Management of Bradycardia

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Leon M. Ptaszek, M.D., Ph.D., F.A.C.C.
Cardiac Arrhythmia Service
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Objectives

1. Recognize the different mechanisms of bradycardia

2. Evaluate the level of threat to life posed by the different mechanisms

3. Devise a strategy to avoid alarm fatigue based on the mechanism for bradycardia
Management of Bradycardia

- Guideline documents are easily available
- Conceptual framework to help interpret these documents
Available Resources: ACLS

AHA Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care (Circulation, 2005)
Available Resources: Device Implant Guidelines

ACC/AHA/HRS 2008 Guidelines for Device-Based - Journal of the American College of Cardiology
content.onlinejacc.org/article.aspx?articleid=1138927
ACC/AHA/HRS 2008 Guidelines for Device-Based Therapy of Cardiac Rhythm Abnormalities: Title and subtitle break.
A Report of the American College of Cardiology/American Heart Association

Practice Guidelines: Full Text
circ.ahajournals.org/content/117/21/e350.full.pdf

National Guideline Clearinghouse | ACC/AHA/HRS 2008 guidelines
guidelines.gov/content.aspx?id=12590 - Cached
ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities. A report of the American College of Cardiology/American Heart Association

ACC/AHA Joint Guidelines
my.americanheart.org/.../StatementsGuidelines/.../ACCAHA-Joint-Guidelines_UCM_321694_Article.jsp - Cached
ACC/AHA Joint Guidelines. Title, Year Published, Product Information.
Available Resources: Device Implant Guidelines

[Search results for ACC/AHA Guideline Device]

ACC/AHA/HRS 2008 Guidelines for Device-Based - Journal of the American College of Cardiology

Practice Guidelines: Full Text

National Guideline Clearinghouse | ACC/AHA/HRS 2008 guidelines

ACC/AHA Joint Guidelines

ACC/AHA Joint Guidelines
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Objectives

1. Recognize the different mechanisms of bradycardia
   - Relevant anatomy of the cardiac conduction system
   - Procure appropriate history, read ECGs

2. Evaluate the level of threat to life posed by the different mechanisms

3. Devise a strategy to avoid alarm fatigue based on the mechanism for bradycardia
Anatomy of the Cardiac Conduction System

Wang and Estes, Circulation 2002
Anatomy of the Cardiac Conduction System

SAN Disease

AV Nodal Block

Infranodal Block

Less ominous

More ominous

Wang and Estes, Circulation 2002
For instances of bradyarrhythmia due to dysfunction proximal to the AV node: no clear survival advantage, so decision to implant PPM based on symptoms

- Clear role for pacing in symptomatic bradyarrhythmias (class of indication variable)
- PPM not recommended for asymptomatic or minimally symptomatic bradyarrhythmias
Case 1

- 28M admitted due to N/V associated with acute gastroenteritis, poor PO intake and subsequent dehydration. Admit to telemetry unit due to electrolyte abnormalities and low BP at presentation (86/60). No other relevant past medical or family history, no medications. Physical exam does not reveal any concerning abnormalities.
Case 1

Telemetry during a violent bout of vomiting

Baseline

Event
Autonomic Regulation of Heart Rhythm

Wang and Estes, Circulation 2002
Vagus Nerve Inputs

Wang and Estes, Circulation 2002
Vagus Nerve Firing: Slower Rate of SAN, AVN Depolarization

Effects of Parasympathetic (Vagal) and Sympathetic Nerve Activation on AV Nodal Action Potentials
Case 1

Sinus bradycardia  →  sinus pause, slow junctional escape

Baseline

Event

Cause of bradycardia is “external” to the heart
Case 1

Which of the following statements regarding the next step in the management of this patient is correct:

A. Pacemaker implantation
B. Invasive cardiac electrophysiology study
C. Observe
D. Tilt table testing
E. Stress testing to assess chronotropic incompetence
Case 1

- Which of the following statements regarding the next step in the management of this patient is correct:

A. Pacemaker implantation
B. Invasive cardiac electrophysiology study
C. Observe
D. Tilt table testing
E. Stress testing to assess chronotropic incompetence
Other Considerations: Neurocardiogenic Symptoms

- PPM decision driven by whether or not insult can be addressed/treated
  - Carotid hypersensitivity
  - Vasovagal syncope
    (cardioinhibitory vs. vasodepressor)
Case 2

