EKG reading made easy

Rates

- Normal: 60-100 bpm
- Tachycardia: > 100 bpm
- Bradycardia: < 60 bpm

Readings

- Count the number of large squares present within one R-R interval.
- Divide 300 by this number to calculate heart rate.

OR

- Count the number of complexes on the rhythm strip (each rhythm strip is typically 10 seconds long).
- Multiply the number of complexes by 6 (giving you the average number of complexes in 1 minute).

Note:

- A patient’s heart rhythm can be regular or irregular.
- Irregular rhythms can be either:
- Regularly irregular (i.e. a recurrent pattern of irregularity)
- Irregularly irregular (i.e. completely disorganized)

The cardiac axis

The cardiac axis describes the overall direction of electrical spread within the heart.

In a healthy individual, the axis should spread from 11 o’clock to 5 o’clock.

To determine the cardiac axis you need to look at leads I, II, and III.

Right Axis deviation

- Right axis deviation (RAD) involves the direction of depolarisation distorted to the right (between +90º and +180º).
- The most common cause of RAD is right ventricular hypertrophy. Extra right ventricular tissue results in a more robust electrical signal being generated by the right side of the heart. This causes the deflection in lead I to become negative and the deflection in lead aVF/III to be more positive.
- RAD is commonly associated with conditions such as pulmonary hypertension, as they cause right ventricular hypertrophy. RAD can, however, be a normal finding in very tall individuals.

Left Axis deviation

- Left axis deviation (LAD) involves the direction of depolarisation distorted to the left (between -30° and -90°).
- This results in the deflection of lead III becoming negative (this is only considered significant if the deflection of lead II also becomes negative).
- Conduction abnormalities usually cause LAD.

P Wave

The next step is to **look at the P waves**

- Sawtooth baseline → flutter waves
- Chaotic baseline → fibrillation waves
- Flatline → no atrial activity at all
- The **PR interval should** be between **120-200 ms** (3-5 small squares).

Note: A prolonged PR interval suggests the presence of atrioventricular delay (AV block).

If the **PR interval** is **shortened**, this can mean one of two things:

- the SA node is not in a fixed place and some people's atria are smaller than others.
- an **accessory pathway** and can be associated with a **delta wave** (see below which demonstrates an ECG of a patient with Wolff Parkinson White syndrome).

QRS Complex

When assessing a QRS complex, you need to pay attention to the following **characteristics**:

- Width
- Height
- Morphology

Width can be described as **NARROW** (< 0.12 seconds) or **BROAD** (> 0.12 seconds)

Height can be described as either **SMALL** or **TALL**:

- **Smallcomplexes**are is defined as < 5mm in the limb leads or < 10 mm in the chest leads.
- **Tallcomplexes**imply ventricular hypertrophy (although can be due to body habitus e.g. tall slim people).

To assess **morphology**, you need to assess the individual waves of the QRS complex.

Note – the presence of a delta wave does NOT diagnose Wolff-Parkinson-White syndrome. This requires evidence of tachyarrhythmias AND a delta wave.

Q Wave

Isolated Q waves can be **normal**.

A **pathological Q wave** is **> 25% the size of the R wave that follows it** or **> 2mm in height and > 40ms in width**.

R Wave

Assess the R wave progression across the chest leads (from small in V1 to large in V6).

The transition from the S > R wave to the R > S wave should occur in V3 or V4.

Poor progression (i.e. S > R through to leads V5 and V6) can be a sign of previous MI but can also occur in very large people due to poor lead position.

ST-Segment

The **ST segment** is the part of the ECG **between the end of the S wave and the start of the T wave**.

In a healthy individual, it should be an isoelectric line (neither elevated nor depressed).

ST-elevation is significant when it is **greater than 1 mm** (1 small square) **in 2 or more contiguous limb leads** or **>2mm in 2 or more chest leads**. It is most commonly caused by **acute full-thickness myocardial infarction**.

ST depression ≥ 0.5 mm in **≥ 2 contiguous leads** indicates **myocardial ischemia**.

T Waves

T waves are considered **tall** if they are:

- **> 5mm** in the **limb leads**AND
- **> 10mm**in the **chest leads** (the same criteria as ‘small’ QRS complexes)

Tall T waves can be associated with:

- **Hyperkalaemia**(“tall tented T waves”)
- **HyperacuteSTEMI**

Inverted T waves in other leads are a nonspecific sign of a wide variety of conditions:

- Ischaemia
- Bundle branch blocks (V4-6 in LBBB and V1-V3 in RBBB)
- Pulmonary embolism
- Left ventricular hypertrophy (in the lateral leads)
- Hypertrophic cardiomyopathy (widespread)
- General illness

Flattened T waves are a non-specific sign, that may represent **ischemia** or **electrolyte imbalance**.

Biphasic T waves have **two peaks** and can be indicative of **ischemia** and **hypokalaemia**.

> **U Waves**

U waves are **not** a **common** finding.

The U wave is a **> 0.5mm deflection after the T wave** best seen in **V2** or **V3**.

These become larger the slower the bradycardia – classically U waves are seen in various **electrolyte imbalances**, **hypothermia** and secondary to **antiarrhythmic therapy** (such as digoxin, procainamide, or amiodarone).

References

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Revision #3
Created 25 February 2022 06:31:34 by Katarina Soewono
Updated 10 June 2022 04:48:44 by Katarina Soewono