TREATMENT IN BRADYCARDIA
DEFINITION OF BRADYCARDIA

• 12- LEAD ECG
• 24-hour ambulatory monitoring
DEFINITION OF BRADYCARDIA

12- LEAD ECG
• 0-3 years: <100 bpm
• 3-9 years: <60 bpm.
• 9-16 years: <50 bpm
DEFINITION OF BRADYCARDIA

24-hour ambulatory monitoring
• 0-2 years : <60 bpm/asleep <80 bpm/ awake
• 2-6 : <60 bpm.
• 6-11: <45 bpm
• >11: <40 bpm
• > 11 years who are well-trained athletes: <30 bpm
MECHANISMS OF BRADYCARDIA

• Sinus bradycardia
• AV node or the bundle of His block
## CAUSES

### Intrinsic causes

- Cardiomyopathy
- Familial
- Inflammatory
  - Myocarditis
  - Pericarditis
- Collagen vascular disease
  - Systemic lupus erythematosus
- Congenital Heart Disease
  - Atrial septal defect
  - Atrioventricular canal
  - Long QT syndrome
  - Pulmonary stenosis
  - Ventricular septal defect
  - Transposition of the great arteries
  - Wolff Parkinson White syndrome
- Myocardial ischemia or infarction
- **Surgical trauma**
  - Atrial operations
## CAUSES

**Extrinsic causes**

<table>
<thead>
<tr>
<th>Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antiarrhythmic agents</td>
</tr>
</tbody>
</table>

**Beta-adrenergic blockers**

- Calcium-channel blockers
- Clonidine
- Digoxin

**Hypothermia**

- Hyperventilation
  - Breath-holding spells

- Coughing

- Esophageal or nasopharyngeal stimulation

- Increased intracranial pressure

**Medications**

- Edrophonium, physostigmine, bethanechol, neostigmine, acetylcholine, hyoscyamine, phenylephrine, methoxamine, morphine

**Neurocardiac syncope**

**Sleep**
CLINICAL PRESENTATIONS

• Asymptomatic
• Dizziness
• Syncope
• Exercise intolerance
• Poor systemic perfusion or shock
• Cardio-respiratory arrest
• Sudden death
Treatment

ASYMTOMATIC

TREAT CAUSES

SYMTOMATIC

SEVERE

NOT SEVERE

PACEMARKERS

TREAT CAUSES
Treatment - Severe Bradycardia

Pediatric bradycardia algorithm (with a pulse and poor perfusion): 2010 PALS guidelines

1. Identify and treat underlying cause
   - Maintain patent airway; assist breathing as necessary
   - Oxygen
   - Cardiac monitor to identify rhythm; monitor blood pressure and oximetry
   - IO/IV access
   - 12-lead ECG if available; don’t delay therapy

2. Cardiopulmonary compromise continues?
   - No
   - Support ABC’s
     - Give oxygen
     - Observe
     - Consider expert consultation

3. CPR if HR < 60/min with poor perfusion despite oxygenation and ventilation
   - Yes

4. Bradycardia persists?
   - Yes
   - Epinephrine
   - Atropine for increased vagal tone or primary AV block
   - Consider transthoracic pacing/ transvenous pacing
   - Treat underlying causes

5. If pulseless arrest develops, go to “Pediatric cardiac arrest algorithm”
AHA Practice Guideline

ACC/AHA/HRS 2008 Guidelines for Device-Based Therapy of Cardiac Rhythm Abnormalities

### Size of Treatment Effect

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Class I</strong></td>
<td>Benefit &gt;&gt; Risk</td>
</tr>
<tr>
<td>Procedure/Treatment SHOULD be performed/administered</td>
<td></td>
</tr>
<tr>
<td><strong>Class IIa</strong></td>
<td>Benefit &gt;&gt; Risk</td>
</tr>
<tr>
<td>Additional studies with focused objectives needed</td>
<td></td>
</tr>
<tr>
<td>IT IS REASONABLE to perform procedure/administer treatment</td>
<td></td>
</tr>
<tr>
<td><strong>Class IIb</strong></td>
<td>Benefit ≥ Risk</td>
</tr>
<tr>
<td>Procedure/Treatment MAY BE CONSIDERED</td>
<td></td>
</tr>
<tr>
<td><strong>Class III</strong></td>
<td>Risk ≥ Benefit</td>
</tr>
</tbody>
</table>

