

# Electrocardiogram

The electrocardiogram is graphic record of electrocardiography. ECG curve contains waves P, Q, R, S, T, and sometimes U. For description of ECG are very important intervals and segments between waves. Every ECG description has to start with description of heart rhythm (regularly or irregularly, sinus or nonsinus rhythm) and frequency.

## Description of Waves, Intervals and Segments

### P Wave

P wave should be **always before QRS complex**, separated by PQ interval. P wave is a sign of normal atrial depolarization.

#### Parameters:

- duration: 110 ms;
- amplitude: 0.25 mV;
- polarity:
  - positive – always in leads I and II;
  - negative – always in aVR lead.

**When is P wave missing?** Atrial flutter or fibrillation, ...

### PQ Interval

PQ interval is a period of atrial contraction. The depolarization is delayed in AV node.

#### Parameters:

- duration: 120–200 ms
- polarity: isoelectric

### QRS Complex

QRS complex represents ventricular depolarization and contraction. There are two phases of ventricular depolarization:

1. depolarization of interventricular septum – the vector is oriented from left to right and anteriorly;
2. depolarization of ventricles – because the left ventricle is more massive than the right ventricle, the vector oriented from right to left and posteriorly<sup>[1]</sup>.

There are three waveforms in QRS complex:

- Q wave – the first negative wave following P wave, may not always be presented;
- R wave – the first positive wave following P wave or Q wave;
- S wave – the first negative wave following R wave.

#### Parameters:

- duration of QRS complex: 100 ms or less;
- amplitude of Q wave;
- amplitude of R wave;
- amplitude of S wave.

### ST Segment

ST segment is an isoelectric line, a time period with no electrical activity of the heart. Should be in the same level as PQ interval. Every elevation or depression of this line is pathological.

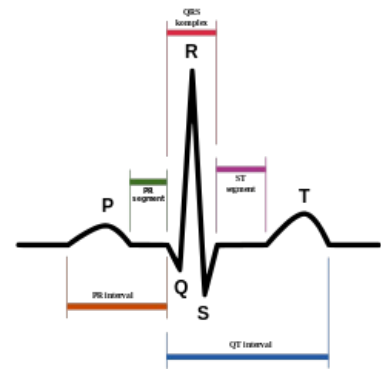
- Physiological duration is 320 ms.

### T Wave

T wave represents repolarization of ventricles. The positivity or negativity should be the same as the major vector of the QRS complex.<sup>[1]</sup>

- Physiological duration 160 ms.

### U Wave



Basic ECG waveforms, intervals and segments

The U wave is ordinarily small and follows T wave and usually has the same polarity as T wave.<sup>[1]</sup>

## Heart Rhythm

Heart rhythm is physiologically generated by the SA node. Sign of its healthy functioning is P wave and PQ interval. Rhythm generated in SA node is called the *sinus rhythm*.

## Heart Frequency

Heart frequency or heart rate is based on frequency of ventricular contraction. Can be easily measured from the ECG curve. It is necessary to compare two QRS complexes and measure the time interval between their R waves – RR interval (in seconds):

$$HR = 60/RR$$

Normal heart rate is 55–90/min (varies in different books).

## Links

### Related Articles

- [Electrocardiography](#)
- [ECG Abnormalities](#)
- [ECG Leads](#)

### References

1. KASPER, Dennis L – FAUCI, Anthony S – LONGO, Dan L, et al. *Harrison's principles of Internal Medicine*. 16th edition. New York : McGraw-Hill Companies, Inc, 2005. 2607 pp. pp. 1313-1314. ISBN 0-07-139140-1.