Objectives

- Hospital policies
- Electrical conduction pathway
- How to interpret a rhythm strip
- Sinus and atrial dysrhythmias
- Junctional and ventricular dysrhythmias
- Paced rhythms
- Medications and treatment
- Common mistakes
- Questions???
Hospital Policies for Telemetry Patients

• Record EKG strips every 4 hours
• Patient is always on a cardiac monitor, even if off the unit
• All EKG changes need to be:
  • Recorded
  • MD notified
  • For better or for worse!
Bedside Telemetry

• Look at the patient- are they perfusing?
  • Level of consciousness
  • Vital signs
  • Skin signs

• Look at the rhythm
  • Regular or irregular
  • Are there P waves present
  • Narrow or wide
  • Fast or slow
Electrical Conduction Pathway

- SA node: 60-100 BPM
- AV node: 40-60 BPM
- Ventricles: 20-40 BPM
Autonomic Nervous System

FIGHT OR FLIGHT

REST AND DIGEST
Willem Einthoven (1860–1927)

- Dutch doctor and physiologist
- Invented the first practical electrocardiogram (EKG or ECG) in 1903
- Assigned the letters P, Q, R, S and T to the various deflections still used today
- The term "Einthoven's triangle" is named for him. It refers to the imaginary inverted equilateral triangle
Einthoven’s Triangle

**Limb leads:** positive and negative electrodes. (bipolar)
- Leads I, II, III

**Augmented leads:** only positive electrodes (unipolar)
- Leads aVR, aVL, aVF

*Heart is the zero reference point or central terminal*
How to Read a Rhythm Strip

• The conduction of an electrical impulse for a single heart beat normally contains five major waves: P, Q, R, S, AND T
• A cardiac cycle is measured from the beginning of one P wave to the beginning of the next P wave
Measuring Intervals

- PRI: 0.12 to 0.20 sec
- QRS: < 0.12 sec
- QT: < ½ of R to R interval
Interpreting a Rhythm Strip

1.) *P waves* - examine each P wave
   - Are there P waves present? Are they all upright?
   - Do all P waves look alike?
   - Is there a P wave before every QRS complex?
   - Are the P to P intervals equal?

2.) *PR intervals* - measure each PRI
   - Are PRI’s present? If so, are they equal?
   - Are all PRI’s within the normal range of 0.12 to 0.20

3.) *QRS complexes* - examine and measure each complex
   - Are all QRS complexes present? Do they look alike?
   - Is there a QRS complex after every P wave?
   - Are the R to R intervals equal?
   - Are all QRS complexes within the normal range of <0.12 sec?
• Does QT=QTc?

• Why do we care?

• Drugs can change the interval.
• How is the quality of the strip? Is there artifact?
• Does it look regular? If not sure, use calipers or paper to measure.
• Are there P waves, PRI’s, QRS complexes? Are they WNL?
More Practice...

Artifact and wandering baselines
Normal Sinus Rhythm

Characteristics of normal sinus rhythm

- Rate: 60 to 100 beats per minute
- Rhythm: regular
- P wave: normal
- PR interval: 0.12 to 0.2 second
- QRS complex: ≤ 0.1 second

• What is the atrial rate? Ventricular rate?
Sinus Bradycardia

Less than 60 BPM

- What is the atrial rate? Ventricular rate?
- Are there P waves present? Does a QRS complex follow every P wave?
- Is SB ever a normal finding?
- What are signs of poor cardiac output?
- What are some causes of SB?
Sinus Tachycardia

101 to 150 BPM

- What is the atrial rate? Ventricular rate?
- Are there P waves present? Does a QRS complex follow every P wave?
- Is ST ever a normal finding?
Sinus Arrhythmia

Regularly Irregular

- What is the atrial rate? Ventricular rate?
- Are there P waves present? Does a QRS complex follow every P wave?
- Is this a normal finding?
Atrial Dysrhythmias

• Most atrial dysrhythmias are not lethal but some may require intervention.

• Patient assessment is necessary to determine tolerance of the dysrhythmia.
Premature Atrial Contraction (PAC)

- PAC’s originate from any atrial site outside of the SA node

**NOTE:** Although the term contraction is used with PAC, this complex represents electrical activity and may not reflect an actual contraction.
Supraventricular Tachycardia (SVT)

Greater than 150 BPM

- Can you identify P waves?
- Are the intervals WNL?
- What interventions or treatments might be implemented?
Atrial Flutter

“Saw-toothed” waves

- Flutter waves have a typical “saw-toothed” appearance
- Ventricular rate is typically 60-100 BPM
- Atrial rate usually ranges from 250-350 impulses per minute
- Loss of atrial kick
Atrial Fibrillation

- No identifiable P waves or PRI’s
- The atrial heart rate is typically 350-500
- Loss of atrial kick - no forceful contraction of atria

*Irregularly Irregular*
• 40 to 60 impulses/minute
• Characteristic P wave changes
Junctional Dysrhythmias

<table>
<thead>
<tr>
<th>P Wave Location</th>
<th>QRS morphology</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;High&quot; nodal</td>
<td>precedes QRS</td>
<td>normal</td>
</tr>
<tr>
<td>&quot;Mid&quot; nodal</td>
<td>no P wave seen</td>
<td>normal</td>
</tr>
<tr>
<td>&quot;Low&quot; nodal</td>
<td>follows QRS</td>
<td>normal</td>
</tr>
</tbody>
</table>

P wave Characteristics: inverted, buried, and retrograde
Junctional Bradycardia and Accelerated Junctional
Four Types of AV-block
(PQ interval > 0.2 s)

First - degree 1:1 AV-block

Second - degree AV-block

Wenchebach block (type I)

Second - degree AV-block

Mobitz II block (no warning)

Third - degree AV-block

Complete AV-block (Adam Stokes disease in AV or His-bundle)

Fig. 11-12
First-Degree Heart Block

A-V BLOCK, FIRST DEGREE
Atrioventricular conduction lengthened

P-wave precedes each QRS-complex but interval is > 0.2 s

PR interval > 0.20 seconds

* Not a true block, but a delay in the electrical conduction
Second-Degree Heart Blocks

• Two types of 2\textsuperscript{nd} degree heart blocks: type I and type II

• Interruption in the conduction of an electrical impulse through AV Junction
Second-Degree Heart Block, Type I

Second-Degree AV Block

Type I (Mobitz I or Wenckebach)
- P-R intervals become progressively longer until one P wave is totally blocked and produces no QRS. After a pause, during which the AV node recovers, this cycle is repeated.

