



Heart Rhythm Analysis

Description

The heart rhythm is one of the easiest aspects to evaluate within the electrocardiogram. In most cases it is possible to define it just by looking at the electrocardiogram. However, on some occasions you may need a more detailed analysis.

What is the Heart Rhythm?

The Heart Rhythm can be defined as the succession of all the heartbeats. In an Electrocardiogram the Heart Rhythm is represented by the QRS complexes. Therefore, the Heart Rhythm is the succession of all the QRS complexes throughout the Electrocardiogram.

The Heart Rhythm is normally regular and usually has a heart rate between 60 and 100 beats per minute. When this is not the case then it can be an Irregular Heart Rhythm, which is usually caused by Arrhythmias or other cardiac pathologies.

Regular or Irregular Heart Rhythm

Determining if the Heart Rhythm is regular or irregular is the first step in analyzing the Heart Rhythm on the ECG.

To define it, the RR interval is used. **Remember that the RR interval is the distance between two consecutive R waves.** The most commonly used Lead to analyze the Rhythm is the DII.

A Regular Rhythm is one in which the distance is similar between each RR interval or QRS complex. Whereas when this interval is not similar between each R wave, the Rhythm is considered to be Irregular.

ekg con ritmo regular

Figure 1 – ECG with Regular Rhythm

In Figure 1 an Electrocardiogram (ECG) can be seen in which the QRS complexes, more specifically

the R waves of these, are separated by 13 small squares (highlighted in yellow). If you look closely, this separation is similar between the different RR intervals. So it is confirmed that this ECG has a Regular Rhythm.

It is important to remember that each small square on the ECG has a value of 0.04 seconds. So in the previous example, each QRS complex is separated by 0.52 seconds or 520 milliseconds (ms). This value is constant between each R wave, so the Rhythm is Regular.

ekg con ritmo irregular

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Figure 2 – ECG with irregular rhythm

In Figure 2 we can see an Electrocardiogram with an irregular rhythm. In the first QRS complexes we can observe a distance of 5 large squares or 1 second. While in the last RR interval (marked with the number 5) it can be seen that the distance is only 4 large squares and 1 small square, that is, 840 milliseconds. This difference between the different RR intervals results in an Irregular Heart Rhythm.

Normal Sinus Heart Rate

What is the sinus rhythm?

The Sinus Rhythm is the rhythm that the heart has in a physiological way. In other words, it is the normal rhythm of the heart. The Sinus Rhythm represents the normal electrical activity of the heart in which the electrical impulse produced by the Sinus node in the atria passes to the Atrium Ventricular (AV) node allowing the passage of the action potential.

Representation of the electrical activity of the heart on the ECG

The electrical conduction of the heart is represented in the Electrocardiogram by the different waves, intervals and segments.

conduccion electrica - corazon

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Figure 3 – Electrical Activity of the Heart

In Figure 3 you can see an image that represents the electrical activity of the heart. Let us remember that the activity begins in the Sinus Node at the level of the Atria, which depolarize and contract to allow the passage of blood to the Ventricles. **This first point is represented in the Electrocardiogram as the P Wave.**

The electrical impulse then passes to the Atrioventricular (AV) node. This step generates a small delay in electrical conduction that is represented as the **PR Segment.**

The AV node then sends the electrical impulse through the Bundle of His for Ventricular Depolarization to occur. The one that is represented in the Electrocardiogram as the **QRS Complex.**

Lastly, Ventricular Repolarization occurs, which is represented by the **T Wave** in the Electrocardiogram. In this other article you can read more about the electrical conduction of the heart.

How to determine if the ECG has a Normal Sinus Rhythm

To determine whether the ECG has a Normal Sinus Rhythm should consider the following features:

- It should have a positive P Wave at DI, DII, and aVF. In addition to Precordial Leads V2 to V6. And negative on aVR.
- There should be a QRS complex followed by each P wave.
- The rhythm must be regular. This means that the RR Interval must remain constant in the Electrocardiogram.
- The duration of the PR Interval must be greater than or equal to 0.12 seconds.
- The heart rate should be in the normal range (Between 60 and 100 beats per minute)

Sinus Tachycardia and Bradycardia

Sometimes the Heart Rhythm can be sinus but the heart rate is not in normal ranges. In these scenarios the Rhythm is still considered as Sinus but the name of Tachycardia or Bradycardia is added depending on the Heart Rate.

Sinus tachycardia

This is considered when the **heart rate is above 100 beats per minute** and the Electrocardiogram meets all the characteristics of the Sinus Rhythm.

Taquicardia Sinusal

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Figure 4 – Sinus Tachycardia at 136 beats per minute

In Figure 4 you can see a Sinus Tachycardia. The Electrocardiogram meets the characteristics to be a Sinus Rhythm but when [calculating the heart rate](#) it is observed that it has 136 beats per minute.

Sinus Tachycardia does not necessarily represent the presence of a cardiac pathology. This usually occurs in healthy people when they perform physical activity. It can also be present in infections, shock states and Acute Myocardial Infarction (AMI).

Sinus bradycardia

Sinus Bradycardia is when an Electrocardiogram presents all the characteristics to be considered as Sinus Rhythm but the **heart rate is below 60 beats per minute**.

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Figure 5 – Sinus Bradycardia

In Figure 5 you can see an Electrocardiogram where the Heart Rhythm is Sinus. However, the heart rate is 40 beats per minute.

Sinus Bradycardia can usually be found in patients with drug treatment that includes beta-blockers or Anti arrhythmics. However, it is important that every patient with a heart rate less than 40 beats per minute or with symptoms of dizziness, pre-syncope or syncope, consider and rule out Sinus Node Disease or other bradyarrhythmias.

Heart Rhythm Analysis Video

[su_youtube url="https://www.youtube.com/watch?v=AC9VbZMqMf0?"]

Other Heart Rhythm Alterations

There are cardiac alterations such as Arrhythmias in which the rhythm is different from the Sinual Rhythm. In these cases, Tachycardias and Bradycardias can also occur. If you are interested you can read more about this in our article on Cardiac Arrhythmias.

Category

1. Electrocardiogram

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