



**Ministry of Higher Education and Scientific Research**  
**Al-Mustaqbal University College**  
**Department of Medical Physics**



# **Practical Medical Physics**

## **Lecture 1**

### **Electrocardiogram (ECG)**

By

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# Electrocardiogram (ECG)

An electrocardiogram (ECG) is a simple test that can be used to check your heart's rhythm and electrical activity. Sensors attached to the skin are used to detect the electrical signals produced by your heart each time it beats.

These signals are recorded by a machine and are looked at by a doctor to see if they're unusual. An ECG may be requested by a heart specialist (cardiologist) or any doctor who thinks you might have a problem with your heart, including your GP. The test can be carried out by a specially trained healthcare professional at a hospital, a clinic or at your GP surgery.

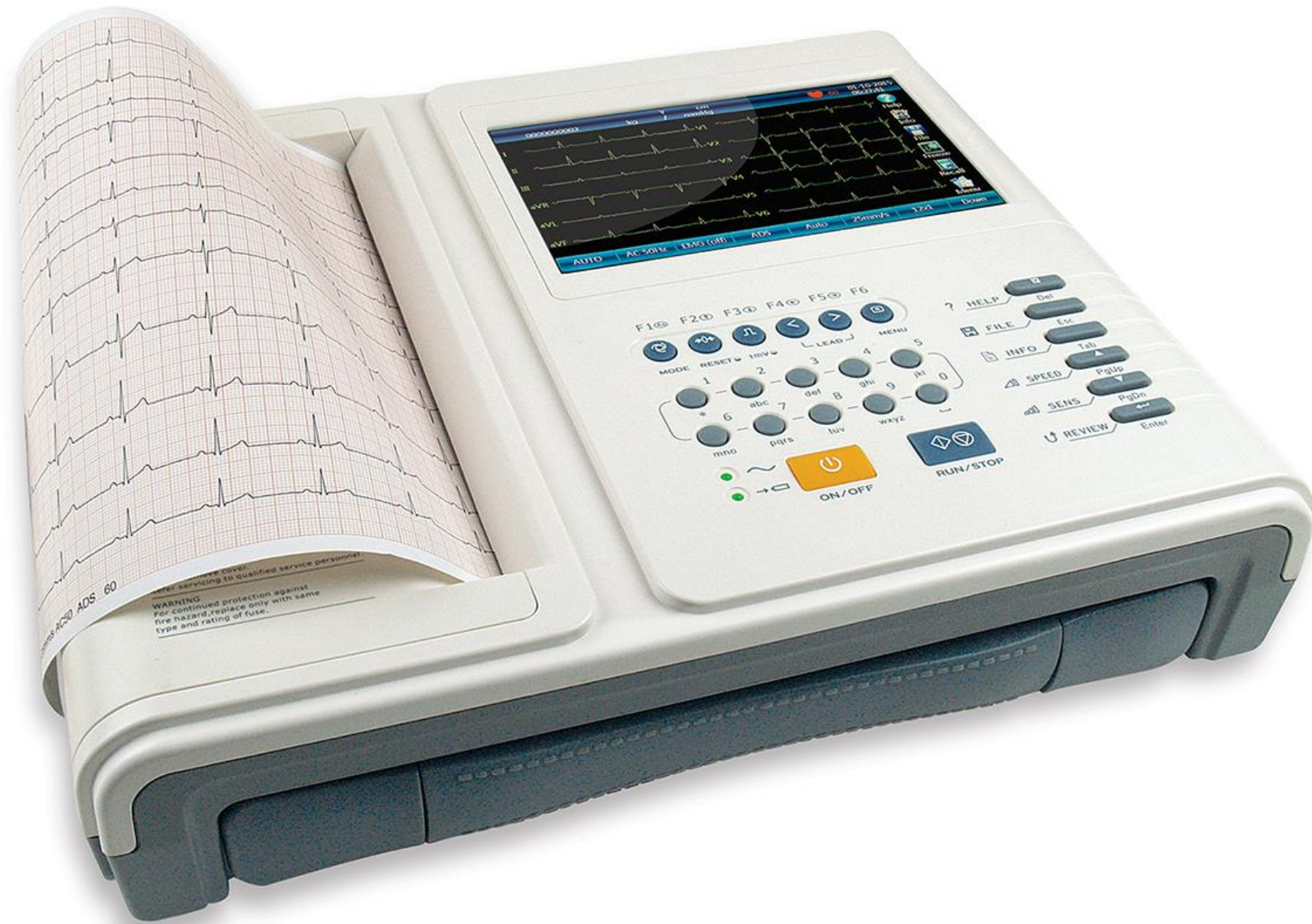


Figure (1) Electrocardiograph Machine.

