Case 7
Bradycardia

An 87-year-old woman reports feeling weak and short of breath for 2 hours while walking short distances. She feels exhausted moving from the car to the ED stretcher.

On physical exam she is pale and sweaty; HR = 35 bpm; BP = 90/60 mm Hg; RR = 18 rpm. Rhythm: see next slide.

87-Year-Old Woman: Symptomatic Bradycardia

Identify A, B, and C
Which one is most likely to be her rhythm?

A

B

C

She experienced no chest pain or ischemic symptoms prior to the onset of her weakness and shortness of breath. Therefore, the only rhythm not associated with acute pain, rhythm A, is the more likely cause of her symptomatic bradycardia.

Learning Objectives
1. By the end of Case 7 be able to discuss
   • Asymptomatic vs symptomatic bradycardia
   • Signs and symptoms of symptomatic bradycardia
   • Intervention agents and sequences to use
   • Recognition criteria for heart blocks: 1st, 2nd (types I and II), and 3rd degree
   • Pathology of conduction system in heart blocks

2. By the end of Case 7 be able to discuss
   • Significance of bradycardia in AMI patients
   • Significance of RV infarction plus bradycardia
   • Atropine pharmacology: why atropine helps some heart blocks and not others
   • Set up, start, troubleshoot transcutaneous pacing

What is Symptomatic?

Bradycardia is symptomatic when:
• Heart rate is “slow” (absolute or relative)
• Patient has symptoms
• Symptoms are caused by bradycardia

What is Symptomatic?

• Symptoms
  • Chest pain
  • Dyspnea
  • Weakness
  • Altered LOC
What is Symptomatic?

- **Signs**
  - Hypotension
  - Diaphoresis
  - Pulmonary congestion
  - PVCs
  - Unstable angina

- **Key question**
  - Is the bradycardia causing the patient to be ill? OR
  - Is there some illness that is causing the bradycardia?

- If the etiology is AMI:
  - Treat the AMI (MONA)

Key point:
- Treat the patient and NOT the monitor.

Rhythms to Learn

- Sinus bradycardia
- Heart blocks
  - 1st degree
  - 2nd degree type I
  - 2nd degree type II
  - 3rd degree

Drugs to Learn

- Atropine
- Dopamine
- Epinephrine
- Transcutaneous pacing
- Isoproterenol (*rarely used*)

**Remember**

- Atropine – will not work on denervated hearts. Why?
- Epinephrine – must be used with caution with some patients. Why?

Cardiac Conduction System 1

- Bachman's bundle
- AV node
- Right bundle branch
- Left bundle branch
- Purkinje fibers
- Internodal pathways
- Posterior division
- Anterior division

Cardiac Conduction System 2

Relationship of ECG to anatomy
Determining the Rate

Analyzing Rhythm Strips

- Key questions
  - Are QRS complexes present?
  - Are P waves present?
  - How is the P wave related to the QRS complex?

Relationship of P Waves and QRS Complexes

- Every P wave is followed by a QRS complex with a normal P–R interval
- Every P wave is followed by a QRS complex but the P–R interval is prolonged
- Some P waves are not followed by a QRS complex; more P waves than QRS complexes

What Is This Rhythm?

- This is First Degree Block.

AV Block

- First-degree AV block
- Delay

Diagnosis?

- This is Sinus Bradycardia.

Diagnosis?

- This is Second-degree type I AV block. Note the progressive PRI.

AV Block

- Second-degree type I AV block
Diagnosis?

This is Second-degree type II AV block. Note the non-conducting Ps.

