Learning Objectives

1. Differentiate the diagnosis and management of Mobitz type I and Mobitz type II AV heart block.
2. Analyze the diagnosis and management of common forms of supraventricular arrhythmias.
3. Summarize the diagnosis and management of sinus node disease.
4. Outline the diagnosis and management of ventricular tachycardia.

1. A 52-year-old male who is an avid golfer and tennis player has stage 1 hypertension. PMH is benign. His electrocardiogram is shown below.

Given the EKG findings, which of the following drugs would be unsafe to use in this patient?

A. Dihydropyridine calcium channel blockers
B. Non-dihydropyridine calcium channel blockers
C. ß-Blockers
D. Central α₂-agonists
E. Cyanide

Sinus Bradycardia, 1st Degree AVB

- Both EKG findings are commonly associated with higher degrees of physical conditioning
- Neither is a contraindication to the use of β-blockers or non-dihydropyridine CCBs (or any other antihypertensives)
2. A 52-year-old man with a history of COPD and hypertension presents with worsening fatigue. He denies chest pain or shortness of breath.

Exam is notable for a slow, irregular pulse; his lungs are clear.

His current medications include lisinopril, HCTZ, tiotropium and ASA.

Which does this rhythm strip show?

- A. Mobitz type I AV block
- B. Mobitz type II AV block
- C. Blocked premature atrial contraction
- D. Complete (third-degree) heart block

3. What is the most likely cause of this dysrhythmia?

- A. Anterior wall infarction
- B. Dihydropyridine calcium channel blocker therapy
- C. Inferior wall ischemia
- D. Hyperthyroidism

Mobitz Type I Second-Degree AV Block (Wenckebach)

The PR interval progressively lengthens until a P wave fails to conduct and a beat is “dropped.”

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- A. Anterior wall infarction
- B. Dihydropyridine calcium channel blocker therapy
- C. Inferior wall ischemia
- D. Hyperthyroidism
Mobitz Type I Second-Degree AV Block (Wenckebach)

- Almost always represents disease of the AV node.
  - May be seen in athletically fit individuals, especially during sleep.
- In the acute setting, inferior wall ischemia is likely.
  - Inferior wall is supplied by RCA, which also supplies the AV node.
  - Anterior wall is supplied by the left coronary artery, which supplies the His-Purkinje system.
- Treatment: the rhythm itself generally does not require treatment; the underlying cause may.

Mobitz Type I Second-Degree AV Block (Wenckebach)

- β-blockers and non-dihydropyridine CCBs (diltiazem and verapamil) slow conduction in the AV node
  - Dihydropyridine CCBs (all end in “pine”) generally do not cause significant AV slowing
- Hypothyroidism can cause AV slowing; hyperthyroidism does not

Mobitz Type II Second-Degree AV Block

Characterized by intermittently nonconducted P waves not preceded by PR prolongation and not followed by PR shortening.

Mobitz Type II Second-Degree AV Block

- Almost always represents disease of the distal conduction system, below the AV node: His-Purkinje system
- May progress to third-degree heart block, with no emerging escape rhythm
- Treatment: permanent pacemaker

Third-Degree AV Block Complete Heart Block

Characterized by a regular rhythm with complete AV dissociation. Impulses generated by the SA node do not propagate to the ventricles. Two independent rhythms can be noted on the ECG.

Third-Degree AV Block Complete Heart Block

- If the result of inferior MI, AV node may recover
  - Escape rhythm typically originates in AV junction, and is narrow-complex
- If the result of anterior MI, distal conduction system is typically permanently damaged
  - Escape rhythm originates in the ventricles, and is wide-complex
- Treatment: permanent pacemaker

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4. A 24-year-old college student presents with an intermittent sensation of rapid heartbeat. These episodes may occur at rest or with exertion and seem to start and stop abruptly. The patient is a nonsmoker and denies alcohol or drug use. There is no history of heart disease.

Which does this rhythm strip show?