### Estimate of Certainty (Precision) of Treatment Effect

<table>
<thead>
<tr>
<th>Level A</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple populations evaluated*</td>
<td></td>
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<tr>
<td>Data derived from multiple randomized clinical trials or meta-analyses</td>
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</tr>
<tr>
<td><strong>Level B</strong></td>
<td>Description</td>
</tr>
<tr>
<td>Limited populations evaluated*</td>
<td></td>
</tr>
<tr>
<td>Data derived from a single randomized trial or nonrandomized studies</td>
<td></td>
</tr>
<tr>
<td><strong>Level C</strong></td>
<td>Description</td>
</tr>
<tr>
<td>Very limited populations evaluated*</td>
<td></td>
</tr>
<tr>
<td>Only consensus opinion of experts, case studies, or standard of care</td>
<td></td>
</tr>
</tbody>
</table>

- Recommendation that procedure or treatment is useful/effective |
- Sufficient evidence from multiple randomized trials or meta-analyses |
- Recommendation in favor of treatment or procedure being useful/effective |
- Some conflicting evidence from multiple randomized trials or meta-analyses |
- Recommendation’s usefulness/efficacy less well established |
- Greater conflicting evidence from multiple randomized trials or meta-analyses |

- Recommendation that procedure or treatment is useful/effective |
- Evidence from single randomized trial or nonrandomized studies |
- Recommendation in favor of treatment or procedure being useful/effective |
- Some conflicting evidence from single randomized trial or nonrandomized studies |
- Recommendation’s usefulness/efficacy less well established |
- Greater conflicting evidence from single randomized trial or nonrandomized studies |

- Recommendation that procedure or treatment is useful/effective |
- Only expert opinion, case studies, or standard of care |
- Recommendation in favor of treatment or procedure being useful/effective |
- Only diverging expert opinion, case studies, or standard of care |
- Recommendation’s usefulness/efficacy less well established |
- Only diverging expert opinion, case studies, or standard of care |

- Recommendation that procedure or treatment is not useful/effective and may be harmful |
- Sufficient evidence from multiple randomized trials or meta-analyses |

- Recommendation that procedure or treatment is not useful/effective and may be harmful |
- Evidence from single randomized trial or nonrandomized studies |

- Recommendation that procedure or treatment is not useful/effective and may be harmful |
- Only expert opinion, case studies, or standard of care |
TREATMENT- NOT SEVERE

- SINUS BRADYCARDIA
- AV BLOCK
TREATMENT- NOT SEVERE SINUS BRADYCARDIA

- Causes:
  - Sick sinus syndrome
  - Exaggerated vagal activity
  - Increased intracranial pressure
  - Acute myocardial infarction
  - Obstructive sleep apnea
  - Drugs
    - Atropine in acute myocardial infarction
    - Chronic medical therapy for symptomatic sinus bradycardia is usually not effective
    - Pacemaker
Pacing in SINUS BRADYCARDIA

• **Class I:**
  – Sinus node dysfunction with correlation of symptoms during age-inappropriate bradycardia (Level of Evidence B)

• **Class Ila:**
  – Sinus bradycardia for the prevention of recurrent episodes of intra-atrial reentrant tachycardia; SND may be intrinsic or secondary to antiarrhythmic treatment. (Level of Evidence: C)
  – Sinus bradycardia with complex congenital heart disease with a resting heart rate less than 40 bpm or pauses in ventricular rate lasting longer than three seconds, Impaired hemodynamics due to sinus bradycardia (Level of Evidence: C)
AV BLOCK