Rate: Depends on rate of underlying rhythm
Rhythm: Irregular
P Waves: Normal (upright and uniform)
PR Interval: Progressively longer until one P wave is blocked and a QRS is dropped
QRS: Normal (0.06–0.10 sec)

Clinical Tip: This rhythm may be caused by medication such as beta blockers, digoxin, and calcium channel blockers. Ischemia involving the right coronary artery is another cause.
Second-Degree Heart Block, Type II

- Intermittent interruption
- Not a progressive block
- PRI’s are constant
Third-Degree Heart Block

- **Lethal dysrhythmia!!!**
- Complete dissociation, atria and ventricles function independently
- Atrial rate is usually between 60-100, ventricular rate is 20-40

Treatment???
Bundle Branch Block

Right bundle branch block characteristics

V1  V6
rSR' qRs

Left bundle branch block characteristics

V1  V6
rS  R
Bundle Branch Blocks

- QRS > 0.12
- Assess V1 for QRS morphology
- Patients with a prolonged QRS (> 0.15) may require a pacemaker
Practice with Heart Blocks

[ECG images]
Ventricular Dysrhythmias

- QRS > 0.12
- Wide and Bizarre
- Hidden P waves
- 20-40 BPM
Premature Ventricular Contraction (PVC)
Premature Ventricular Contraction (PVC)

- Patient Assessment?
- Treatment?
Ventricular Tachycardia

• Life-threatening dysrhythmia!
• Wide and bizarre
• Rate of 101-250 impulses/min
• Pulses vs. pulseless
Torsades De Pointes

- Lethal dysrhythmia!
- Wide and bizarre
- Often > 150 impulses/min
- Pulses vs. pulseless
Ventricular Fibrillation

- Pulseless!!! Lethal dysrhythmia
Idioventricular/Agonal Dysrhythmia

• Lethal! Last attempt!
Asystole

- Lethal!
- Immediate Treatment Required!
Name this rhythm
PEA

• Pulseless electrical activity
  • Can be ANY electrical rhythm
Pacemakers!
Pacemaker Terminology

• **Fixed**- set to generate impulses at a constant rate, usually 60-80/ min

• **Demand**- set to generate electrical impulses only when the patient’s heart rate falls below a predetermined rate, usually <70 BPM

• **Capture**- the cardiac cell’s ability to depolarize in response to the electrical impulse generated by a mechanical pacemaker

• **Sensing**- the ability of the pacemaker to detect an intrinsic depolarization
Sensing

Factors That May Affect Sensing Are:

• Lead polarity (unipolar vs. bipolar)
• Lead integrity
  • Insulation break
  • Wire fracture
• EMI – Electromagnetic Interference
  – MRI machines
Under-sensing . . .

- Pacemaker does not “see” the intrinsic beat, and therefore does not respond appropriately.
Over-sensing...

- An electrical signal other than the intended P or R wave is detected.

Marker channel shows intrinsic activity... though no activity is present.
Interpretation
More Interpretation...

What’s happening in this strip?
More Rhythms...
More Practice...
And Even More Practice...
Looks Like...

• ST vs A-flutter (2:1)
• LBBB vs STEMI
• SVT vs A-fib
• Pericarditis vs STEMI
• V-fib vs broken wire
• Junctional vs a-fib (slow)
• Evaluate P waves
• Measure PR intervals
• Evaluate the QRS complexes, including shape and size
• Identify any abnormalities in the ST segments, T waves, and QT intervals
• Count both the atrial and ventricular rates
• Look for unusual markings, such as pacer spikes
Common Causes: H’s and T’s

• The H’s include:
  Hypovolemia, Hypoxia, Hydrogen ion (acidosis), Hyper-/hypokalemia (check K and Mg levels, Hypothermia

• The T’s include:
  Toxins, Tamponade (cardiac), Tension pneumothorax, Thrombosis (coronary and pulmonary), Trauma
Putting It All Together

• Always *assess* your patient first!
• Determine the situation
• Investigate the cause
• Intervene/Treatment
• Reassess
Questions???
Rhythm Interpretation

MEASURE:  PR interval __________________________ Rhythm___________________
          QRS complex ________________________ Heart rate_________________

INTERPRETATION: ________________________________________________________

MEASURE:  PR interval __________________________ Rhythm___________________
          QRS complex ________________________ Heart
          rate_________________

INTERPRETATION: ________________________________________________________
Rhythm Interpretation

MEASURE: PR interval __________________________ Rhythm___________________
QRS complex ________________________ Heart
gate_________________
INTERPRETATION: ________________________________________________________

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Sgarbossa Criteria

**Discordance**: Opposite deflections of the QRS and ST segment

- Concordant STE > 1mm in any lead
- Discordant STE > 5mm
- Concordant STD > 1mm in V1, V2, or V3
64 yo female, difficulty breathing Pulmonary edema was present upon exam and this is the initial 12-Lead. What do you see?
Pericarditis

Acute vs. Chronic
Pericarditis 12-Lead ECG