

**Northwest Community Healthcare
Paramedic Program**

AV Conduction Defects/AV Blocks

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Reading assignments:

Aehlert Vol. 1 pp ,799-804

SOP: Bradycardia with a pulse

National EMS Education Standard:

AEMT Material PLUS: Anatomy, physiology, epidemiology, pathophysiology, psychosocial impact, presentations, prognosis, and management of complex depth, comprehensive breadth: Cardiac rhythm disturbances.

KNOWLEDGE OBJECTIVES:

Upon completion of the reading assignments, class, and homework questions, reviewing the SOPs, and working with their small group, each participant will independently do the following with at least an 80% degree of accuracy and no critical error:

1. Identify on a 6-second strip the following rhythms:
 - a) First degree AV block
 - b) Second degree AV block Mobitz I
 - c) Second degree AV block Mobitz II
 - d) Third degree AV block with a junctional and ventricular escape rhythm
2. Systematically evaluate each rhythm using the following discriminators:
 - a) Rate: atria and ventricles,
 - b) Rhythm: Regular/irregular,
 - c) Presence/absence/morphology of P waves,
 - d) R-R interval, P-P Interval,
 - e) P-QRS relationship, and
 - f) QRS duration.
3. Correlate the cardiac rhythm with patient assessment findings to determine the emergency treatment for each rhythm according to NWC EMSS SOPs.
4. Review the actions, prehospital indications, side effects, doses and contraindications of the following:
 - a) Atropine
 - b) Norepinephrine (Dopamine backup)
 - c) Transcutaneous pacing
 - d) Glucagon

NCH Paramedic Program
Atrio-Ventricular Conduction defects/AV Blocks
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I. Conduction disturbances as sources of dysrhythmias

A. Etiology

1. Problems with electrical conduction through the heart.
2. With the AV blocks (AVBs), the conduction defect is usually in the AV node or Bundle of HIS which fail to act as a reliable bridge between the atria and the ventricles. Sometimes the impulses are just delayed, other times they are blocked entirely. **This will cause a variation in the PR interval (PRI) and/or the P to QRS ratio.**
3. With bundle branch blocks, the delay is in the ventricles causing a wide QRS following a P wave that usually has a normal PRI.
4. **In all of the AV blocks, P waves are present and the P-P is usually regular as the SA node is still healthy and firing normally.**

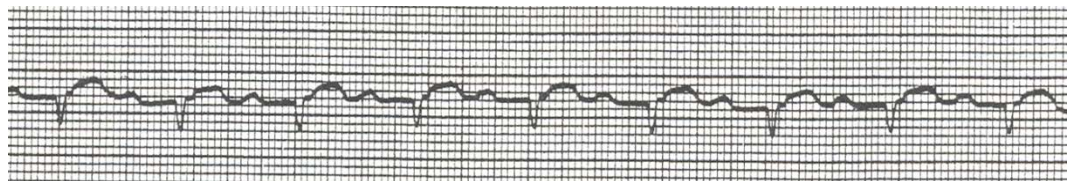
B. Classifications of atrioventricular blocks

1. Classified by the site of the block and the severity of the defect in descending order from mildest to the most severe form (much like a burn).
2. **First Degree:** All of the atrial impulses are conducted to the ventricles, they are just consistently delayed.
3. **Second Degree types (or Mobitz) I and II:** Some of the atrial impulses are conducted to the ventricles and some are not.
4. **Third Degree:** None of the atrial impulses are conducted to the ventricles.

C. Assessing for AV blocks

1. Assess rhythm regularity.
 - a. Determine if P waves are present and if P-P is regular. They may be a little difficult to see in some strips, but find two you can see and use that measure to look for subtle indications of P waves buried in other waves or segments. **In all 4 AV blocks, the P-P must be present and essentially regular.**
 - b. **R-R may be regular or irregular depending on degree of block**
2. Assess the relationship of the P waves to the QRS complexes. More P waves than QRS complexes? It must be a heart block if the P-P is regular.
3. Measure all the PR intervals for the P waves immediately preceding each QRS. Are they fixed (same PRI for each complex) or variable?
4. Measure the width of the QRS. Is it normal or wide?