## When an ECG is used?

An ECG is often used alongside other tests to help diagnose and monitor conditions affecting the heart. It can be used to investigate symptoms of a possible heart problem, such as chest pain, palpitations (suddenly noticeable heartbeats), dizziness and shortness of breath.

A series of ECGs can also be taken over time to monitor a person already diagnosed with a heart condition or taking medication known to potentially affect the heart.

# When an ECG is used?

An ECG can help detect:

- **Arrhythmias:** where the heart beats too slowly, too quickly, or irregularly.
- **Coronary heart disease:** where the heart's blood supply is blocked or interrupted by a build-up of fatty substances.
- **Heart attacks:** where the supply of blood to the heart is suddenly blocked.
- **Cardiomyopathy:** where the heart walls become thickened or enlarged.

## Normal heart rhythm



## Irregular heart rhythm



Figure (2) Normal and up normal Heart beats.

# Types of ECG

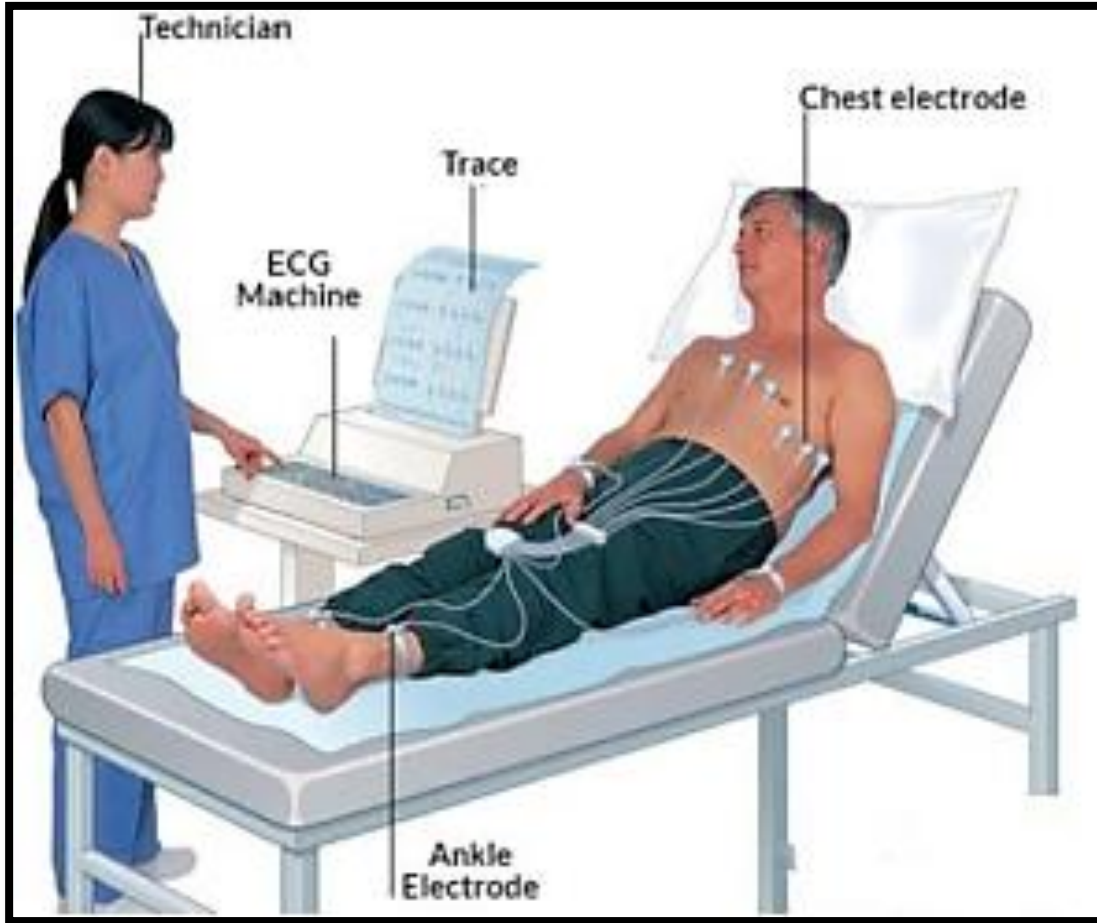
There are 3 main types of ECG:

- **a resting ECG:** carried out while you're lying down in a comfortable position
- **a stress or exercise ECG:** carried out while you're using an exercise bike or treadmill
- **an ambulatory ECG (Holter monitor):** the electrodes are connected to a small portable machine worn at your waist so your heart can be monitored at home for 1 or more days

The type of ECG you have will depend on your symptoms and the heart problem suspected. For example, an exercise ECG may be recommended if your symptoms are triggered by physical activity, whereas an ambulatory ECG may be more suitable if your symptoms are unpredictable and occur in random, short episodes.



