

EKG Review

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Learning Objectives

Review the basics of the conduction system

Review normal ECG intervals (PR, QRS, QT)

Identification of PACs and PVCs

Understand the mechanism and differentiate between AV blocks (first degree, second degree Mobitz I and II, and third degree)

Identify SVTs on ECG. Briefly cover ways to differentiate between SVTs on ECG. Describe initial management strategies.

Conduction System Overview



Waveforms and Intervals on Normal ECG

P wave- Caused by depolarization of the atria (atrial contraction)

• Normal: 80 ms

PR Interval- Represents time from onset of atrial depolarization to the onset of ventricular depolarization.

• Normal: 120-200 ms

QRS complex- Represents conduction of the electrical impulse from the bundle of His throughout ventricular myocardium (**ventricular depolarization**)

• Normal: 70-100 ms

ST segment- End of ventricular repolarization and start of ventricular repolarization. T wave- Latter phase of ventricular repolarization.

QT Interval-Represents time between the onset of ventricular depolarization and the end of ventricular **repolarization (duration of electrical systole)**

- QTc >440 msec in men
- QTc >460 msec in women

U wave- Last phase of ventricular repolarization.



Stepwise Approach to ECG Interpretation

Rate		
Rhythm		
Axis		
PRI		
QRS		
ST segment		
QT		

Other: Assess for LVH, R wave progression, atrial enlargement, low voltage, bundle branch blocks, LAFB, LPFB etc.



P Wave Axis





Is the rhythm sinus?

• Normal sinus p wave bifid in V1, upright in I,II, AVL, and inverted in AVR.

QRS Axis



+90°

What is the axis?



What is the axis?



Negative in lead I and positive in AVF = Right axis deviation

What is the Axis?



What is the Axis?



What is the Axis?

Positive in lead I and negative in AVF and lead II= Left axis Deviation

50 yo woman with sensation of "skipped beats" over past few months presents to outpatient clinic.

A. Atrial fibrillation

B. Atrial flutter

C. 2nd Degree AV block Mobitz type 1

D. 2nd Degree AV block Mobitz type 2

E. Sinus rhythm with PACs

65 yo man with hx of HFrEF, HTN, CAD, and HLD presents for routine f/u in clinic.

- A. Sinus rhythm w/ PACs
- B. Ventricular bigeminy
- C. Focal atrial tachycardia
- D. Sinus rhythm with frequent PVCs
- E. Wandering atrial pacemaker

78 yo man with HTN, HLD, CKD 3 here for routine f/u in clinic. What is the rhythm?

- A. Normal sinus rhythm with 1st degree AV block
- B. Junctional rhythm with prominent u wave
- C. Normal sinus rhythm
- D. Second Degree AV block Mobitz type 1
- E. Second Degree AV block Mobitz type 2

First Degree AV Block

PR interval >200 ms on surface ECG

Slow conduction through the AV node/delay of impulse from the atria to the ventricles.

- Not truly a block in conduction as all atrial depolarizations waves traverse the AV node.
- Typically seen during states of high vagal tone

Treatment

Vast majority of cases no tx needed.

Etiologies of Sinus Node Dysfunction and AV Conduction Diseases

Reversible or Transient Causes

- Induced vagal tone
- Drugs
- Infections (lyme, infective endocarditis)
- Inflammatory or infiltrative conditions
- Ischemia
- Electrolyte abnormalities

Non-Reversible Causes

- Fibrosis
- Degeneration
- Genetic
- Traumatic/iatrogenic (surgical or percutaneous)
- Ischemia
- Rheumatic

Second Degree AV Block

Mobitz Type I

Progressive prolongation of the P-R interval leading to a non-conducted P wave.

Site of block is typically in the AV node. (narrow QRS complex)

Often seen during sleep or periods of high vagal tone and with drug treatment.

Treatment: Monitor. Tx underlying etiology (OSA)

Mobitz Type II

Abrupt loss of AV conduction for one beat. Usually repetitive and without any PR interval prolongation.

Site of block is more commonly distal to the AV node (intra-Hisian or infra-Hisian).

Often show evidence of other conduction system disease (BBB, fascicular block)

Treatment: Typically, PPM (unless reversible causes (such as with increased vagal tone during sleep)

Advanced Second Degree/High Degree AV Block

More severe than 2nd degree blocks, but not quite complete AV block.

Some P waves do conduct, and AV dissociation is not present.

