

DIAGNOSIS OF SOME CARDIOVASCULAR DISEASES USING THE ELECTROCARDIOGRAPH

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Abstract: Through the patient samples that we obtained from Al-Zahraa Teaching Hospital, some of them were suffering from high rates (a very critical condition), which led to death for some patients, while others were suffering from low rates. Over time, with treatment, their conditions became stable and they were discharged from the hospital. Some of them are in critical condition and may take a long time to recover, and this is what was written in the patient records (patient charts) in the hospital. All of these cases and percentages were identified and diagnosed by an electrocardiogram (ECG) device. Cardiovascular diseases were also discussed in detail in the first chapter, the ECG device is a painless method that helps in diagnosing many common heart problems in the second chapter. In the third chapter, the devices used in measuring (ECG) were discussed, and it was learned how to conduct a medical examination for the patient, the steps of the examination, the reasons for performing the examination, and the uses of the examination. Electrocardiography, the risks of conducting the examination, the type of medical examination for males and females, and its unit of measurement. In the fourth chapter, we discussed the samples obtained from Al-Zahraa Teaching Hospital, explaining each one of them, and comparing them with the healthy sample from a healthy heart.

Keywords: Cardiovascular Diseases, Electrocardiograph.



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Introduction

Cardiovascular diseases are the leading cause of death globally, claiming an estimated 17.9 million lives each year. Cardiovascular diseases are a group of disorders of the heart and blood vessels and include coronary heart disease, cerebrovascular disease, rheumatic heart disease, and other conditions. More than four out of five deaths from cardiovascular disease are due to heart attacks and strokes, and one-third of these deaths occur prematurely in people younger than 70 years [1]

It is the leading cause of disability worldwide. The underlying pathology is atherosclerosis, which develops over many years and is usually advanced by the time symptoms appear, generally in middle age. Cerebrovascular events (strokes) often occur suddenly, and are often fatal before medical care is provided. Risk factor modification can reduce clinical events and premature death in people with cardiovascular disease as well as people at risk of developing cardiovascular disease due to one or more risk factors. The most important behavioral risk factor for heart disease and stroke is unhealthy diet. Lack of physical activity, tobacco use and harmful use of alcohol. The effects of behavioral risk factors may appear on individuals, such as high blood sugar, high blood pressure, high blood fats, overweight and obesity. These “intermediate risk

factors” can be measured in primary care settings and indicate an increased risk of heart attack, stroke, heart failure, and other complications[2].

It has been proven that quitting tobacco use, reducing salt in the diet, eating more fruits and vegetables, regular physical activity, and avoiding the harmful use of alcohol reduces the risk of cardiovascular disease. Health policies that create favorable environments to make affordable and available health choices are essential to motivate people to adopt and maintain healthy behaviors. Access to noncommunicable disease medicines and basic health techniques in all primary healthcare facilities is essential to ensure that those in need are treated and consulted[3]. The ECG is an image of electrical conduction of the heart. By examining the changes from the normal position in the electrocardiogram, doctors can identify several heart disease surgeries[4].

There are two ways to learn to interpret an EKG – pattern recognition (the most common) and understanding the subtle electrical vectors recorded by an EKG as they relate to the electrophysiology of the heart – and most people learn a combination of the two. This educational program combines approaches, as basing ECG interpretation on pattern recognition alone is often insufficient[5].

Electrocardiogram (ECG or EKG from the German Elektrokardiogramm) is a transthoracic (transthoracic or transthoracic) interpretation of the electrical activity of the heart over a period of time, as detected by electrodes attached to the outer surface of the skin and recorded by an external device to the body. The recording resulting from this non-invasive procedure is called an electrocardiogram (also ECG or EKG). An ECG test records the electrical activity of the heart. An electrocardiogram (ECG) is used to measure the rate and regularity of the heartbeat, as well as the size and position of the chambers, the presence of any damage to the heart, and the effects of medications or devices used to regulate the heart, such as a pacemaker.

A 12-lead ECG is one in which 12 different electrical signals are recorded at approximately the same time, and is often used as a one-time recording of an ECG, traditionally printed as a hard copy. Recording the normal rhythmic activity of the heart. This electrical activity of the heart depends on the ability of excitable muscle tissue (such as myocardium or myocardium) to rapidly change its membrane permeability to sodium and potassium ions. When these ions move across the cell membrane, they produce a changing electric field that is recorded as electrical activity of the heart[6][5].

The doctor may perform a physical examination, obtain a comprehensive medical history, and order a number of tests to diagnose coronary heart disease and other types of heart disease.