- 54M with several cardiac risk factors admitted after unwitnessed syncopal episode at home. The patient cut himself while shaving his neck, pressed to stop the bleeding, and awoke surrounded by EMS staff. Admitted to telemetry unit, MI ruled out. TTE revealed structurally normal heart, stress test revealed no concerning ECG changes, no perfusion abnormalities.
Case 2

Telemetry during carotid pressure

Dulay et al, Circulation 2008
Case 2

- Which of the following statements regarding the next step in the management of this patient is correct:

A. Pacemaker implantation
B. Invasive cardiac electrophysiology study
C. Observe
D. Tilt table testing
E. Stress testing to assess chronotropic incompetence
Case 2

Which of the following statements regarding the next step in the management of this patient is correct:

A. Pacemaker implantation
B. Invasive cardiac electrophysiology study
C. Observe
D. Tilt table testing
E. Stress testing to assess chronotropic incompetence
Case 2

• While you wait for PPM implant, the patient has additional symptoms associated with bradycardia. Which of the following is the most appropriate next step in the patient’s treatment:

A. Atropine
B. Dopamine
C. Transcutaneous pacing pad placement
D. Temporary pacing wire placement
While you wait for PPM implant, the patient has additional symptoms associated with bradycardia. Which of the following is the most appropriate next step in the patient’s treatment:

A. Atropine
B. Dopamine
C. Transcutaneous pacing pad placement
D. Temporary pacing wire placement
Case 2

What if you saw this tracing in a sleeping patient who has OSA?

Dulay et al, Circulation 2008
Case 2

Treat the sleep apnea!

Dulay et al, Circulation 2008
Case 3

- 43F with no prior history undergoes routine 12-lead ECG prior to scheduled cholecystectomy. She reports no palpitations, presyncopal symptoms, or syncopal events.
Case 3

- Type 2 AV block (Wenckebach)
What is the Level of Block?
What is the Level of Block?

[Diagram of heart with labeled parts: SA node, AV node, Purkinje fibers, Right atrium, His fibers, Left atrium, Right ventricle, Left ventricle]
Case 3

Which of the following statements regarding the next step in the management of this patient is correct:

A. Pacemaker implantation
B. Invasive cardiac electrophysiology study
C. Observe
D. Tilt table testing
E. Stress testing to assess chronotropic incompetence
Case 3

• Which of the following statements regarding the next step in the management of this patient is correct:

A. Pacemaker implantation
B. Invasive cardiac electrophysiology study
C. Observe
D. Tilt table testing
E. Stress testing to assess chronotropic incompetence
Case 4

- 59F with no prior medical history admitted for observation after traumatic leg fracture sustained in MVA (passenger). No concerning exam or laboratory findings. Routine telemetry was performed after surgical repair of her fracture.
Case 4

- Poorly controlled pain related to fracture
- No palpitations/lightheadedness
- Does not endorse prior presyncope/syncope
Case 4

What is the rhythm?
Case 4

Mobitz Type II AV Block

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What is the Level of Block?
What is the Level of Block?

- Below the AV Node:
  - Mobitz Type II
  - Wide QRS complex (RBBB)
Case 4

Which of the following statements regarding the next step in the management of this patient is correct:

A. Pacemaker implantation
B. Invasive cardiac electrophysiology study
C. Observe
D. Tilt table testing
E. Stress testing to assess chronotropic incompetence
Case 4

• Which of the following statements regarding the next step in the management of this patient is correct:

A. Pacemaker implantation
B. Invasive cardiac electrophysiology study
C. Observe
D. Tilt table testing
E. Stress testing to assess chronotropic incompetence
Case 4

While you wait for PPM implant, the patient has additional symptoms associated with bradycardia. Which of the following is the most appropriate next step in the patient’s treatment:

A. Atropine
B. Dopamine
C. Transcutaneous pacing pad placement
D. Temporary pacing wire placement
Case 4

While you wait for PPM implant, the patient has additional symptoms associated with bradycardia. Which of the following is the most appropriate next step in the patient’s treatment:

A. Atropine *
B. Dopamine
C. Transcutaneous pacing pad placement
D. Temporary pacing wire placement

* may not be effective for block below the AV node
Case 5

- 64M with long-standing PAF, resident of MV, admitted with fevers/chills. Lyme titer positive. Admit to SDU, the following 12-lead is obtained at admission. Noted to be lightheaded.
Case 5

What is the rhythm?
Case 5

AF with complete heart block
Case 5

AF with complete heart block

Subsequent telemetry revealed more junctional escape
What is the Level of Block?
What is the Level of Block?