II. 1st Degree AV Block



A. Description

1. Impulse originates in the sinus node and is conducted normally through the atria. It is delayed longer than normal in the AV node (> 0.20 sec), but all atrial impulses (P waves) are conducted through the AV node to the ventricles to create a QRS.
2. 1st Degree AVB is a SUPRAHISIAN block. The AV node is the source of disease.

3. Not a rhythm in itself, but a condition superimposed on another rhythm. Interpret the underlying rhythm first and then add...with first degree AV block.

B. Characteristics

1. Rate: May occur at any underlying heart rate
2. Rhythm: Generally regular if 1st degree block is the only abnormality
3. P waves
 - a. Present, upright in normal leads
 - b. P-P regular
 - c. P:QRS ratio is 1:1
4. P-R interval
 - a. **Consistently prolonged > 0.20 seconds but less than 0.40 seconds**
 - b. PRI is fixed
5. QRS duration: normal - 0.04-0.10 seconds

C. Etiology

1. Drugs: Quinidine, procainamide, digitalis, beta-blockers, calcium-channel blockers
2. Acute inferior wall MI causing ischemia of the AV junctional tissue
3. Increased vagal tone
4. ↑ K
5. Rheumatic fever; degenerative disease of conduction system
6. Congenital abnormality

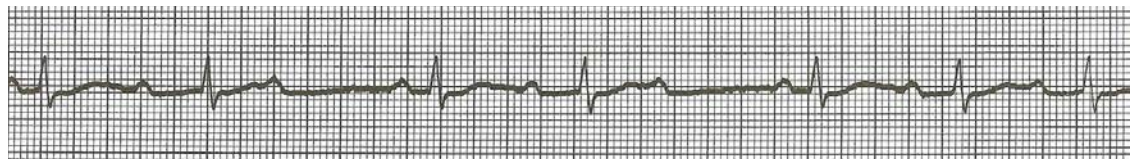
D. Clinical significance

1. No danger in itself - all impulses are conducted to ventricles and cardiac output should be OK.
2. Usually produces no symptoms.
3. May be a forerunner of a more advanced block so continue ECG and SpO₂ monitoring into the hospital.

E. Treatment:

1. IMC and treat for ischemia if chest pain present
2. If the heart rate is also slow and the patient is hypotensive and unstable, atropine may be highly effective.

III. 2nd Degree Block – type 1 (Mobitz I or Wenckebach pattern)

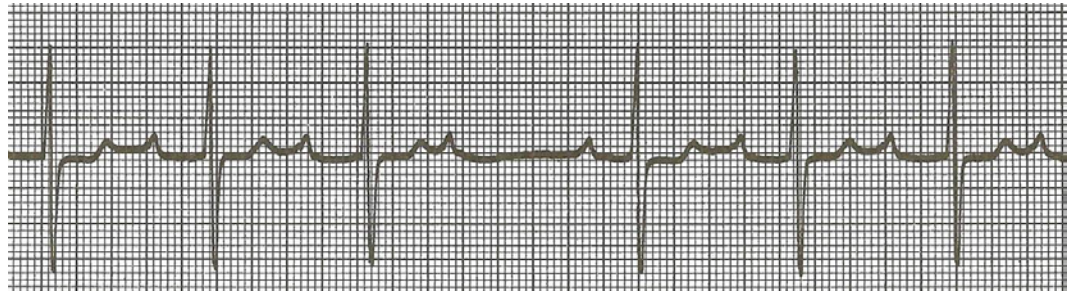


A. Description

1. Well over 90-95% of 2nd degree AV blocks are Mobitz I which is a SUPRAHISIAN **Intermittent** block at the level of the AV node.
2. P waves come on time), but have a more and more difficult time getting through the AV node, until one does not get through at all and the pattern resets.
3. On the ECG, this is reflected as regular P-P intervals; P-R intervals become progressively longer until one P wave is present without a QRS followed by a slight pause until the next P wave comes on time, and the pattern starts over again. Because conduction to the ventricles becomes progressively delayed until one impulse is blocked entirely at the AV node and there is no QRS, the R-R intervals are irregular and the QRS complexes have a classic "**group beating**" appearance.

4. Because the site of the conduction disturbance is at the AV node, the ventricles conduct the impulses they get normally and the QRS complexes should be narrow.