Coronary heart disease occurs when coronary arteries develop cholesterol deposits in their walls. The condition causes blockages in the arteries that supply oxygen-rich blood to the heart; The arteries also harden and inflammation increases.

CAD can be difficult to treat and may lead to a heart attack or stroke. However, people can take steps to reduce their risk of coronary heart disease by exercising regularly, following a healthy diet, and avoiding or quitting tobacco.

People should seek immediate medical attention if they experience chest pain and shortness of breath, as this may indicate a heart attack.[7]

Cardiovascular diseases

It is a category of diseases that involve the heart or veins. Cardiovascular disease includes heart disease such as angina and dead heart muscle tissue (commonly known as respiratory failure). Other cardiovascular diseases include stroke, heart failure, hypertensive heart disease, cardiomyopathy, abnormal heart rhythms, congenital heart disease, valvular heart disease, carditis, aortic aneurysm, peripheral artery disease, and obstructive disease. Thrombosis, rheumatic heart disease, and venous thrombosis [8].

The underlying mechanisms vary depending on the disease. Heart disease, stroke, and peripheral arterial disease include atherosclerosis. This may be caused by high blood pressure, smoking, diabetes, inactivity, obesity, high cholesterol, poor diet, excessive consumption of alcoholic beverages, and lack of sleep, among others. High blood pressure was assessed to account for approximately 13% of those with cardiovascular disease, while tobacco accounted for 9%, diabetes 6%, inactivity 6%, and weight 5%. Rheumatic heart disease may follow untreated strep throat.

It is estimated that up to 90% of cardiovascular diseases are preventable. Controlling CVD involves developing more risk factors through: following a good diet, exercising, avoiding tobacco smoke, and restricting liquor consumption. Treating risk factors, such as high blood pressure, blood fats, and diabetes is also helpful. Treating individuals with strep throat with antivenom can reduce the risk of rheumatic heart disease. The use of aspirin in people who are otherwise healthy has no clear benefit[9].

Cardiovascular disease is the leading source of death worldwide except in Africa. Cardiovascular disease accounted for approximately 17.9 million (32.1%) in 2015, up from 12.3 million (25.8%) in 1990. Mortality, in lifespan. Certainly, the incidence of cardiovascular disease is more normal and expanding in much of the creating landscape, while rates have declined in much of the developing world since the 1970s. Coronary artery disease and stroke account for 80% of cardiovascular disease cases in men and 75% of female cardiovascular disease cases. Most cardiovascular diseases affect more experienced adults. In the United States, 11% of individuals somewhere between 20 and 40 have it[10-13]

Cardiovascular disease, while 37% are in the range of 40 and 60, 71% of individuals are somewhere between 60 and 80, and 85% of individuals over the age of 80 have cardiovascular disease. The average age of death from coronary artery disease in the created world is around 80 years while in the created world it is around 68 years. The resolution of the disease usually occurs seven to ten years earlier in men than in women. Heart attacks and strokes are serious diseases that result from blockages that prevent blood from flowing to the heart or brain. The most common cause of blockage is the formation of fatty deposits in the inner walls of vessels that supply the heart or brain. Strokes can also occur as a result of bleeding from a blood vessel in the brain or from blood clots [14-16].

Methods

It is a simple procedure. Electrodes are placed on the skin of the chest and connected in a specific order to a device that, when turned on, measures electrical activity throughout the heart. The output usually appears on a long roll of paper displaying a printed graph of the activity on the computer screen. The initial diagnosis of a heart attack is usually made by observing a combination of clinical symptoms and characteristic changes on the electrocardiogram. An EKG can detect areas of oxygen-deprived muscle and/or dead tissue in the heart. If a medication is known to occasionally negatively affect heart function, a baseline ECG may be ordered before the patient starts taking the medication, and follow-up testing may be performed at regular intervals to look for any changes[17].

An EKG is a painless way to help diagnose many common heart problems. Your health care provider may use an EKG to identify or detect[18]: Irregular heartbeat (arrhythmia). If blocked or narrowed arteries in the heart (coronary artery disease) cause chest pain or a heart attack. Whether you have had a previous heart attack. How well some heart disease treatments work, such as a pacemaker. You may need an EKG if you have any of the following signs and symptoms: Source. Dizziness, vertigo, and confusion. Heart palpitations. Pulse speed. shortness of breath. Weakness, fatigue, or decreased ability to exercise. The American Heart Association does not recommend using an EKG to evaluate low-risk adults who are asymptomatic. But if you have a family history of heart disease, your health care provider may suggest an EKG as a screening test, even if you don't have symptoms[19]. If symptoms come and go, they may not be detected during a standard ECG recording. Your health care provider may recommend remote or continuous ECG monitoring. There are several different types. Holter monitor: A Holter monitor is a small, wearable device that records a continuous ECG, usually for 24 to 48 hours. Event Monitor: This portable device is similar to a Holter monitor, but it only records at certain times for a few minutes at a time. You can wear it for longer than a Holter monitor, usually 30 days. Generally you press the button when you feel symptoms. Some devices automatically record when an irregular rhythm is detected[20].

