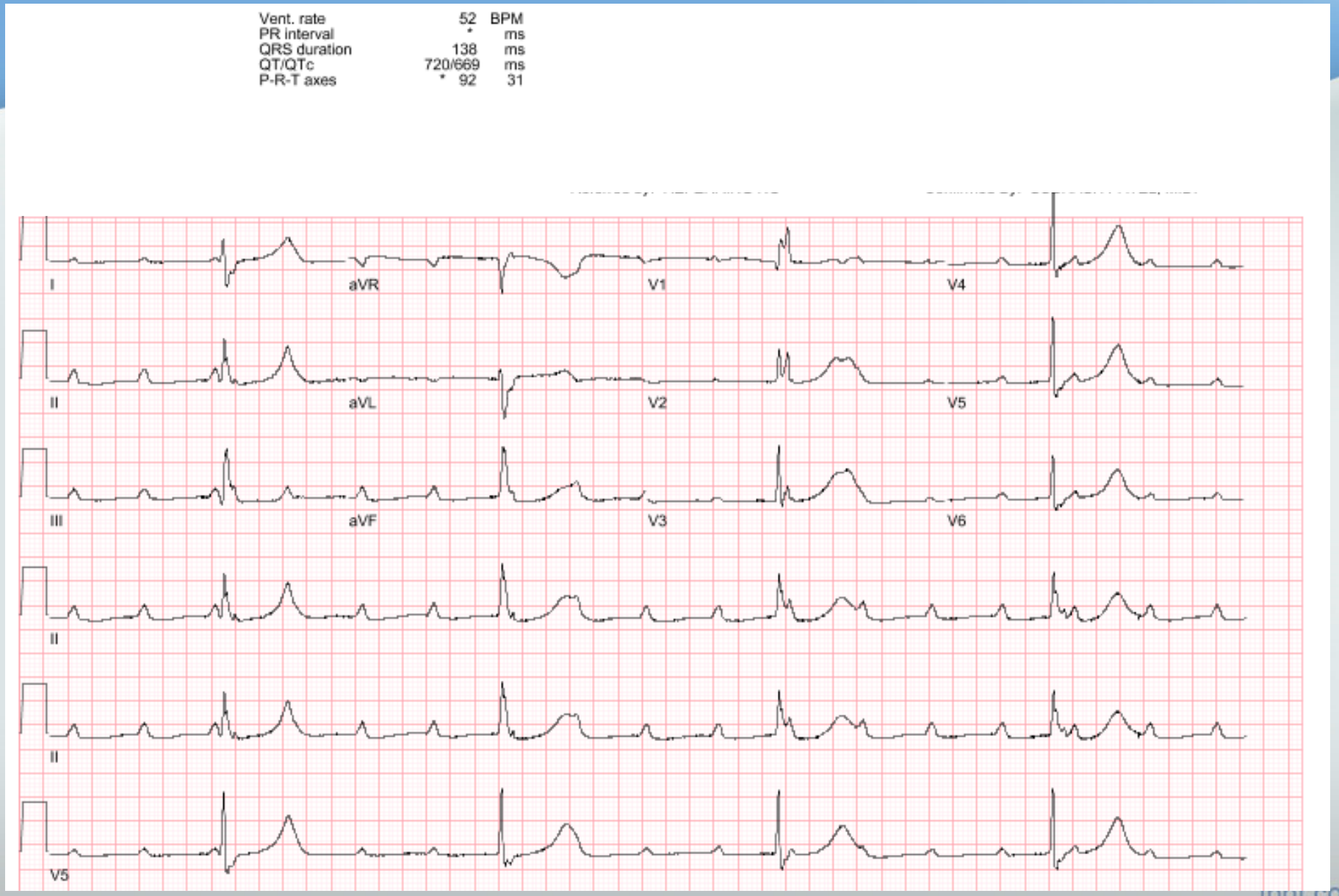
Vent. rate	81	BPM
PR interval	296	ms
QRS duration	156	ms
QT/QTc	476/552	ms
P-R-T axes	47 18	93