Distal to the AV node
Case 5

• Is temporary pacemaker implant indicated?

  A. Yes
  B. No
Case 5

• Is temporary pacemaker implant indicated?
  A. Yes
  B. No
Case 4

• Now that the temporary pacemaker wire is in place, which of the following statements regarding the next step in the management of this patient is correct:

A. Pacemaker implantation
B. Invasive cardiac electrophysiology study
C. Observe
D. Tilt table testing
E. Stress testing to assess chronotropic incompetence
Case 4

• Now that the temporary pacemaker wire is in place, which of the following statements regarding the next step in the management of this patient is correct:

A. Pacemaker implantation
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C. Observe
D. Tilt table testing
E. Stress testing to assess chronotropic incompetence
Heart Block in the Context of Myocardial Infarction

• Location of the infarct will determine the segment of the conduction system affected

• Requirement for temporary pacing does not constitute an indication for PPM

RCA: SA node, incr. vagal tone (observe)

LCA: infra-His conduction system (pace)
Case 5

- 62M with multiple cardiac risk factors who self-reported to EW after 1 hour of unremitting, substernal chest discomfort that started at rest.
Case 5

- Heart block remained after definitive, successful PCI of culprit lesion in mid-LAD. Which of the following statements regarding the next step in the management of this patient is correct:

  A. Temporary pacemaker wire implant
  B. Invasive cardiac electrophysiology study
  C. Observe
  D. Tilt table testing
  E. Stress testing to assess chronotropic incompetence
Case 5

- Heart block remained after definitive, successful PCI of culprit lesion in mid-LAD. Which of the following statements regarding the next step in the management of this patient is correct:

A. Temporary pacemaker wire implant
B. Invasive cardiac electrophysiology study
C. Observe
D. Tilt table testing
E. Stress testing to assess chronotropic incompetence

* If heart block does not recover, PPM is indicated
AV Block

• Summary of class I indications for pacing:
  
  – 2\textsuperscript{nd} degree AVB: Mobitz II
  
  – 3\textsuperscript{rd} AVB
    
    – Any 2\textsuperscript{nd} degree AVB with associated with symptoms and/or ventricular rate < 40 bpm
    
    – 2\textsuperscript{nd} AVB with pauses > 3 seconds (> 5 for AF)
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Identification of Level of Block

- History
  - Nature of symptoms (vasovagal?)
  - Reversible factors that can cause block (drugs, Lyme)
  - Other heart disease (recent/ongoing MI)

- 12-lead ECG/telemetry
  - Type of block (vagal, 1\textsuperscript{st} AVB, 2\textsuperscript{nd} AVB, 3\textsuperscript{rd} AVB)
  - Distal conduction system disease
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Level of Heart Block will Determine Your Response to Bradycardia

At or above AV node: less ominous
- SAN block
- AVN block (Wenckebach)

Below AV node: more ominous
- Mobitz II block
- Complete heart block
- Wide QRS complex
Don’t Forget the History…

- Always look for reversible factors
  - Triggers of high vagal tone, or symptoms classic for vagal events
  - Drugs (AV nodal blockers, digoxin, anti-arrhythmics)
  - Electrolyte abnormalities
  - Renal failure
  - Infections (endocarditis, Lyme disease)
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   - patient is stable or unstable?
   - plan of action for unstable patient?
Response Determined by Level of Block

- History
  - Identify patients with vagal symptoms
  - Identify and promptly address reversible factors (drugs/toxins, infection)

- 12-lead ECG
  - Identify level of block
  - Consider more lenient management of vagal issues without evidence of distal conduction system disease
  - Careful management of patients with severe bradycardia (HR <30 bpm), distal disease
Thank you!
Device Selection: Single- versus Dual-Chamber

- Ventricular pacing may be sufficient to prevent hemodynamic collapse, but loss of AV synchrony can lead to symptoms, “pacemaker syndrome”
  - Low systemic BP
  - Cannon A waves on exam of JVP

- Purported benefits of AV synchrony have been studied:
  - PASE, NEJM 1997*
  - MOST, NEJM 2002**

* Mortality benefit of dual-chamber pacing
** Sub-study revealed deleterious effects of long-term RV pacing