B. Interpretation



1. Rate
 - a. Atrial usually normal
 - b. Ventricular may be slow depending on the number of dropped QRS complexes
2. Rhythm
 - a. Atrial: Regular P-P
 - b. **Ventricular: Irregular R-R: group beating**
3. P waves
 - a. Present, upright
 - b. More P waves than QRS complexes
4. P-R interval
 - a. **Variable - progressive lengthens prior to a dropped QRS.**
 - b. May be longer than 0.20 seconds.
5. QRS complex: 0.04-0.10 seconds. A narrow QRS makes Mobitz I much more likely (though doesn't quite rule out Mobitz II)

C. Etiology

1. Same causes as 1st degree AVB - common in inferior wall MI
2. Increased parasympathetic tone
3. Drug effects
4. May be a normal variant in some (athletes)

D. Clinical significance

1. Patients may be asymptomatic because ventricular rate usually remains nearly normal and CO is not significantly affected.
2. Frequent dropped beats creating a ventricular bradycardia may decrease cardiac output
3. Mobitz I is much more commonly seen in association with acute inferior MI - often with progression from 1st degree - to 2nd degree (Mobitz I) - and sometimes to 3rd degree AV block.

E. Treatment

1. Asymptomatic: IMC - monitor into hospital.
2. Symptomatic - Bradycardia with pulse SOP
IMC: Atropine; norepinephrine; transcutaneous pacing

IV. 2nd Degree AV Block type II (Mobitz II)

A. Etiology

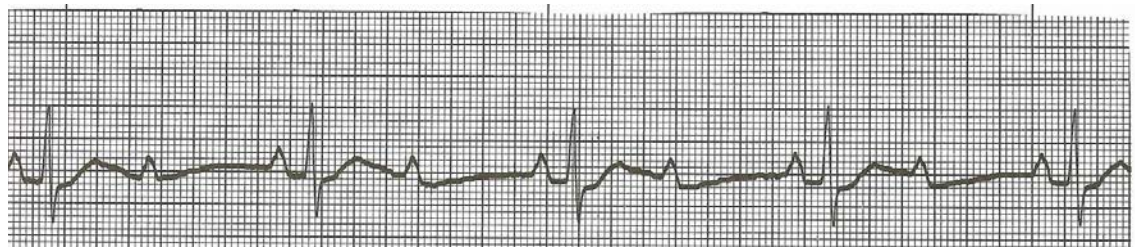
1. INFRAHISIAN block: disease is below the AV node and may involve the bundle of HIS or both bundle branches

2. **Much more serious than Mobitz I**
3. Usually associated with acute anterior or anteroseptal MI and more likely in that setting to be abrupt in onset
4. Degeneration of the electrical conduction system usually related to age
5. Same other causes as 1st degree AVB
6. It is very unlikely (*though not impossible*) to switch back-and-forth from Mobitz I to Mobitz II.

B. Description

1. **Intermittent block** characterized by P waves that originate in the sinus node but are not all conducted to the ventricles.
 - a. The P-P is reg. as in all AV blocks, but only every 2nd, 3rd, or 4th P wave conducts to the ventricles resulting in a QRS.
 - b. **Fixed PRI before each QRS present** that is more likely to be normal.
 - c. Seeing two or more P waves in a row without a QRS complex makes Mobitz II more likely (though doesn't rule out Mobitz I) – look at PRI
 - (1) Variable PRI with Irregular R-R: Mobitz I
 - (2) Fixed PRI: Mobitz II
2. The site of the block is in the Bundle of HIS or bundle branches so the QRS complexes may be narrow (if block is in the bundle of HIS) or wide (if block is in the bundle branches).

C. Interpretation



1. Rate
 - a. Atrial: Usually normal
 - b. Ventricular: Depends on the number of impulses that conduct to the ventricles - always less than the atrial rate.
2. Rhythm
 - a. Atrial: P-P regular
 - b. Ventricular: May be regular or irregular depending on conduction ratio.
3. P waves
 - a. Present upright
 - b. **More P waves than QRS complexes**
4. P-R interval
 - a. **Constant (fixed) for conducted beats**
 - b. May be normal or greater than 0.20 seconds.
5. QRS complex: May be normal or wide depending on site of block.

D. Clinical significance

1. Slow rate may compromise cardiac output
2. Frequently progresses to 3rd degree block or asystole with no warning.

E. Treatment

1. Continuous ECG & SpO₂ monitoring
2. Norepinephrine (atropine contraindicated)

3. Apply pace-defib pads. Pace if BP drops or patient is or becomes unstable.
4. Most patients in this block go on to get permanent implantable pacemakers.