Interpretation of the examination.

The cardiologist interprets the results of the ECG examination, and the ECG test can be considered normal if the number of heart beats per minute ranges between 60-100 beats per minute, specifically 82 beats per minute, and the normal duration of the P wave is equal to 0.11 seconds or less. The PR interval is considered normal if it is between (0.12 – 20) seconds. As for the QRS complex, which combines three graphic deviations, its duration is shorter or equal to 0.12 seconds. As for the QT interval, it is considered normal if it is equal to or less than 0.4 seconds in men, and 0.44 seconds in men. Women[21-23].

Steps followed when performing an ECG:

ECG can be performed on an outpatient basis or in a hospital setting. The type of procedure varies according to the patient's condition and the doctor's evaluation. In general, the following steps are followed when performing an EKG: Any jewelry or other objects that may interfere with the procedure are removed, and the patient can wear glasses, dentures, or hearing aids if he uses any of them. The patient removes clothing items from the waist up and is provided with a gown to wear. The patient lies on a table or bed on his left side, and his back may be supported by a pillow or something similar. The patient is connected to a monitor to record the electrical activity of the heart and monitor the heart during the procedure via small adhesive electrodes. ECG traces that record the heart's electrical activity are compared to images displayed on the echocardiogram screen. The room is kept dark so the technician can view the images on the screen. The technician applies warm gel to the patient's chest and then places the probe on the gel.[24-26] The patient may feel slight pressure when the technician places the probe to obtain the required images of the heart. During the procedure, the technician moves the probe and applies varying amounts of pressure to obtain images of different heart sites and structures. The amount of pressure generated by the probe should not be uncomfortable, and if this happens, the patient should inform the technician about this. The patient may be asked to hold their breath, take a deep breath, or even breathe through their nose during the procedure. The technician may inject a substance to create contrast through a vein if the heart chambers cannot be seen. After completing the procedure, the technician wipes the gel from the patient's chest and removes the electrodes. The patient can then get dressed. The ECG test is performed by attaching electrodes to the chest, arms, and legs, after the individual lies flat on a table or bed. The ECG test takes a few minutes [27].

Results and Discussion

A healthy sample of a healthy heart as shown in:



Figure (1): A sample of a healthy heart

The most important characteristics of a healthy heart sample are: They should have the same direction, duration and shape throughout the entire EKG sheet. During each heartbeat a healthy heart has an orderly progression of depolarization that begins with the pacemaker cells in the atrial node and spreads through the atrium and passes through the atrium. The normal heart rate in a healthy person ranges from 60 to 100 beats per minute, and the heart rate can be determined through electrocardiography when the heart rhythm is regular. The distance between the beats of a healthy heart should be equal. The resting heart rate for adults ranges between 60 and 100 beats per minute. In general, a lower resting heart rate indicates more efficient heart function and better cardiovascular health.

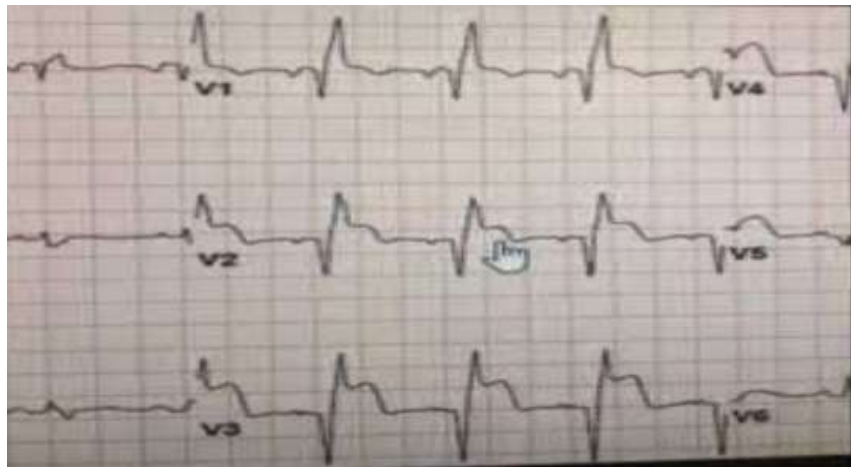


Figure (2) Heart attack

The sample shows the following:

