ECG pre-reading manual

Created for the North West Regional EMET training program

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Disclaimer

This handbook has been created for use with the EMET program in the North West Regional Hospital, Tasmania.

It is to be used as a basic introduction to the interpretation and recognition of basic patterns of ECGS. It is not a comprehensive text book. Further resources should be utilised for a more detailed and comprehensive analysis.

It should also be noted that as in other fields of medicine, advances or better understandings are always a potential. Whilst we will endeavour to update this manual, at times new information may not have been entered in.

I would like to mention Life in the Fastlane and Dr Amal Mattu as invaluable resources in the creation of this manual.
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Basic Electrophysiology

<table>
<thead>
<tr>
<th>Wave</th>
<th>Stage in Cardiac Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>Atrial Systole</td>
</tr>
<tr>
<td>QRS</td>
<td>Ventricular Systole</td>
</tr>
<tr>
<td>T</td>
<td>Ventricular Diastole</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interval</th>
<th>Characteristics</th>
<th>Normal Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>PR</td>
<td>Onset of P wave to start of QRS</td>
<td>120-200ms (3-5 small squares)</td>
</tr>
<tr>
<td>QRS</td>
<td>Onset of Q wave, to end of S wave</td>
<td>70-100ms Narrow complex &lt; 100ms</td>
</tr>
<tr>
<td>ST</td>
<td>Flat isoelectric section between end of S wave and beginning of T wave</td>
<td>Broad complex &gt; 100ms</td>
</tr>
</tbody>
</table>
12 Lead ECG – How to start

- **What is the rate**
  - Look at the ventricular rate
    - Count number of big boxes between R-R interval and divide this into 300.
    - Rate here is approximately $300/5 = 60$ bpm

- **What is the Rhythm**
  - Is there a P wave before every QRS wave
    - Yes – this is a sinus rhythm
    - No – are P waves present or absent and how are they related to the QRS wave

- **Look at P wave and PR interval**
  - Observe any abnormalities or interval widening/shortening

- **Look at QRS wave**
  - Look for Q waves that might be pathological
    - $>40$ms; $>2$mm deep; lead V1-V3
  - Is it narrow or broad complex

- **Look at the ST segment**
  - Is there depression
  - Is there elevation

- **Look at T wave**
ECG Interpretation Handbook

- Identify its morphology
- Is it upright or inverted

ECG and ischaemic patterns

A. Inferior Acute Myocardial Infarction (AMI)

- Look at leads II, III, aVF
- > 1mm ST elevation in 2 contiguous leads
- 20% patients with Inferior STEMI develop second or third degree heart block

B. Anterior AMI

- Look at leads V1-V6
  - V1V2 = septal infarct
  - V3V4 = anterior infarct
  - V5V6 = lateral infarct
- >2mm ST elevation in 2 contiguous chest leads
ECG and ischaemic patterns

C. Posterior AMI

- Changes to V1-V3
  - Horizontal ST depression
  - Tall, broad R waves
  - Upright T waves
  - Dominant R waves in V2
- Do posterior leads
  - V7
    - Left posterior axillary line in same horizontal plane as V6
  - V8
    - Tip of left scapula
  - V9
    - Left paraspinal region
- >2mm ST elevation in 2 contiguous chest leads
ECG and ischaemic patterns

The following are important patterns to recognise as part of potential cardiac ischaemia.

A. Hyperacute T-waves

- Can be early sign of infarction
- Tall, peaked, asymmetrical
- Broad base

B. Non ST Elevation Myocardial Infarctions (NSTEMI)

- **ST depression** occurs at J point and is > 0.5mm at 2 or more contiguous lead
- **T wave inversion** occurs at 2 or more contiguous leads and generally has a prominent R wave.

C. De Winters T waves

- This is an Anterior STEMI equivalent
- **Features**
  - Precordial leads
  - ST depression @ J point
  - Tall peaked T waves
  - aVR ST elevation 0.5-1mm
D. Wellens Syndrome

- Highly specific for critical LAD stenosis
- Leads V2, V3
- No precordial Q waves
- Normal R wave progression
- Recent history of angina, and patients can present pain free

Type A
25%
Biphasic with initial positive and terminal negativity

Type B
75%
Deeply inverted T waves
Atrio-Ventricular Blocks (AV-Blocks)

- **First degree heart block**
  - P wave for every QRS
  - PR interval > 0.2 sec

- **Second degree heart block**
  - Type 1 (Wenkebach)
    - P waves are constant
    - PR gradually increases and then drops QRS
  - Type 2
    - P waves are constant
    - PR is constant
    - Dropped QRS
    - Wide QRS

- **Third degree heart block**
  - P waves are constant
  - QRS is constant
  - PR varies
Narrow Complex Tachycardia’s

Ask the following questions:
1. Is it a narrow or broad QRS?
2. Is it regular or irregular?
3. What is the atrial activity?

We can now divide our narrow complex tachycardias into two groups
1. Narrow Regular
   a. Sinus tachycardia
      i. One P wave with every QRS
   b. SVT
      i. P waves may be hidden or follow QRS
   c. Atrial Flutter
      i. Inverted p waves give saw tooth appearance
      ii. Best lead to look at is V1

2. Narrow Irregular
   a. Atrial Fibrillation
      i. No distinct regular atrial activity
   b. Atrial Flutter with variable rate
      i. Regular atrial activity
   c. Multi-focal atrial tachycardia
i. P waves are present, but with 3 or more morphologies

Wide Complex Tachycardia’s

1. Ventricular Tachycardia
   a. ECG is reliable at ruling in VT
   b. If there is a regular wide complex tachycardia, assume VT
      i. Rules are not always reliable
      ii. Clinical correlation is always reliable

2. VT Mimics
   a. If rate is less than 120 beats per minute, consider:
      i. Hyperkalaemia
      ii. Tricyclic overdose
      iii. Reperfusion rhythm post AMI
   b. Bundle branch block with aberrancy
      i. Can use baseline ECG that has same morphology
      ii. But always look at clinical correlation and assume VT