F. Consider underlying cause. Rx per SOP.

V. **3rd Degree (Complete) AV Block**

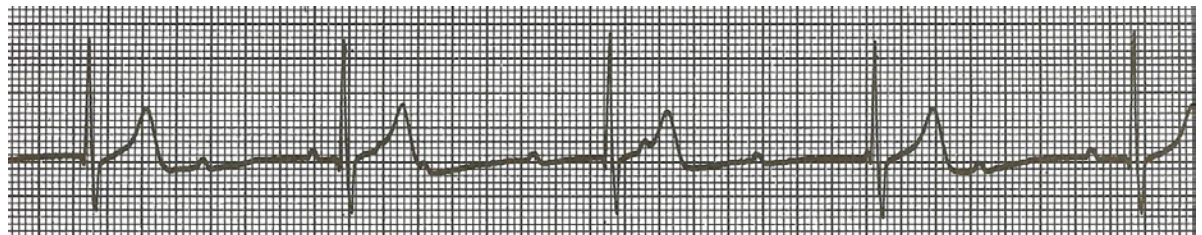
A. **Description**

1. INTRAHISIAN block: disease is below AV node and may involve bundle of HIS or both bundle branches
2. Most serious AVB - Can progress suddenly to asystole without warning
3. No atrial impulses are conducted to ventricles **due to complete electrical block below the AV node.**
4. Atria pace themselves (P-P regular)
5. Ventricles are paced by an escape pacemaker. This may be in the AV node (giving the appearance of a junctional rhythm) or the ventricles (giving the appearance of an Idioventricular rhythm) at a **regular rhythm** for that pacemaker. Thus the QRS may be narrow or wide and the ventricular rate will often depend on the escape pacemaker site.
6. **No relationship between Ps and QRSs**
7. PRI will be constantly changing (variable)

B. **Etiology**

1. Inferior and anterior MI
2. Drug toxicity: Beta blocker, calcium blocker, digitalis
3. Degenerative conduction system disease
4. Following cardiac surgery
5. Elderly with degeneration of conduction system

C. **Interpretation**



1. Rate
 - a. Atrial: P wave rate usually WNL for SA node, may be slow if sinus bradycardia
 - b. Ventricular (R rate):
 - (1) 40-60 if paced by AV node
 - (2) 20-40 if paced by ventricles
2. Rhythm
 - a. Atrial: P-P regular
 - b. Ventricular: R-R regular
3. P waves
 - a. Present; upright
 - b. More P waves than QRS complexes as atrial rate is usually faster
 - c. P may be buried in a QRS complex - look for it
4. **PRI – totally variable; no correlation between Ps and QRSs**
5. QRS complex
 - a. Narrow if junctional escape pacemaker
 - b. Wide if ventricular escape pacemaker



D. Clinical significance

1. Heart sounds variable in intensity
2. May have 3rd & 4th HS, murmurs or gallops (variable ventricular filling by atrial rhythm)
3. Cannon A waves: Jugular vein pulsations become momentarily massive – atria contract against closed AV valves. Blood cannot enter ventricles. Cause huge venous pulsations.
4. Relative or actual hypotension
5. Serious & potentially life threatening
6. Can progress to asystole without warning
7. May have severe hemodynamic compromise due to slow ventricular rate and ↓ CO
8. May experience dyspnea, HF, ↓ BP, chest pain or syncope

E. Treatment

1. See bradycardia with a pulse SOP – NO ATROPINE
2. Norepinephrine
3. Transcutaneous pacemaker
4. Continuous monitoring into hospital; Transport ASAP