AV Block

Second-degree type II AV block

Non-Conducting P waves

Differentiation of Second- and Third-Degree AV Blocks

More P's than QRSs

PR fixed?

no

yes

QRSs that look alike

regular?

no

yes

yes

Second-degree AV block

Fixed

Mobitz II

Third-degree AV block

2nd-degree AV block

Variable

Mobitz I

Wenckebach

Bradycardia Algorithm (1 of 2)

Bradycardia Algorithm (2 of 2)

Intervention sequence

• Atropine
  0.5 to 1.0 mg

• Transcutaneous pacing
  if available

• Dopamine
  5 to 20 µg/kg per minute

• Epinephrine
  2 to 10 µg/min

• Isoproterenol
  2 to 10 µg/min

Serious signs or symptoms?

Due to bradycardia?

Type II second-degree AV block

or

Third-degree AV block?

Observe

• Prepare for transvenous pacer

• If symptoms develop, use transcutaneous pacemaker until transvenous pacer placed

No

Yes

For example:

• 1 mg Epinephrine or Isuprel in 100 ccs NS
  10 µgs / cc or 60 gtts / min
  7.5 µgs = 45 gtts / min
  5 µgs = 30 gtts / min
  2.5 µgs = 15 gtts / min

Remember that Isoproterenol must only be considered if the patient fails to respond to other therapies.

You must exercise extreme caution when using it. Why?

What Is This Rhythm?

This is Third-degree AV block. Supranodal – note the atrial rate is between 48 – 79

AV Block

Third-degree AV block

Consistent P to P interval
What Is This Rhythm?

Treatment?

What Is This Rhythm?

Indications for Transcutaneous Pacing

• Hemodynamically unstable bradycardias
• In the setting of AMI: sinus node dysfunction, type II 2nd-degree block, 3rd-degree heart block
• Bradycardia with symptomatic ventricular escape beats

Indications for Transcutaneous Pacing

• In the presence of escape beats, you must decide
  • if the PVCs are effective contractions
  • Should they be treated with pacing or medications (rate related fix)

Indications for Transcutaneous Pacing

• However, 3rd degree block should NEVER be treated with lidocaine. Why?

Transcutaneous Pacing

Transcutaneous Pacing: “Capture” vs “No Capture”
Rates of Intrinsic Cardiac Pacemakers

- Primary pacemaker
  - Sinus node (60-100 bpm)
- Escape pacemakers
  - AV junction (40-60 bpm)
  - Ventricular (<40 bpm)

Pulse Generators for Transvenous Pacing

- Characteristics
  - Variable output in milliamps
  - Fixed versus demand mode
  - Variable rate setting
  - Firing and sensing indicators
  - Familiarize yourself with the equipment!

Drug Calculation

- Dopamine
  - Add 200 mgs into a 250 cc bag of IV NS
  - Patient weight is 225 lbs.
  - The initial dose would be ____ gts?

Drug Calculation

- Dopamine
  - 200 mgs into a 250 cc bag of IV NS
    - \( \frac{200 \times 1000 \, \mu g}{1000} = 200,000 \, \mu g \)
    - \( \frac{800 \, \mu g}{1 \, cc} \)
    - \( \frac{13.333 \, \mu g}{1 \, gtt} \)
  - Patient weight is 225 lbs.
  - The initial dose would be ____ gts?

Drug Calculation

- So……
  - Patient weight is 225 lbs.
  - \( \frac{225}{2.2 \, lbs} = 100 \, kgs \)
  - \( 100 \, kgs \times 5 \, \mu g/min = 500 \, \mu g/min \)
  - \( \frac{500 \, \mu g}{13.333} = 37.5 \, gtt/min \)

Dopamine - effects

- alpha
  - heart: none
  - arteries: constriction
  - lungs: constriction
- beta
  - heart: > rate
  - arteries: dilation
  - lungs: mild dilation

Cardiac dosage range is 5 \( \mu g \) - 10 \( \mu g/kg/min \)

Infarct Location

- RV
  - Often present with increased parasympathetic tone
  - Look for volume problems with associated hypovolemia

Arrhythmias

Determining the pattern

Escape Patterns
Action Potential of Pacemaker Cell

Second-Degree AV Block Type I