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Brady Arrhythmias & Pacemakers

Objectives

- How to evaluate bradycardia
- Who needs a pacemaker?
- Special situations NOT covered
 - Acute bradycardia (ACLS)
 - Device therapy for Congestive Heart failure
 - Device indications for CHF are usually independent of heart rate



Normal EKG



EKG boxes

► Heart Rate

- ▶ 1 big box = 200ms
- ▶ 1 small box = 40ms

Big Boxes Between QRS complexes	1	2	3	4	5	6	7
Heart Rate (300/big boxes)	300	150	100	75	60	50	42

1st Degree AV Block



>200 ms from onset of P wave to onset of QRS



2nd Degree AV Block Type 1 - Wenckebach

P-R interval prolongs until QRS is dropped



2nd Degree AV Block Type 1 - Wenckebach



2nd Degree Heart Block Type 2

PR interval remains constant, QRS drops unexpectedly



2nd Degree Heart Block Type 2



2nd Degree Heart Block Type 2



3rd degree Heart Block

- ▶ P rate faster than QRS rate
- No correlation between P's and QRS



Bundle Branch Blocks



Right Bundle Branch Block
 QRS duration >120ms (3 small boxes)

► rsR' in V1

'Rabbit Ears'



Bundle Branch Blocks

Left Bundle Branch Block
 QRS duration >120ms (3 small boxes)
 R in V6









Axis



Left Anterior Fascicular Block

- Frontal Axis -45 to -90 degrees
- ▶ QRS <120ms
- ▶ rS pattern in II, II, aVF (inferior leads)



NSR with 1st AVB, RBBB, LAFB



Left Posterior Fascicular Block

- Frontal Axis +/-120 degrees (typically right axis deviation)
- QRS <120ms</p>
- rS pattern I
- qR pattern in II, II, aV (inferior leads)



Symptoms of Bradycardia/Heart Block

- Chest pain
- Confusion or memory problems
- Dizziness or lightheadedness
- Easily tiring during physical activity
- ► Fatigue
- Fainting (syncope) or near-fainting
- Shortness of breath

https://www.mayoclinic.org/diseases-conditions/bradycardia/symptoms-causes/syc-20355474

Case Presentation

- 50ish year old white female
- No cardiac history
- Admitted 2 weeks ago at outside hospital for syncope
- Watched for 2 days, diagnosed with possible seizures, had "negative" echo
- Recurrent syncope, admitted to KMC

4/21/07 21:30



4/21/07 23:45



Later that night....





A Wo for Br



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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 J Am Coll Cardiol. 2019 Aug 20;74(7):1016-1018]. J Am Coll Cardiol. 2019;74(7):e51-e156. doi:10.1016/j.jacc.2018.10.044

FIGURE 3 Initial Evaluation of Suspected Atrioventricular Block Algorithm

Atrioven



Medications that cause bradycardia/AV Block

TABLE 4 Medications That Can Induce/Exacerbate Bradycardia or Conduction Disorders

Antihypertensive	Antiarrhythmic	Psychoactive	Other	
 Beta-adrenergic receptor blockers (including 	 Adenosine 	Donepezil	 Anesthetic drugs (propofol) 	
beta-adrenergic blocking eye drops used for	 Amiodarone 	■ Lithium	 Cannabis 	
glaucoma)	 Dronedarone 	 Opioid analgesics 	 Digoxin 	
Clonidine	 Flecainide 	Phenothiazine antiemetics and antipsychotics	Ivabradine	
Methyldopa	 Procainamide 	Phenytoin	 Muscle relaxants 	
 Non-dihydropyridine calcium channel blockers 	Propafenone	Selective serotonin reuptake inhibitors	(e.g., succinylcholine)	
 Reserpine 	 Quinidine 	 Tricyclic antidepressants 		
	 Sotalol 			

Intrinsic Causes of Bradycardia/AV Block

- Cardiomyopathy (ischemic or nonischemic)
- Congenital heart disease
- Degenerative fibrosis

- Infection/inflammation
 - Chagas disease
 - Diphtheria
 - Infectious endocarditis
 - Lyme disease
 - Myocarditis
 - Sarcoidosis
 - ► Toxoplasmosis

Intrinsic Causes of Bradycardia/AV Block

- ► Infiltrative disorders
 - Amyloidosis
 - Hemochromatosis
 - Lymphoma
- Ischemia/infarction
- Rheumatological conditions
 - Rheumatoid arthritis
 - Scleroderma
 - Systemic lupus erythematosus

- Surgical or procedural trauma
 - Cardiac procedures such as ablation or cardiac catheterization
 - Congenital heart disease surgery
 - Septal myomectomy for hypertrophic obstructive cardiomyopathy
 - Valve surgery (including percutaneous valve replacement)

Extrinsic Causes of Bradycardia/AV Block

Autonomic

- Carotid sinus hypersensitivity
- Neurally-mediated syncope/presyncope
- Physical conditioning
- Situational syncope
 - Cough
 - Defecation
 - Glottic stimulation
 - Medical procedures
 - Micturition
 - Vomiting
 - Sleep (with or without sleep apnea)

- Metabolic
 - Acidosis
 - Hyperkalemia
 - Hypokalemia
 - Hypothermia
 - Hypothyroidism
 - Hypoxia

A Few Specific Considerations for AV Block

- Sarcoid
- Lyme Disease
- Lupus

- Neuromuscular disorders
 - Myotonic dystrophy
 - ► Kearns-Sayre syndrome
 - Erb's dystrophy
 - Lamin A/C Gene mutation
 - Limb-girdle and Emery-Dreifuss muscular dystrophies

Atrioventricular Block



FIGURE 7 Management of Bradycardia or Pauses Attributable to Chronic Atrioventricular Block Algorithm







Sometimes heart blocks don't easily fit into a defined category...



