AV Blocks
Artificial Pacemakers
AV Blocks

- Disorders of conduction at AV Junction
- Categories
  - First degree (1° AV Block)
  - Second degree (2° AV Block)
    - Type I
    - Type II
  - Third degree (3° AV Block or Complete AV Block)
Analyze the Rhythm
AV Blocks

- First Degree
  - Prolonged AV conduction time
  - PR interval > 0.20 seconds
  - Characteristics of that of any other rhythm with a SINGLE sinus or atrial pacemaker site
  - Associated with an underlying sinus or atrial rhythm!!!
SR with 1st° AV Block
AV Blocks

- **First Degree**
  
  - **Causes**
    - AV node ischemia/hypoxia
    - Increased vagal or decreased sympathetic tone
  
  - **Drug effects**
    - Digitalis
    - Beta blockers
    - Calcium channel blockers
    - Quinidine
    - Pronestyl
AV Blocks

- **First Degree**
  - **Management**
    - Usually requires no specific treatment
    - Treat the patient!!!
    - Monitor for progression to higher degree block
AV Blocks

- **Second Degree**
  - **Definition**
    - More Ps than QRSs
    - Every QRS caused by a P
  - The pattern determines the type of 2° AV block
  - Since requires presence of P waves, it also requires an underlying sinus or atrial rhythm
SR with 2nd° Type 1 AV Block
AV Blocks

- Second Degree
  - Types
    - Type I
      - Variable
      - Wenckebach phenomenon
    - Type II
      - Mobitz II
      - Fixed
      - Classic
Analyze the Rhythm
AV Blocks

- **Second Degree**
  - **Type I**
    - **Definition**
      - PR interval lengthens
      - Beat drops
    - **Pathophysiology**
      - Usually physiologic
      - Increased vagal tone (Acute inferior MI, RVI)
      - Drug effects (digitalis, beta blockers, CCBs)
      - Frequently resolves
AV Blocks

- Second Degree
  - Type I
  - Good prognosis
  - Specific therapy usually not necessary
    - therapy, if indicated, most likely targeted towards bradycardia
  - Treat the patient!!!
Analyze the Rhythm
AV Blocks

- **Second Degree**
  - **Type II**
    - **Definition**
      - P waves fail to conduct without warning
      - PR interval does not lengthen
    - **Characteristics**
      - Atrial rate > Ventricular rate
      - QRS usually longer than 0.12 sec
      - Usually 4:3 or 3:2 conduction ratio (P:QRS ratio)
SR with 2nd° Type 2 AV Block
AV Blocks

- **Second Degree**
  - **Type II**
  - **Pathophysiology**
    - Organic lesions in bundle branches
      - Usually occurs below bundle of His in the bundle branches (infranodal AV block)
      - Intermittent block of conduction through one bundle and complete block in other
    - Usually caused by Acute anterior or anteroseptal MI
AV Blocks

- **Second Degree**
  - **Type II**
    - **Outlook**
      - Usually associated with anterior or anteroseptal MI
      - Frequent progression to complete AV block
    - **Requires pacemaker**
    - Worsened by digitalis, procainamide, lidocaine, propranolol, TCAs
Analyze the Rhythm
AV Blocks

- **Complete**
  - Definition
    - No conduction through AV node
    - Independent atrial and ventricular rhythms
    - Ventricular depolarization dependent on automaticity of ventricular pacemaker sites
  - Pathophysiology
    - AV node hypoxia/ischemia
    - Myocardial infarction
    - Increased vagal or decreased sympathetic tone
AV Blocks

- Complete
  - Characteristics
    - Atrioventricular dissociation
    - Regular P-P and R-R but without association between the two
    - Atrial rate > Ventricular rate
    - QRS > 0.12 sec
AV Blocks

- Complete
  - Outlook
    - Junctional escape rhythm: good
    - Ventricular escape rhythm: worrisome
  - Warning
    - Do NOT give lidocaine or other ventricular antidysrhythmics!!!
SR with 3rd° AV Block
SR with 3rd° AV Block
AV Blocks

