ECG reading: the common and dangerous
Review essential technical aspects of ECG recording

Distinguish between “normal” and “abnormal” ECG findings

Recognize arrhythmia type during sustained tachycardia

Identify main ECG abnormalities caused by MI and ischemia

List the criteria for heart blocks and WPW
common technical pitfalls
Lead placement
4th intercostal space - right of sternum

4th intercostal space to the left of the sternum
halfway between V2 and V4

The left midclavicular line in the 5th intercostal space
The left anterior axillary line in the 5th intercostal space
The left midaxillary line in the 5th intercostal space
Angle de Louis

2ème EIC

2ème EIC

3ème EIC

4ème EIC
Paper Speed

50 mm/sec  25 mm/sec
1 mm
0.04 sec

5 mm
0.2 sec

25 mm/sec

1 mV = 10 mm

10 mm/mV

0.04 sec

25 mm/sec
motion artifact
-breathing

stop breathing
Auto mode
Normal ECG ??

- 62 y
- emergency department
- chest pain
- 62 y
- emergency department
- chest pain
T wave polarity depends on T wave axis
Frontal Plane

I

II

aVf

III

- P
- QRS
- T

+ + +
T wave is always positive in leads I and II
may be negative in lead III.

T wave is always positive in precordial leads.
(except V1: may be negative)
Normal ECG ??

- 75 y W
- elective cholecystectomy
- pre op ECG
Positional Q waves (septal Q waves) often disappear with change in heart orientation associated with deep inspiration.
• 33 y M
• ER
• chest pain x 3 hours

Normal ECG ??
“Early Repolarisation Syndrome”  “High take-off ST segment”
Tachycardia
Atrial Fibrillation
Tachycardia (HR > 100/min)

Irregular

Regular

Atrial Fibrillation
Tachycardia (HR > 100/min)

Irregular
- Atrial Fibrillation

Regular
- Narrow QRS tachycardia (< 0.12 sec)
  - “SVTs”
    - Sinus Tachycardia
    - Atrial Flutter
    - AVNRT-AVRT (Bouveret)
- Wide QRS tachycardia (> 0.12 sec)
  - VT
    - “SVTs”
      - + WPW
      - + BBB
Identifying P wave: several approaches

- Spontaneous on surface ECG (compare with previous tracings)
- Lewis lead (DI on chest)
- Esophageal lead
- Epicardiac lead (post open heart)
- CSM, ATP, Adenosine

“SVTs” (Regular, Narrow QRS tachycardia)

Analyze P wave
- Morphology
- Timing
- Rate
Analyze P wave
  - Morphology
  - Timing
  - Rate

“sinus” morphology: positive P wave in leads I and Vf
Analyze P wave
- Morphology
- Timing
- Rate

“P” wave rate

120-150 250 350 /min

Sinus tachy  Atrial tachy  Atrial flutter  Atrial fibrillation
sinus tachycardia
Regular narrow QRS tachycardia at 150/min

Adenosine
Adenosine

Regular P waves at 150/min

1/1 Atrial Tachycardia
Regular tachycardia at 150 / min

2/1 Atrial Flutter

ATP

Regular P waves at 300/min
** All leads at half standard **
AVNRT

Adenosine
Adenosine

Regular narrow QRS-complex tachycardia

- IV adenosine

- No change in rate
- Gradual slowing then reacceleration of rate
- Sudden termination
- Persisting atrial tachycardia with transient high-grade AV block

2003 ACC/AHA/ESC Guidelines for Management of SVA
ECG in CAD
define

- **type** of ischemic changes
- **localization** of ischemic changes
**ECG in CAD**

- *type* of ischemic changes

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<thead>
<tr>
<th>Ischemia:</th>
<th>reversible</th>
<th>repolarisation abnormalities</th>
<th>T wave changes</th>
<th>1/ inverted T wave</th>
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<tbody>
<tr>
<td>Injury:</td>
<td>reversible</td>
<td>repolarisation abnormalities</td>
<td>ST changes</td>
<td>1/ elevated ST</td>
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<tr>
<td>Infarction:</td>
<td>irreversible</td>
<td>depolarization abnormalities</td>
<td>Q wave</td>
<td>2/ depressed ST</td>
</tr>
</tbody>
</table>

- *Elevated ST*:
  - 1/ inverted T wave
  - 2/ Peaked T wave

- *Depressed ST*:
  - 1/ elevated ST
  - 2/ depressed ST
Inverted T wave
Peaked T wave
Elevated ST
Depressed ST

Ischemia
Injury
Localization of ischemic changes

antero-apical postero-inferior
antero-lateral
antero-septal
RV
antero-basal
antero-inferior
RV
antero-lateral
antero-septal
antero-apical
Localization of ischemic changes

antero-septal : V1 V2
apical : V3 V4
lateral : V5 V6
high lateral : I - VL
anterior : V1 - V6
postero-inferior : II - III - VF
postero-basal : V7 V8 V9
RV : V3r V4r
Heart blocks and WPW
Heart blocks

- Sinus dysfunction
- AV Block

AV node
His
1st degree AV block

PR > 0.2 sec
Mobitz 1 AV block

« progressive » AV block
Mobitz 2 AV block
Complete AV block

AV dissociation

P wave

QRS
Sinus dysfunction

- sinus arrest
- junctional escape rhythm
Wolf Parkinson White Syndrome

Zone ventriculaire préexcitée

Zone excitée normalement