A. Atrial flutter
B. Supraventricular tachycardia (SVT)
C. Multifocal atrial tachycardia (MAT)
D. Ventricular tachycardia (VT)
E. Pacemaker-mediated tachycardia (PMT)

Narrow Complex Tachycardia

- Sinus tachycardia and SVT are both regular.
  - Recall sinus tach is a secondary rhythm.
- Atrial flutter can be regular or irregular.
- MAT is always irregular.
- VT and pacemaker-mediated tachycardia are wide-complex rhythms

5. Which of the following interventions is not appropriate to quickly help define this narrow-complex rhythm?

A. Vagal maneuvers
B. IV adenosine
C. IV digoxin
D. IV β-blocker

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Narrow Complex Tachycardia

- Options to quickly slow AV conduction include:
  - Vagal maneuvers: Valsalva, unilateral carotid massage
  - IV adenosine: 6 mg bolus; follow with 12 mg if ineffective
  - IV β-blocker: metoprolol 5 mg
  - IV diltiazem: 15-30 mg bolus
- Ventricular response in sinus tachycardia and atrial flutter gradually slows; ventricular response in SVT abruptly converts to sinus rhythm.
- Digoxin also slows AV conduction, but because it requires loading over hours, it is not quickly effective.

Supraventricular Tachycardia

SVT is a regular, narrow-complex tachycardia. A vagal maneuver (arrow) results in abrupt termination.

An escape beat is also seen (arrowhead)

SVT: Treatment Options

- Drug therapy for acute treatment
- Electrical cardioversion is appropriate if hypotensive or ongoing chest pain.
- Long-term therapy with digoxin, diltiazem or β-blocker
- Ablation of the arrhythmia is an alternative.

Atrial Flutter

Atrial flutter is a regular or regularly irregular narrow-complex rhythm that is typically rapid. Vagal maneuver (arrow) slows AV conduction and makes the flutter waves more apparent (arrowheads).

The atrial rate is ~300. Conduction is expressed as atrial beats:ventricular beats (e.g., 3:1, 2:1).

Multifocal Atrial Tachycardia

- MAT is an irregular narrow-complex rhythm with 3 or more P waves of variable morphology.
- Most common in patients with lung disease; can occur post-MI or with hypokalemia or hypomagnesemia.
- Rate may be reduced by using IV verapamil.
- Differences from wandering atrial pacemaker (WAP): significantly increased rate and almost invariable association with severe pulmonary disease.

6. For long-term therapy, the most effective control of heart rate in atrial fibrillation, both at rest and with exercise, occurs with which one of the following?

A. Digitalis  
B. Calcium channel blockers  
C. Class 1A antiarrhythmics  
D. β-Blockers
6. For long-term therapy, the most effective control of heart rate in atrial fibrillation, both at rest and with exercise, occurs with which one of the following?

- A. Digitalis
- B. Calcium channel blockers
- C. Class 1A antiarrhythmics
- D. β-Blockers

7. Your patient with atrial fibrillation asks whether he should take warfarin to reduce his risk of stroke. Which of the following is a component of the CHADS₂ score?

- A. Congestive heart failure
- B. Hyperlipidemia
- C. Age > 50
- D. Diabetes for > 10 years
- E. Systolic hypertension

Atrial Fibrillation

- Atrial fibrillation is an irregularly irregular narrow-complex rhythm that may be rapid. The atrial rate is >300 bpm.
- No atrial flutter waves or discrete P waves are noted.