## Rest



## Exercise

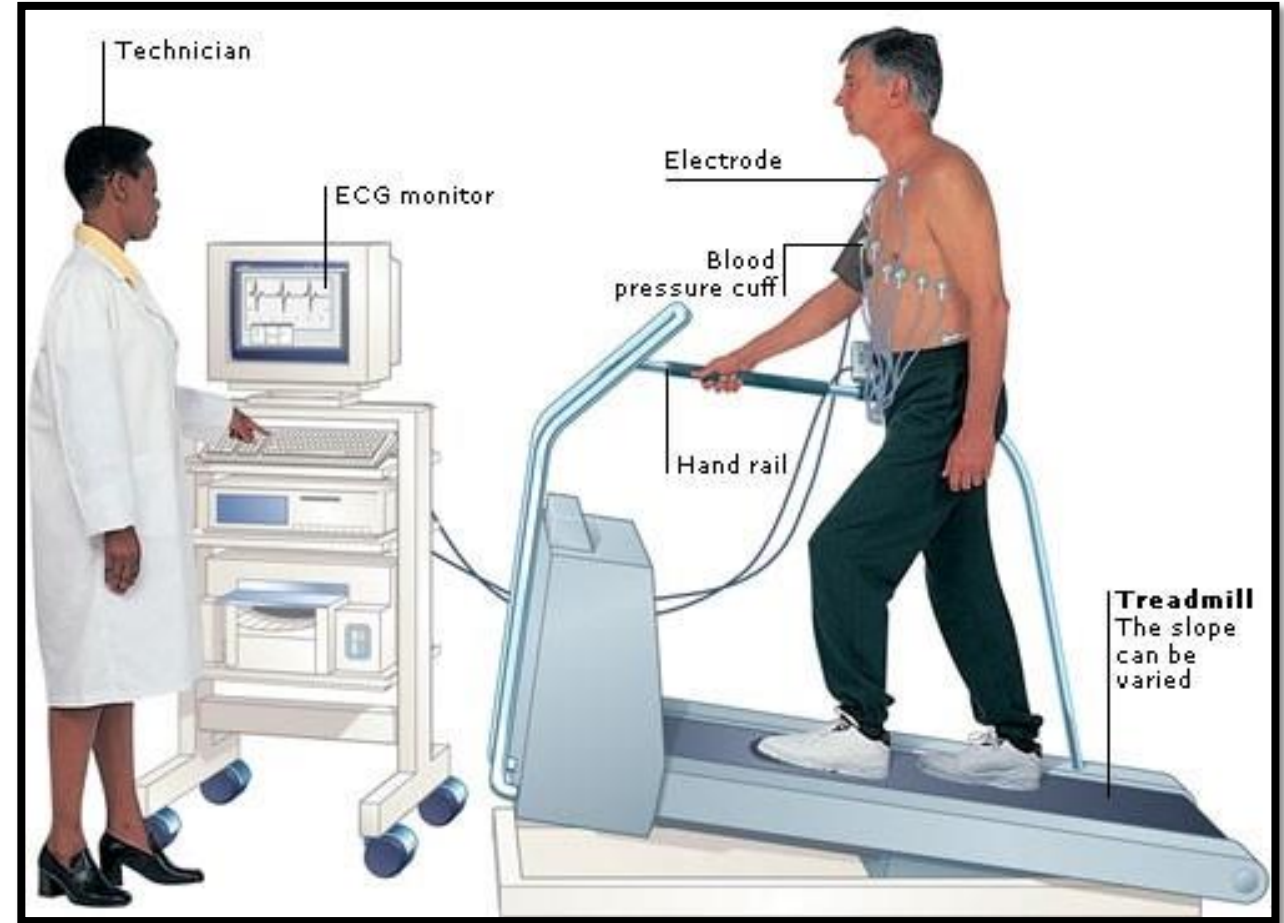


Figure (2) Resting and Exercise ECG.