2:1 AV Block



Inferior/Lateral/Posterior Infarct with 2:1 block



FIGURE 2 Initial Evaluation of Suspected or Documented SND Algorithm





Sinus Node



ent

Colors correspond to Class of Recommendation in Table 2. See Sections 4.3. and 5.5. for discussion. Dashed lines indicate possible optional strategies based on the specific clinical situation. *Symptomatic patients with very infrequent need for pacing for rate support or patients with significant comorbidities, AV indicates atrivoentricular; GDMT, guideline-directed management and therapy; PPM, permanent pacemaker; and RV, right vertricular.

Sinus Node Dysfunction Case While Sleeping....

- 30 YOM admitted with alcohol withdrawal
- No Cardiac History
- No Symptoms
- Echo unremarkable





Case Malignant syncope

- ▶ 63 yo M with HTN, HLP
- 2 episodes of syncope at home, no prodrome
- ▶ 3rd episode witnessed in ER





Another case...

75 year old male admitted with syncope
No significant past medical history or medications
Nothing on telemetry overnight...

$NSR \rightarrow 20$ second asystole



Atrial fibrillation \rightarrow Asystole



Case Sinus Node Dysfunction

▶ 79 yo F

100 75 50

25

- History of Atrial Fibrillation with RVR
- Amiodarone 200mg po daily
- Atenolol 25mg po daily

1.2

 Symptoms of fatigue, dyspnea, exercise intolerance

- Holter monitor
 - Sinus rhythm, no afib
 - HR 35-102 (average 45bpm)





AV Dual Chamber Pacing



Pacemaker Nomenclature

Common Modes

- VVI Single chamber (ventricle)
- DDD Dual chamber
- AAI (uncommon) Single chamber (atrium)
- 1st Letter is chamber PACED
- 2nd Letter is chamber SENSED
- ► 3rd Letter is response
 - ► I = Inhibit
 - T = Triggered (Unusual)
 - D = Dual (Inhibit or Pace)
- 4th Letter R = Rate responsive

Pacemaker In most cases...

- Permanent atrial fibrillation = Single chamber VVI ventricular pacemaker
- Otherwise = Dual chamber DDDR pacemaker
- ▶ If EF <35%
 - ► Consider defibrillator
- ▶ If EF <35% and Left Bundle Branch Block
 - Consider defibrillator + "LV" lead (Bi-Ventricular ICD)

Why Do We Do Pacemakers?

- Symptomatic Bradycardia!
- 3rd degree heart block
- 2nd degree heart block (Mobitz type 2)
- Sick sinus syndrome
- Tachy-Brady syndrome
- Chronotropic Incompetence

2018 Pacemaker Guidelines Selected Take Home Points

- Sinus node dysfunction is most often related to age-dependent progressive fibrosis of the sinus nodal tissue and surrounding atrial myocardium leading to abnormalities of sinus node and atrial impulse formation and propagation and will therefore result in various bradycardic or pause-related syndromes.
- Both sleep disorders of breathing and nocturnal bradycardias are relatively common, and treatment of sleep apnea not only reduces the frequency of these arrhythmias but also may offer cardiovascular benefits. The presence of nocturnal bradycardias should prompt consideration for screening for sleep apnea, beginning with solicitation of suspicious symptoms. However, <u>nocturnal</u> <u>bradycardia is not in itself an indication for permanent pacing</u>.

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 J Am Coll Cardiol. 2019 Aug 20;74(7):1016-1018]. J Am Coll Cardiol. 2019;74(7):e51-e156. doi:10.1016/j.jacc.2018.10.044

2018 Pacemaker Guidelines Selected Take Home Points

- In sinus node dysfunction, there is no established minimum heart rate or pause duration where permanent pacing is recommended. Establishing temporal correlation between symptoms and bradycardia is important when determining whether permanent pacing is needed.
- In patients with acquired second-degree Mobitz type II atrioventricular block, high-grade atrioventricular block, or third-degree atrioventricular block not caused by reversible or physiologic causes, permanent pacing is recommended regardless of symptoms. For all other types of atrioventricular block, in the absence of conditions associated with progressive atrioventricular conduction abnormalities, permanent pacing should generally be considered only in the presence of symptoms that correlate with atrioventricular block

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Board Pearls for Heart Block

Think of potential causes of heart block ► Lyme disease ► Sarcoidosis ► Lupus Drug overdose Hyperkalemia ► Hypothyroidism

References

- 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 J Am Coll Cardiol. 2019 Aug 20;74(7):1016-1018]. J Am Coll Cardiol. 2019;74(7):e51-e156. doi:10.1016/j.jacc.2018.10.044
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