The Basic 12 Lead Electrocardiogram

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Objectives

• How do they work?
• Common mistakes
• How to read an EKG
• Artifacts
• Cases
What is an EKG?

• Tracing of electrical activity of the heart
History of the EKG

- William Einthoven
- Early 1900’s
- String galvanometer
How does an EKG work?
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- Einthoven → I, II, III
How does an EKG work?

- Wilson → augmented leads
  - aVF, aVR, aVL
How does an EKG work?

- Pre-cordial leads
  - V1 – V6
  - Standardized in 1938 by the AHA
Why PQRST?

• Uncorrected tracings – ABCD

• Corrected tracing – PQRST
  – Familiar with Descartes
  – Middle of alphabet (afterthought)
Indications

- Chest pain
- Syncope
- Shortness of breath
- Nausea/Vomiting
- Palpitations
- Diaphoresis
- Stroke symptoms
- Before and after cardioversion
- Hemodynamic instability
- Suspected electrolyte disorder
- Overdose
- Arrhythmia
Common Mistakes

• Limb lead placement

RIGHT

WRONG
Common Mistakes

- Pre-cordial lead placement
  - Angle of Louis
  - V1
  - What about breast tissue?
How to read an EKG

- The Paper
- The Waveform
- The Plan
How to read an EKG

• The paper
  – Up and down \( \rightarrow \) 1 box = 0.1 mV
  – Across \( \rightarrow \) 1 box = 4 ms

• The rate
  – 10 seconds per page
How to read an EKG

• The Waveform
How to read an EKG

• P wave
How to read an EKG

• PR segment
How to read an EKG

• QRS complex
How to read an EKG

- ST segment
How to read an EKG

• T wave
How to read an EKG

- QT/QTc
How to read an EKG

- R-R
The Plan

- Rate
- Rhythm
- Axis
- Interval
- Disease
Rate

- 300 method
  - 300, 150, 100, 75, 60
Rate

- 10 second method
  - Each EKG is 10 seconds
  - Count total QRS complexes
  - Multiply by 6
Rate

- Normal
  60 – 100

- Bradycardia
  < 60

- Tachycardia
  > 100
Rhythm

- Sinus
- Atrial
- Supraventricular
- Junctional
- Ventricular

Narrow QRS

Wide QRS
<table>
<thead>
<tr>
<th>Rhythm</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Normal Sinus</td>
<td><img src="image" alt="Normal Sinus" /></td>
</tr>
<tr>
<td>• Sinus Arrhythmia</td>
<td><img src="image" alt="Sinus Arrhythmia" /></td>
</tr>
<tr>
<td>• Sinus Arrest</td>
<td><img src="image" alt="Sinus Arrest" /></td>
</tr>
</tbody>
</table>
Rhythm

• ATRIAL
  – Atrial Flutter
  – Atrial Fibrillation
  – Premature Atrial Contraction
Rhythm

- Supraventricular
  - Catch all term

- Supraventricular Tachycardia
Rhythm

• JUNCTIONAL
  – Junctional Escape
  – Accelerated Junctional
  – Premature Junctional
    Contraction
Rhythm

- VENTRICULAR
  - V Fibrillation
  - V Tachycardia
  - Premature Ventricular Contraction
Axis

- General direction of electrical activity
- Will not change your management
Interval

- **PR**
  - Block between atria and ventricles
  - Heart Block
    - First, second, and third degree

- **QRS**
  - Block in the conduction system
  - Bundle Branch Block
    - LBBB, LAFB, LPFB, RBBB

- **QT/QTc**
P-R Interval

- 1° heart block

- 2° heart block - Type I

- 2° heart block - Type II

- 3° heart block (complete)
QRS Interval

- QRS complex = ventricular depolarization

- QRS widening = delay in depolarization
QRS Interval

• Causes of QRS widening
  – Ventricular rhythm
  – Damage to the conduction system
    • BBB
    • MI
  – Metabolic/Drugs
QRS Interval
QT/QTC Interval

- QT
  - Normal
  - Prolonged
EKG Artifact

- 60 Hz interference
- Muscle tremor
- Wandering baseline
12 leads

• So far we’ve just done basic rhythm recognition with a single lead.

• What about the other 11 leads?
12 leads

• Each lead represents a different view of the heart

• More = better.
12 leads

- II $\rightarrow$ p waves

- Axis

- Diseases
  - Myocardial infarction
  - PE
  - Hyperkalemia
  - Pericarditis
Practice
Fig. 3 - ECG. Atrial flutter with advanced 5:1 atrioventricular block and left bundle branch block.
Practice

www.thrombosisadviser.com