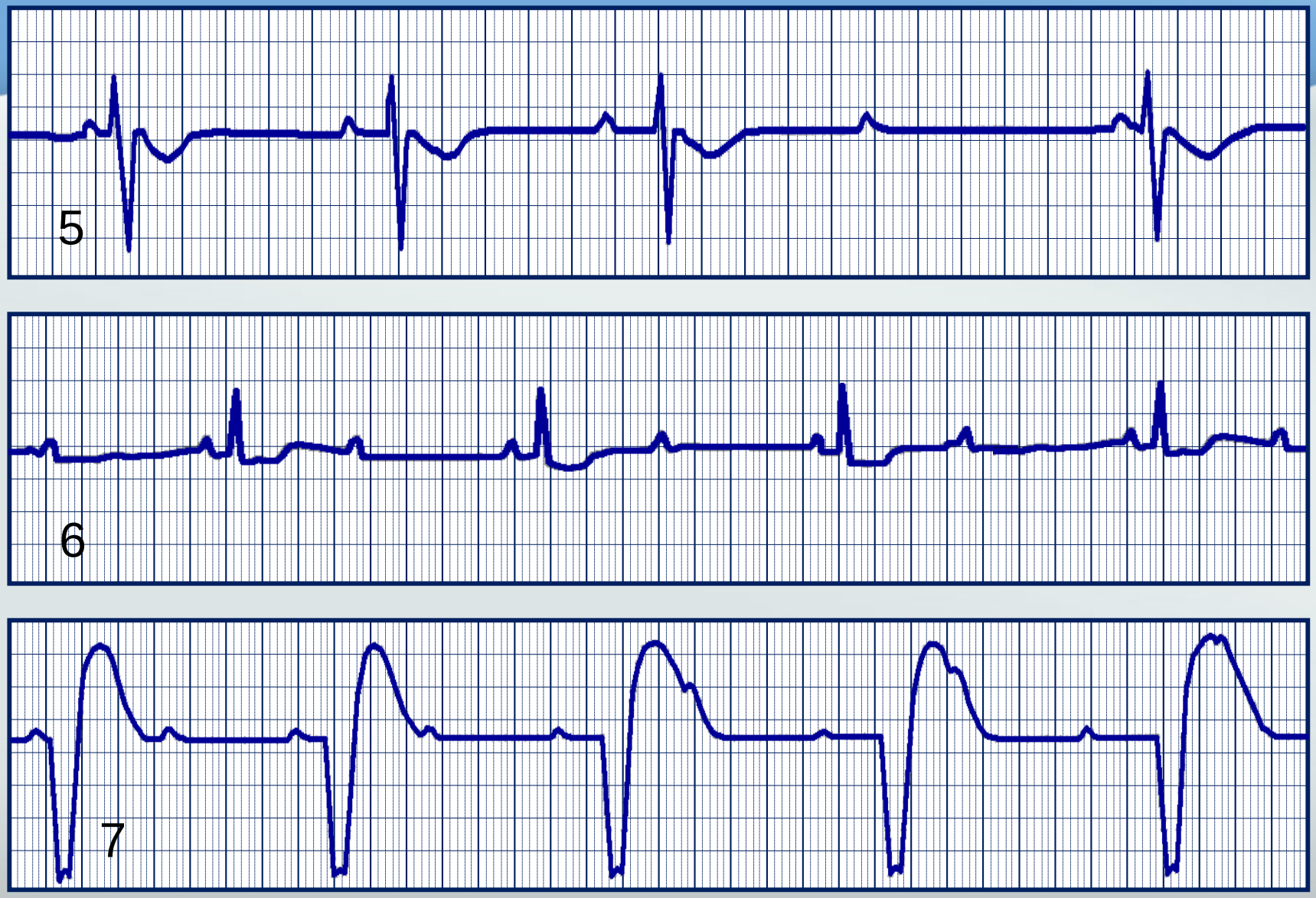
EKG 3



EKG 4



Heart Blocks



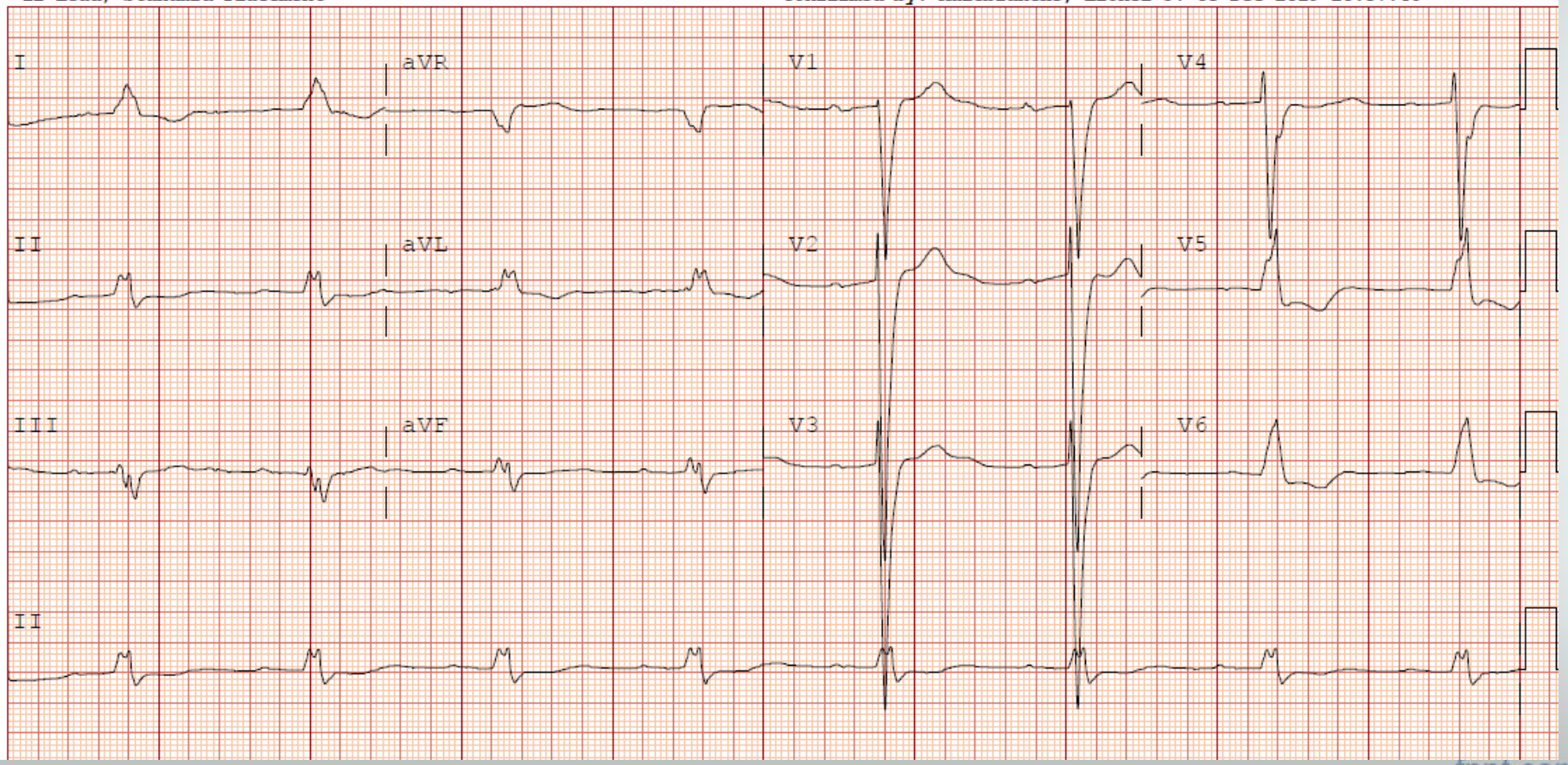
EKG 8

HR	47
PR	313
QRSD	197
QT	533
QTc	472

-- AXIS --

P	102
QRS	-8
T	176

12 Lead; St[illegible]



Answers

1. RBBB
2. LBBB
3. RBBB with ST elevation anterior, septal, lateral leads → cath lab
4. RBBB + Third Degree (Complete) Heart Block with ventricular escape rhythm → pacemake3rr
5. Wenckebach
6. 2nd Degree Heart Block, Mobitz II
7. 3rd Degree Heart Block with ventricular escape rhythm
8. Sinus Bradycardia with 1st Degree AV Block and LBBB