Rest

Exercise

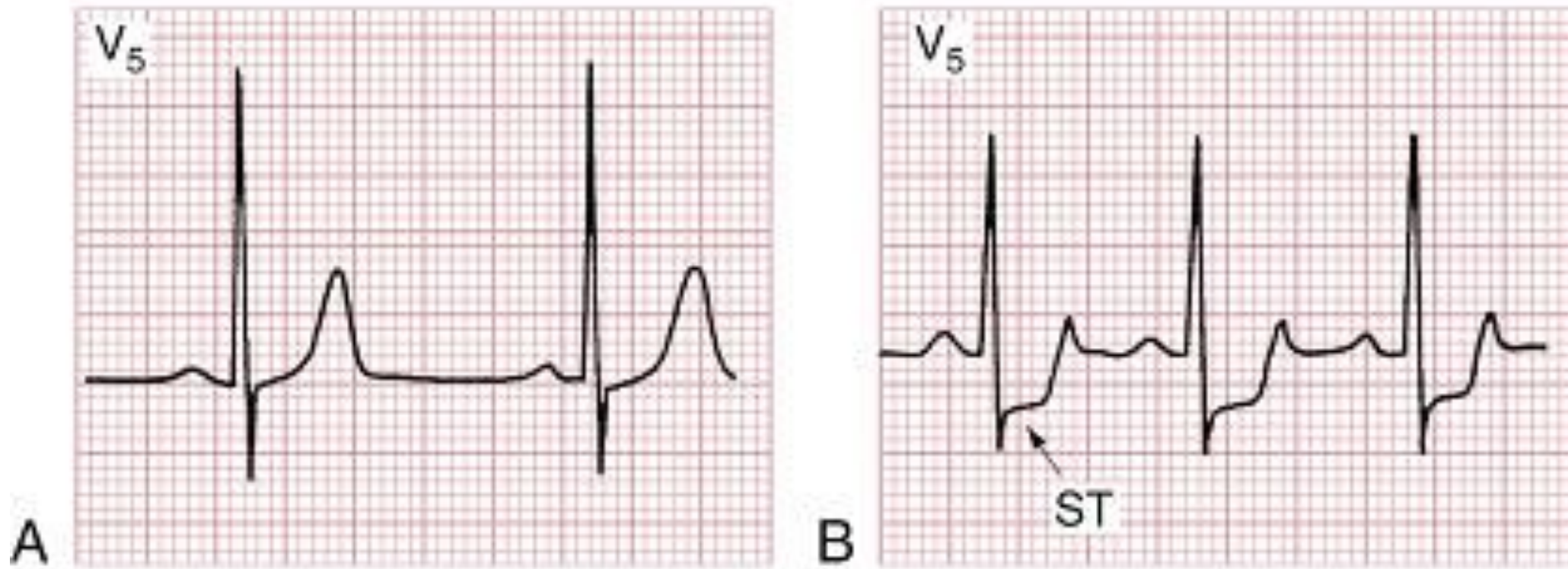
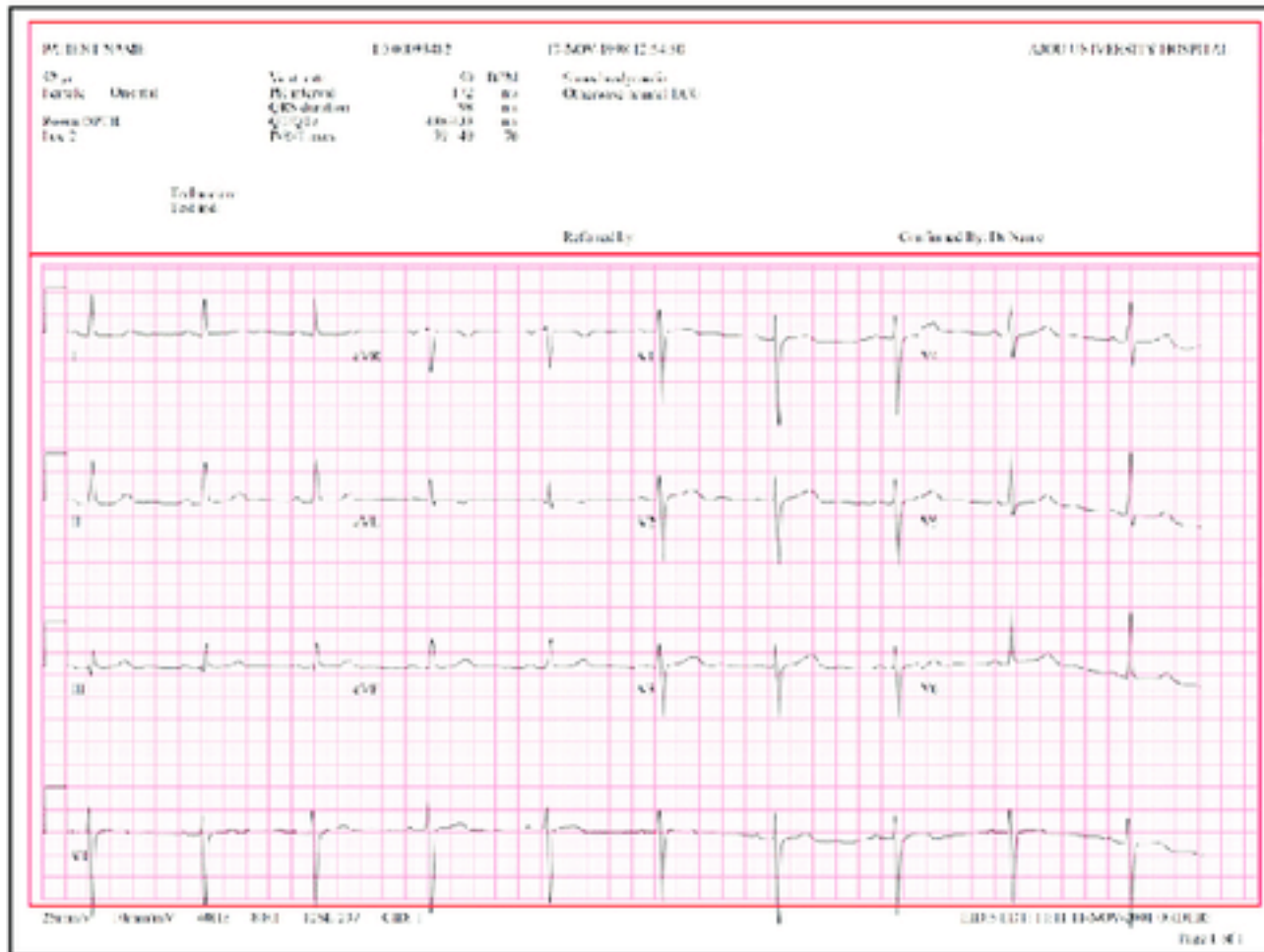