Homework questions

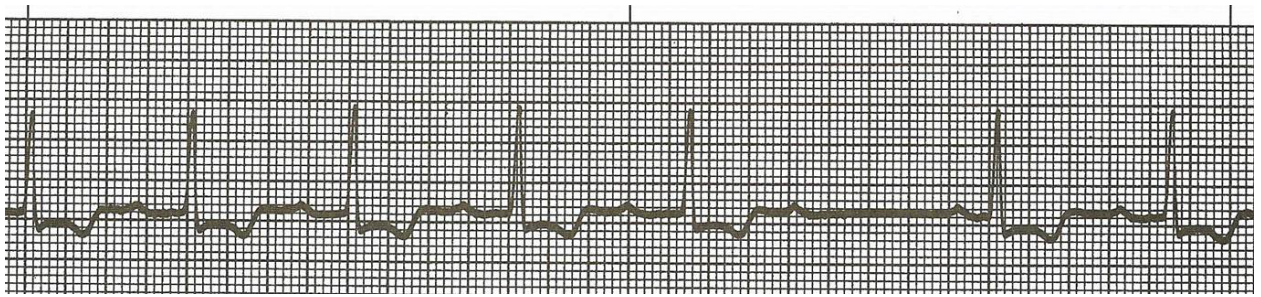
1. The term heart block describes disturbances in conduction through the _____
2. Which is the mildest form of AV block? _____
3. Which is the most extreme or severe AV block? _____
4. List four steps that are critical to accurately diagnosing AV blocks:

5. Which is the main characteristic of all first degree AV blocks?
 - A. All of the atrial impulses are conducted to the ventricles.
 - B. Some of the atrial impulses are conducted to the ventricles and some are not.
 - C. None of the atrial impulses are conducted to the ventricles.
6. The PR interval in first degree block is short / normal / prolonged.
7. The PR interval in first degree AV block is fixed / variable.
8. The QRS complex in first degree AV block should be normal / wide.
9. First degree block usually
 - A. causes no symptoms.
 - B. results in syncope and hypotension.
10. What is the ratio of P waves to QRS complexes in first degree block?
 - A. 3:1
 - B. 2:1
 - C. 1:1
11. Which is a characteristic of all second degree blocks?
 - A. All of the atrial impulses are conducted to the ventricles.
 - B. Some of the atrial impulses are conducted to the ventricles and some are not.
 - C. None of the atrial impulses are conducted to the ventricles.
12. Second degree block Mobitz I has a pattern of conduction known as _____
13. The P - P in 2° AVB MI is regular / irregular.
14. The PR interval in 2° AVB MI is fixed / variable.
15. The P-R interval in 2° AVB MI is progressively shortens / lengthens until a P wave occurs that is not followed by a QRS.
16. This pattern causes the ventricular rhythm to be regular / irregular.
17. The repetitive ventricular pattern is called _____ beating.
18. The QRS complex in 2° AVB MI should be normal / wide.
19. The P - P in a 2° AVB MII is regular / irregular.

20. The PR interval in 2° AVB **Mobitz II (MII)** is fixed / variable.
21. The ventricular pattern in a 2° AVB MII with a fixed conduction ratio is regular / irregular.
22. The location of the conduction disturbance in 2° AVB MII may be in the _____
or _____.
23. As a result, the QRS may be narrow if located in the _____
and wide if located in the _____.
24. 2° AVB MII is less / more serious than Mobitz I.
25. Mobitz II has a potential to progress suddenly to _____
26. The first treatment of choice for 2° AVB MII with a wide QRS is _____.
A. Atropine B. Norepinephrine
Why?
27. Which is a characteristic of all 3° AV blocks?
A. All of the atrial impulses are conducted to the ventricles.
B. Some of the atrial impulses are conducted to the ventricles and some are not.
C. None of the atrial impulses are conducted to the ventricles.
28. In 3° AVB, the atria and ventricles beat synchronously with / independent of each other.
29. The P - P in a 3° AVB is regular / irregular.
30. The R - R in a 3° AVB is regular / irregular.
31. The P-R interval in a 3° AVB is fixed / variable.
32. In 3° AVB, P waves have direct / no relationship to the QRS complexes.
33. The QRS in 3° AVB may be narrow if the ventricles become paced by the _____
and wide if the escape pacemaker comes from the _____
34. Third degree block can progress suddenly to _____
35. List three physical symptoms commonly experienced by patients with 3° AVB