• First-degree AV block does **not** cause bradycardia
• Second-degree AV block Mobitz 1: asymptomatic, not progress to complete block
• Second-degree AV block Mobitz 2: frequently progresses to complete heart block
• Advanced second-degree AV block: two consecutive P waves present that should but fail to conduct to the ventricle
• Third-degree AV block
TREATMENT NOT SEVERE AV BLOCK

CAUSES

• Congenital complete heart block
  – Neonatal lupus
  – Structural cardiac defects
    • Corrected transposition of the great arteries
    • Polysplenia with atrioventricular canal defect

• Acquired complete heart block
  – Myocarditis
  – Acute rheumatic disease
  – Myocardial infarction
  – Trauma
  – Injury from surgery or catheterization
  – Cardiomyopathy
Pacing in AV block

- **Class I**
  - Third and advanced second-degree AV heart block that is associated with symptomatic bradycardia, ventricular dysfunction, or low cardiac output (Level of Evidence C)
  - Children who have third or advanced second-degree AV heart block after cardiac surgery that is not expected to resolve or that persists **seven days** after surgery (Level of Evidence B)
  - Congenital third-degree AV block with a wide QRS escape rhythm, complex ventricular ectopy, or ventricular dysfunction. (Level of Evidence B)
  - Congenital third-degree AV block in the infant with a ventricular rate less than 55 bpm or with congenital heart disease and a ventricular rate less than 70 bpm. (Level of Evidence C)

- **Class IIa**
  - Congenital third-degree AV block beyond the first year of life with an average heart rate less than 50 bpm, abrupt pauses in ventricular rate that are two or three times the basic cycle length, or symptoms due to chronotropic incompetence. (Level of Evidence: B)
  - Unexplained syncope in the patient with prior congenital heart surgery complicated by transient complete heart block with residual fascicular block after a careful evaluation to exclude other causes of syncope. (Level of Evidence: B)
BRADYCARDIA IN FETUS
DEFINITION

• Normal: 110 to 180 bpm
• Bradycardia: < 110 bpm ->10 m
• Distinguished from fetal heart rate changes in response to hypoxia
DIAGNOSIS

• Two-dimensional ultrasound
  – M–mode
  – Doppler
  → Evaluation of AV Relationship and Atrial/ventricular Rate
Normal M Mode
1:1 AV Conduction
M-Mode

M Mode
Complete AV Block
Figure 3: Pulsed Doppler of the mechanical PR interval
FETUS BRADYCARDIA

A-V RATE

1:1

• Sinus bradycardia
• Sinus node dysfunction
• Atrial Bradycardia

≠ 1:1

• Blocked atrial bigeminy
• AV block
  • structural heart disease
  • immune-mediated
Sinus bradycardia in fetus

- Causes *(100 to 110 bpm)*
  - Fetal distress
  - Structural cardiac anomalies: heterotaxy
  - Long Q-T syndrome
  - Maternal hypothyroidism
  - Fetal CNS abnormalities
  - Maternal medications or illness
  - Familial sinus bradycardia
Sinus bradycardia in fetus

• Treatment
  – Cause
  – Weekly obstetrical follow-up
AV BLOCK in fetus

- **CAUSE (<60 bpm or 60 and 80 bpm )**
  - L-transposition of the great arteries
  - Polysplenia
  - Maternal lupus autoantibodies
    - 2-18% AVB
TREATMENT AV block in fetus

Due to the low incidence of complete AV block in the general population, studies are mainly observational, retrospective and involve small cohorts of patients.
AV BLOCK / FETUS

Maternal SSA/Ro and SSB/La antibody titers
Structure of heart

Normal Structure of heart and SSA/Ro SSB/La (+)

1-2^0
Dexamethasone

3^0
Dexamethasone

FHR<55/ fetal hydrops

Sabutamol +/- IvIg

No FHR<55/ fetal hydrops

Follow

Abnormal Structure of heart

Follow