The difference in distance between pulses. Distance differences indicate problems with the heart muscle. In the drawing, there is a pulse surrounded by a small circle. This indicates the presence of a certain heart disease called (heart attack). The ST elevation shown in the sample above is evidence that the patient is suffering from a heart attack. When the patient improves, the ST begins to descend gradually until it reaches its normal location. A heart attack occurs when there is a blockage in one or more of the coronary arteries, which in turn reduces or stops blood flow to the heart, thus depriving part of the heart muscle of oxygen. The tests help the doctor determine the presence of a heart attack, the amount of damage to the heart, and the degree of coronary artery disease a person may have. Tests examine the heart and help the doctor determine treatment and make lifestyle changes, which in turn help maintain heart health and prevent the development of a more severe health condition in the future.

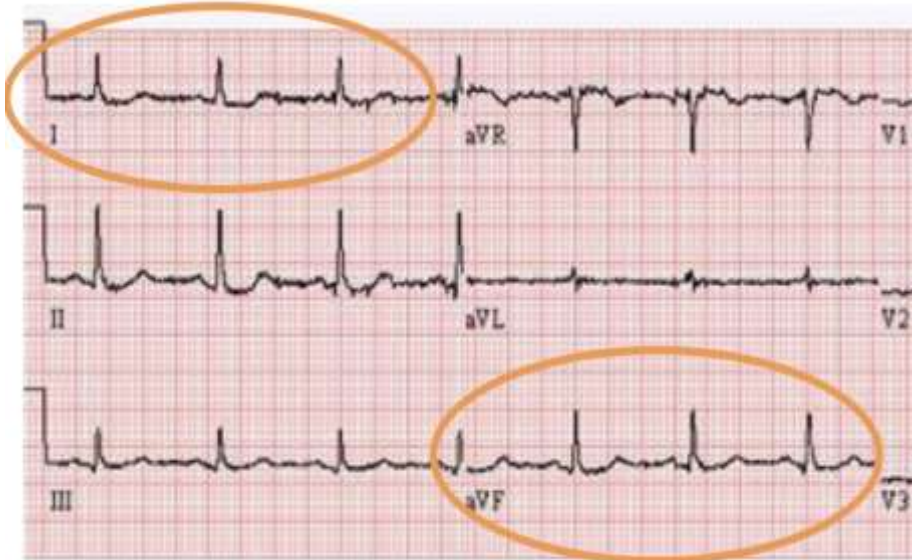


Figure (3) Heart disorders

The sample shows the following: Distance difference between heartbeats. The sample shows that there is an accelerated heartbeat. The surrounded circle indicates the presence of a disease in the heart called (cardiac muscle disorders). Tachycardia Tachycardia may be triggered on its own or by exercise, emotional stress, excessive alcohol consumption, smoking, or use of medications that contain stimulants, such as cold and hay fever medications. It may be caused by hyperthyroidism (producing high levels of thyroid hormone) tachycardia. Bradycardias may be triggered by pain, hunger, fatigue, gastrointestinal disturbances (such as diarrhea and vomiting), or swallowing, which may overstimulate the vagus nerve. If the vagus nerve is overstimulated, which is rare, this may cause Causes the heart to stop beating for a moment. In most of these cases, arrhythmias tend to resolve on their own. Often, a patient’s description of symptoms helps doctors make the initial diagnosis and determine the severity of the arrhythmia. The most important considerations are whether palpitations.

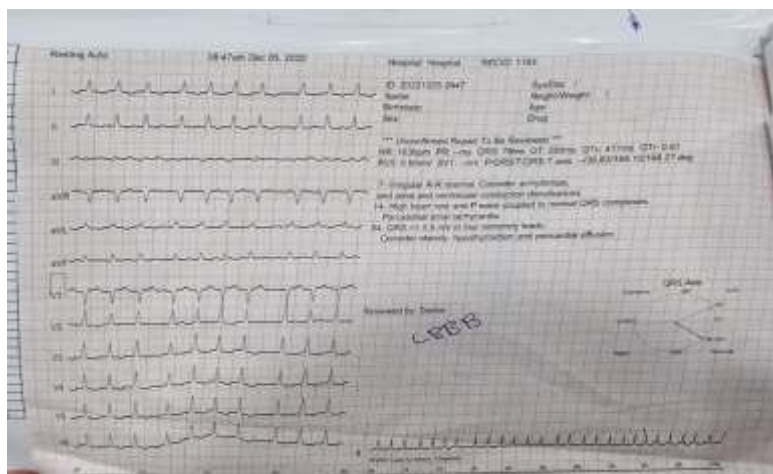


Figure (4) Advanced heart failure

The sample shows the following: The difference in distance between one pulse and another. It also indicates problems with the heart muscle. The sample also indicated and demonstrated the

