ECG INTERPRETATION: the basics

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Overview

• Conduction Pathways
• Systematic Interpretation
• Common abnormalities in Critical Care
  – Supraventricular arrhythmias
  – Ventricular arrhythmias
Conduction Pathways

Sinoatrial node
60 – 100 bpm

Internodal tracts

Atrioventricular node
60 bpm

Atrioventricular Bundle of His
40 – 60 bpm

Right Bundle Branch
30 – 40 bpm

Left Bundle Branch
30 – 40 bpm

Purkinje Fibres
10 – 30 bpm
Conduction Pathways

P wave = atrial depolarisation.

PR Interval = impulse from atria to ventricles.

QRS complex = ventricular depolarisation.

ST segment = isoelectric - part of repolarisation.

T wave = usually same direction as QRS - ventricular repolarisation.

QT Interval = This interval spans the onset of depolarisation to the completion of repolarization of the ventricles.
Interpretation

1. **Rate** = Number of P’s (atrial) R’s (ventricular) per minute (6 second [30 squares] X 10 = minute rate).
   - P rate: $8 \times 10 = 80$
   - R rate: $8 \times 10 = 80$

2. **Rhythm** = Regular or irregular. Map P-P and R-R intervals.
3. P wave = present, 1 per QRS, shape, duration, voltage.

4. P-R interval = length (0.12 - 0.2 sec = <1 big square), isoelectric.
5. **QRS** = duration (0.06 - 0.10), voltage, q or Q waves

6. **ST Segment** = shape, isoelectric with PR segment
7. **T wave** = shape, direction

8. **QT interval** = length (R-R/2 or QTc <0.40 sec)
Abnormalities: Supraventricular arrhythmias

- Atrial Fibrillation
- Atrial Flutter
- Supraventricular Tachycardia (SVT)

Abnormalities: Ventricular arrhythmias

- Premature Ventricular Complexes (PVCs)
- Ventricular tachycardia (VT)
Conduction Pathways

- **Supraventricular**
  - Narrow QRS complex

- **Atrioventricular**
  - Node: 60 bpm
  - Bundle of His: 40 – 60 bpm

- **Ventricular**
  - Wide QRS complex

- **Nodes and Tracts**
  - Sinoatrial node: 60 – 100 bpm
  - Internodal tracts
  - Right Bundle Branch: 30 – 40 bpm
  - Purkinje Fibres: 10 – 30 bpm
  - Left Bundle Branch: 30 – 40 bpm
Abnormalities:

**atrial fibrillation**

Rhythm: Irregular
Rate: A: 350 – 650; V: varies
P: poorly defined
P-R: N/A
QRS: narrow complex
S-T: normal
T: normal
Q-T: normal
Abnormalities:

atrial flutter

Rhythm: Regular / Irregular
Rate: A: 220 – 430; V: <300 (2:1, 3:1 or sometimes 4:1)
P: Saw toothed appearance
P-R: N/A
QRS: narrow complex
S-T: normal
T: normal
Q-T: normal
Abnormalities:

supraventricular tachycardia (SVT)

Rhythm: Regular
Rate: >100
P: not visible
P-R: not defined
QRS: narrow complex
S-T: depression (sometimes)
T: normal
Q-T: prolonged (sometimes)
Abnormalities: premature ventricular complexes
Examples
ECG INTERPRETATION:
12 Lead
Overview

- Lead Placement
- Axis
- Common abnormalities in Critical Care
  - Heart block
  - Bundle branch blocks
  - Life threatening arrhythmias
Lead Placement

V1 = 4th ICS right sternum
V2 = 4th ICS left sternum
V3 = midway between V2 and V4
V4 = 5th ICS midclavicular
V5 = between V4 and V6 anterior auxiliary line
V6 = midauxillary line lateral to V4 and V5
Lead Placement

- Electrical activity towards = ↑
- Electrical activity away = ↓
Lead Placement
• The direction of an ECG waveform in the frontal plane measured in degrees
• Represents the flow of the majority of electrical activity
• Normally the QRS complex is measured
• Each lead has its own axis
Lead Placement

Standard Leads (bipolar)
- I - lateral wall
- II - inferior wall
- III - inferior wall

Augmented leads (unipolar)
- aVR - no mans land
- aVL - lateral wall
- aVF - inferior wall

Chest Leads (unipolar)
- V1 - septal wall
- V2 - septal wall
- V3 - anterior wall
- V4 - anterior wall
- V5 - lateral wall
- V6 - lateral wall
Lead Placement

No-mans land, inferior, lateral, anterior, septal,
Abnormalities: 
**bundle branch blocks**

- QRS widened, greater than 0.12 secs
- Change in axis
- Difficult to interpret ECG
- Right or Left
- Normal P wave
- Followed by a T wave
Abnormalities: right bundle branch blocks

- Indicates conduction problems in the right side of the heart
- May be normal in healthy people
- R wave in V1, ie two R waves in V1
- Q wave in V6
- Lead V1 cats ears
Abnormalities: left bundle branch blocks

- Always indicates heart disease, usually of the left side of the heart
- Hard to interpret an ECG with LBBB
- Lead V1 Q wave and an S wave
- Lead V6 an R wave followed by another R wave
- Lead V6 Rabbit ears
Abnormalities: heart block

- SA block (exit block)
- 1\textsuperscript{st} degree AV block
- 2\textsuperscript{nd} degree AV block
  - Wenckebach (type I)
  - Mobitz (type II)
- 3\textsuperscript{rd} degree AV block
Abnormalities: 
*heart block – SA block*
Abnormalities:
heart block – 1st degree AV
Abnormalities:
*heart block – 2nd degree AV*

**Wenkeback**

**Mobitz**
Abnormalities:

heart block – 3rd degree AV
Abnormalities: *life threatening arrhythmias*

- Ventricular Tachycardia
- Ventricular Fibrillation
- Asystole
Abnormalities: life threatening arrhythmias - VT
Abnormalities:

*life threatening arrhythmias - VF*
Abnormalities:

Life threatening arrhythmias – Asystole
Examples
Examples