Atrial Fibrillation Therapy

- For long-term therapy, β-blockers provide the most effective control of heart rate in AF, both at rest and during exercise
- CCBs, particularly diltiazem, lower rate at rest and with exercise, but overall are not as effective as β-blockers
- Digitalis more effectively controls rate at rest; it may not control rate with exercise
- Class 1A antiarrhythmics can help maintain sinus rhythm but may increase heart rate

Atrial Fibrillation Therapy

Steps in treatment:
- Control rate
- Select anticoagulation (ASA or warfarin)
- Consider conversion to sinus rhythm
  - Medical/electrical
- If the ventricular rate exceeds 210 bpm, suspect a pre-excitation bypass tract
  - Wolff-Parkinson-White syndrome, involving the bundle of Kent, causing a delta wave

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Atrial Fibrillation: CHADS\textsubscript{2}

- Risk < 2 strokes per 100 patient-years with aspirin: little to gain from warfarin.
- Risk > 4 strokes per 100 patient-years with aspirin: consistent improvement in quality-adjusted survival with warfarin.
- Between these extremes, risk quantification is critical.
- CHADS\textsubscript{2} score relates to non-valvular AF.
- Not considered are: valvular heart disease, prior peripheral embolism, intracardiac thrombus, hyperthyroidism.

**CHADS\textsubscript{2} Score**

- Congestive heart failure = 1 point
- Hypertension = 1 point
- Age > 75 = 1 point
- Diabetes = 1 point
- Prior Stroke or TIA = 2 points

**Score:**

- 0 Low risk; ASA therapy
- 1 Moderate risk; ASA or warfarin therapy
- ≥ 2 Moderate-high risk; warfarin therapy

8. Which one of the following statements concerning sinus node disease is correct?

A. Sinus node disease is most commonly due to left anterior descending coronary artery disease.
B. Sinus node disease may present with episodic sinus arrest.
C. A pacemaker is indicated for all cases of sinus node disease.
D. Sinus node disease is commonly associated with hyperthyroidism.

8. Which one of the following statements concerning sinus node disease is correct?

- 35% A. Sinus node disease is most commonly due to left anterior descending coronary artery disease.
- 40% B. Sinus node disease may present with episodic sinus arrest.
- 8% C. A pacemaker is indicated for all cases of sinus node disease.
- 19% D. Sinus node disease is commonly associated with hyperthyroidism.

Sinus Node Disease

- May present with:
  - Tachy-brady syndrome
  - Persistent sinus bradycardia
  - Persistent sinus tachycardia
  - Episodic sinus arrest
- Most common in patients > 60 years

Sinus Node Disease

- Causes include:
  - Intrinsic aging
  - Superimposed drug effect
  - Right or circumflex coronary artery disease
  - Hypothyroidism
- Pacemaker therapy is indicated only in symptomatic patients.
Question 8 Rhythm Strip

• Sinus arrest due to sinus node disease. Note the lack of a P wave preceding the pause.

• Junctional escape beats may be seen (AV nodal origin; narrow complex; no preceding P wave).

9. Which statement concerning ventricular tachycardia (VT) is correct?

- 9% A. The presence of fusion beats excludes VT
- 28% B. VT is considered sustained if pharmacologic intervention is required to convert the rhythm
- 11% C. Torsades de pointes is typically associated with hypocalcemia
- 61% D. AV dissociation is one feature of VT

Ventricular Tachycardia (VT)

• > 3 beats in a row that originate from the ventricle at a rate of more than 100 bpm
• Self-termination within 30 seconds: non-sustained VT
• Duration > 30 seconds: sustained VT (even if it ultimately self-terminates)
• Signs of VT:
  – AV dissociation
  – Capture beats
  – Fusion beats
  – Concordance

Ventricular Tachycardia (VT)

• Causes:
  – Hypoxia
  – Electrolyte disturbance
  – Ischemia
  – Drug toxicity
  – Heart failure
  – Prolonged QT interval
• Acute therapy:
  – Lidocaine
  – Amiodarone

VT with AV Dissociation

VT with Fusion Beat (2nd) and Capture Beat (4th)
Torsades de Pointes

“Twisting of the points”

- Polymorphic VT, characterized by a cyclical progressive change in cardiac axis.
- Usually nonsustained; may evolve into ventricular fibrillation.
- Associated with hypomagnesemia, hypokalemia and medications or conditions that prolong the QT interval.

References: Arrhythmias