Figure (3) Resting and Exercise ECG.

# Getting your results

An ECG recording machine will usually show your heart rhythm and electrical activity as a graph displayed electronically or printed on paper.

- For an ambulatory ECG, the ECG machine will store the information about your heart electronically, which can be accessed by a doctor when the test is complete. You may not be able to get the results of your ECG immediately.
- The recordings may need to be looked at by a specialist doctor to see if there are signs of a possible problem.
- Other tests may also be needed before it's possible to tell you whether there's a problem.
- You may need to visit the hospital, clinic or your GP a few days later to discuss your results with a doctor.



### Alphanumeric value

- Demographic information
  - Patient ID
  - Date
  - Ethnicity
- ECG parameter values
  - Ventricular rate
  - PR interval
  - QRS duration
  - QT/QTc
  - P-R-T axes
- Interpretation

### Waveform data

- 12 lead waveform data
  - I, II, III
  - aVR, aVL, aVF
  - V1, V2, V3, V4, V5, V6

Figure (4) Example of an electrocardiogram (ECG) report.

## Are there any risks or side effects?

- An ECG is a quick, safe and painless test. No electricity is put into your body while it's carried out. There may be some slight discomfort when the electrodes are removed from your skin (similar to removing a sticking plaster) and some people may develop a mild rash where the electrodes were attached.
- An exercise ECG is performed under controlled conditions. The person carrying out the test will carefully monitor you, and they'll stop the test if you experience any symptoms or start to feel unwell.





4v

4v

4v

4v

2v

2v

2v

2v

P<sub>1</sub>

P<sub>1</sub>

P<sub>1</sub>

P<sub>1</sub>

P<sub>2</sub>

P<sub>2</sub>

P<sub>2</sub>

P<sub>2</sub>

0.1

0.2

0.3

0.4

0.5

0.6

*Thanks for  
listening*