Two or more consecutive p waves are blocked; whereas in second degree, one P wave is blocked at a time.

Treatment: PPM (unless reversible cause identified)

Complete Heart Block/3rd Degree A Block Block

Atrial depolarizations are completely blocked from conducting to the ventricles.

No association between the atria and ventricle.

- AV block needs to be distinguished from AV dissociation in which ventricular rate is faster than the atrial rate.
- In AV block atrial rate is faster than the ventricular rate.

Ventricular depolarizations provided through escape pacemakers (junctional escape rhythm or ventricular escape rhythm).

Tx: PPM

80 yo man with hx of CAD, HTN, HLD, and DM presents with extreme lightheadedness. What is the diagnosis?

- A. First Degree AV Block
- B. Second Degree AV
 - block type 1 . Second
 - Degree AV
 - Block type 2
- D. High Degree AV block
- E. 3rd Degree AV block

80 yo man with hx of CAD, HTN, HLD, and DM presents with extreme lightheadedness. What is the diagnosis?

- A. First Degree AV Block
- B. Second Degree AV
 - block type 1
- C. Second Degree AV
 - Block type 2
- D. High Degree AV block
- E. 3rd Degree AV block

Correct answer E. Each atrial depolarization completely blocked from conducting to the ventricles. No association between the atria and ventricles.

80 yo man with hx of CAD, HTN, HLD, and DM presents with extreme lightheadedness. What is the diagnosis?

- A. First Degree AV Block
- B. Second Degree AV block type 1
- C. Second Degree AV Block type 2
- D. High Degree AV block
- E. 3rd Degree AV block

70 yo man with hx of CAD, HTN, and DM for outpatient cardiology visit. What is the diagnosis?

Answer B. Progressive prolongation of PR interval, with a subsequent non-conducted P wave. Repeating 5:4 conduction ratio of P waves to QRS complexes. Relatively constant P-P interval despite irregularity of QRS complexes

75 yo woman with hx of HTN, DM presented with dizziness

- A. First Degree AV Block
- B. Second Degree AV block type 1
- C. Second Degree AV Block type 2
- D. High Degree AV block
- E. 3rd Degree AV block

75 yo woman with hx of HTN, DM presented with dizziness

- A. First Degree AV Block
- B. Second Degree AV block type 1
- C. Second Degree AV Block type 2
- D. High Degree AV block
- E. 3rd Degree AV block

Answer C. Intermittent dropped QRS complexes without PR interval prolongation.

Supraventricular Tachycardia

- Technically any tachycardia above the AV node is an SVT
 - Sinus tachycardia
 - Atrial fibrillation
 - Atrial flutter
 - Junctional Tachycardia
 - Multifocal atrial tachycardia
 - AVNRT
 - AVRT
 - Atrial tachycardia _____

These 3 are what people are typically referring to when they say "SVT".

45 yo woman presents to ED with palpitations. Blood pressure 110/80 What is the initial management?

- A. Adenosine 24 mg IV push
- B. Metoprolol 5 mg iv push
- C. Diltiazem push followed by drip
- D. Vagal maneuvers
- E. Synchronized cardioversion

SVT Management

Adenosine dosing

- Initial dose typically 6 mg given as rapid push (over 1-2 minutes)
- •If not effective within 1-2 minutes can give additional 12 mg bolus x 2 (if needed).
- •Each dose should be flushed 20 mL normal saline.

Mechanisms of SVT

What's the diagnosis?

- A. AVNRT
- B. Afib with RVR
- C. AVRT/ORT
- D. Atrial tachycardia

Short RP interval SVT. Likely AVRT/ORT.

References

1. Kusumoto FM, Schoenfeld MH, Barrett C, et al. 2018 ACC/AHA/HRS Guideline on the Evaluation and Management of Patients With Bradycardia and Cardiac Conduction Delay: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society [published correction appears in Circulation. 2019 Aug 20;140(8):e506-e508]. *Circulation*. 2019;140(8):e382-e482. doi:10.1161/CIR.0000000000628

2. Al-Khatib SM, Arshad A, Balk EM, et al. Risk stratification for arrhythmic events in patients with asymptomatic pre-excitation: A systematic review for the 2015 ACC/AHA/HRS guideline for the management of adult patients with supraventricular tachycardia: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. *Heart Rhythm*. 2016;13(4):e222-e237. doi:10.1016/j.hrthm.2015.09.017

3. Nishant Verma. Supraventricular Tachycardia. ACC SAP

Questions?