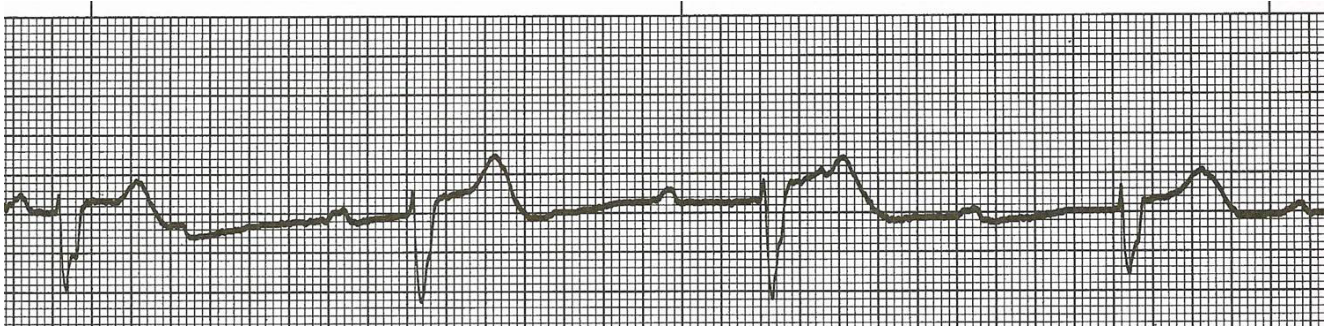
36. What is the first treatment of choice for 3° AVB?
A. Atropine B. Norepinephrine
Why?

37.



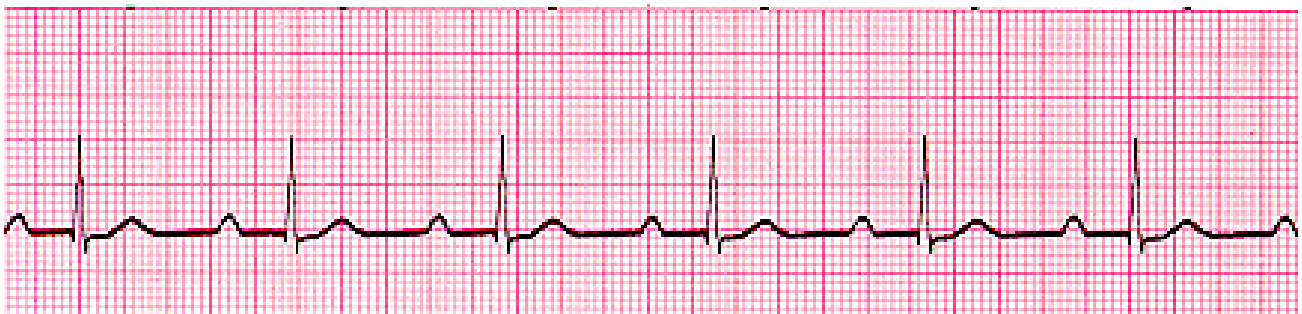
Identify the rhythm: _____

38.



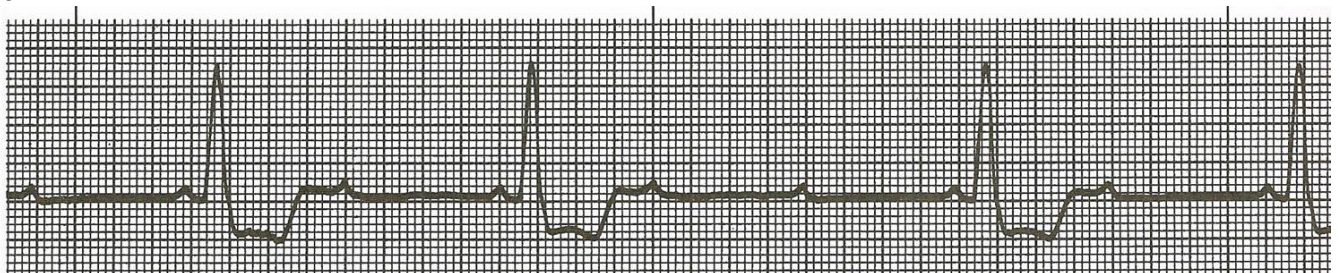
Identify the rhythm: _____

39.



Identify the rhythm: _____

40.



Identify the rhythm: _____

41. Which rhythm has the following characteristics (circle all the correct answers)

More Ps than QRSs?	1°	2° MI	2° MII	3°
P-P interval regular (All Ps march out)?	1°	2° MI	2° MII	3°
P-R interval constant?	1°	2° MI	2° MII	3°
P-R interval variable with no pattern?	1°	2° MI	2° MII	3°
P-R interval progressively lengthens before dropped QRS?	1°	2° MI	2° MII	3°
R-R interval constant (QRSs regular)	1°	2° MI	2° MII	3°

More Ps than QRSs = Rapid AV Block determination