Management

- Treatment based on Sx/Sx
  - Most common complication = Bradycardia
    - IV/O₂/ECG Monitor/12 lead ECG
    - Atropine (not useful in 2° Type II or 3° AV Block)
    - TCP (bridge to transvenous pacer)
    - Catecholamine drip
  - Prophylactic pacer application (standby)
    - 2° Type II AV block
    - 3° AV Block
Analyze the Rhythm
Cardiac Pacemakers

- **Definition**
  - Delivers artificial stimulus to heart
  - Causes depolarization and contraction

- **Uses**
  - Bradyarrhythmias
  - Asystole
  - Tachyarrhythmias (overdrive pacing)
Cardiac Pacemakers

- **Types**
  - **Fixed**
    - Fires at constant rate
    - Can discharge on T-wave
    - Very rare
  - **Demand**
    - Senses patient’s rhythm
    - Fires only if no activity sensed after preset interval (escape interval)

- Transcutaneous vs Transvenous vs Implanted
Cardiac Pacemakers
Cardiac Pacemakers

- **Demand Pacemaker Types**
  - Ventricular
    - Fires ventricles
  - Atrial
    - Fires atria
    - Atria fire ventricles
    - Requires intact AV conduction
Cardiac Pacemakers

- **Demand Pacemaker Types**
  - **Atrial Synchronous**
    - Senses atria
    - Fires ventricles
  - **AV Sequential**
    - Two electrodes
    - Fires atria/ventricles in sequence
Cardiac Pacemakers

- **Problems**
  - **Failure to capture**
    - No response to pacemaker artifact
    - Bradycardia may result
    - Cause: high “threshold”
  - **Management**
    - Increase amps on temporary pacemaker
    - Treat as symptomatic bradycardia
Cardiac Pacemakers

- Problems
  - Failure to sense
    - Spike follows QRS within escape interval
    - May cause R-on-T phenomenon
  - Management
    - Increase sensitivity
    - Attempt to override permanent pacer with temporary
    - Be prepared to manage VF
Cardiac Pacemakers

- **Problems**
  - Inappropriate absence of pacer artifact
    - **Causes**
      - Depleted battery
      - Circuit malfunction
      - Oversense
    - **Management**
      - Decrease sensitivity
      - Treat bradycardia
      - Replace pacemaker
Cardiac Pacemakers

- Problems
  - Runaway pacemaker
    - Rates of up to 400/minute
    - Increasing rate = Emergency
  - Causes
    - Component failure
    - Battery depletion
- Management
  - Transport
  - Enter site surgically, cut lead
  - Some may be turned “off” by donut-shaped magnet
Cardiac Pacemakers

- Special Considerations
  - Pacemaker does NOT affect treatment of cardiac arrest
  - Do NOT fire defibrillator directly over pacemaker generator
  - Pacemakers may keep AEDs from advising shock
Cardiac Pacemakers

- Transcutaneous Pacing
  - Electrical vs Mechanical capture
  - Tips for improving electrical capture
    - Ensure adequate conductance
    - Increase current (mA)
  - Tips for improving mechanical capture
    - Ensure the “tank” is topped off
    - Increase the electrical rate
    - Increase peripheral vascular resistance
You can’t create mechanical capture in dead muscle!

It is much easier to increase the electrical rate of depolarization than it is to increase the mechanical rate of contraction!
Implanted Defibrillators

- **AICD**
  - Automated Implantable Cardio-Defibrillator

- **Uses**
  - Tachyarrhythmias
  - Malignant arrhythmias
    - VT
    - VF
Implanted Defibrillators

- Programmed at insertion to deliver predetermined therapies with a set order and number of therapies including:
  - pacing
  - overdrive pacing
  - cardioversion with increasing energies
  - defibrillation with increasing energies
  - standby mode

- Effect of standby mode on Paramedic treatments
Implanted Defibrillators

- **Potential Complications**
  - Fails to deliver therapies as intended
    - worst complication
    - requires Paramedic intervention
  - Delivers therapies when NOT appropriate
    - broken or malfunctioning lead
    - parameters for delivery are not specific enough
  - Continues to deliver shocks
    - parameters for delivery are not specific enough and device senses a reset
    - may be shut off (not standby mode) with donut-magnet
Questions?