general and acute deficiency in the heart muscle. The above sample shows that the patient suffers from shortness of breath and rapid heartbeat. The sample shows that the patient's physical examination includes listening to murmur sounds in the heart and measuring the heart rate. The injury begins with damage to the heart muscle and continues in an advanced process of continuous change in the shape of the heart (Remodeling). Thus, the heart muscle thickens while trying to relieve wall tension, then the ventricle expands and the shape of the heart becomes round. This process precedes the appearance of symptoms by several months and even years. Types of heart failure: Types of heart failure or failure include the following. Left-sided heart failure: The heart pumps to transfer oxygen-rich blood from the lungs to the left atrium, which pumps it to the rest of the body. The left ventricle provides most of the energy used in the heart's pumping of blood, so it is larger than the rest of the chambers, and its presence is necessary for its function. The heart, when heart failure occurs on the left side, is forced to work harder to pump the same amount of blood. There are also two types of heart failure on the left side, which are:

- Systolic heart failure, in this case the left ventricle loses its ability to contract normally, which deprives the heart of sufficient strength to push blood into the circulation.
- Heart failure with preserved ejection fraction, also called diastolic heart failure, where the left ventricle loses its ability to relax or relax due to stiffening of the heart muscle, causing it to not fill with blood properly during the rest period between one beat and the next. Heart failure on the right side: The blood coming from the body moves through the veins to the right atrium and then to the right ventricle, then it is pumped from the right ventricle of the heart to the lungs to supply them with oxygen. Heart failure on the right side usually occurs as a result of the failure of the left side of it; Because this increases pressure on the right side of the heart, which ultimately leads to its damage, and when the right side loses ability to pump blood, it returns to the veins of the body, causing swelling in the legs and ankles, and swelling in the abdomen. Congestive heart failure: It is a type of heart failure that requires timely medical care. This term is often used to refer to heart failure in general. When blood flows from the heart, what returns to it through the veins returns to the body's tissues, causing fluid retention. In the legs and ankles, and sometimes fluid can accumulate in the lungs, which may cause shortness of breath, especially when lying down. This condition is called pulmonary edema, and if left untreated it can cause shortness of breath. Congestive heart failure may also affect the kidneys' ability to get rid of sodium and water, and the increase in the amount of water retained in the body causes increased swelling in the body's tissues.

Heart diseases can generally be detected using an ECG device, and these diseases can also be diagnosed using this device. We also determined the patient's ability to resist these diseases, and we obtained some samples from heart patients who were suffering from these diseases. We obtained these samples from Al-Zahraa Teaching Hospital, Electrocardiogram (ECG) Department. One of the leading causes of death in the world is cardiovascular disease. An ECG is a transthoracic interpretation of the electrical activity of the heart over a period of time. A 12-lead ECG is one in which 12 different electrical signals are recorded at approximately the same time. To reduce the risk of coronary heart disease by exercising regularly. To prevent cardiovascular disease by up to 90% by: following a good diet, exercising, avoiding tobacco smoke, and restricting alcohol consumption. An EKG is a painless, non-invasive way to help diagnose many common heart problems. Some of these patients have completely improved, some have not completely improved, some have completely improved from

the disease and have been discharged from the hospital, some have become critical in condition and have been placed under observation, and some have died due to complications, and this has led to cardiac arrest. This is the most prominent results of the examination using an ECG device. According to the International General Classification of Diseases [28,29].

Conclusion

In this study concluded that Electrocardiography, the risks of conducting the examination, the type of medical examination for males and females, and its unit of measurement. In the fourth chapter, we discussed the samples obtained from Al-Zahraa Teaching Hospital, explaining each one of them, and comparing them with the healthy sample from a healthy heart.

References

- [1] Adam Felman (7-2-2018), "Everything you need to know about heart disease" , 13-9-2020. Edited.
- [2] World Health Organization. Prevention of Cardiovascular Disease. Guidelines for assessment and management of cardiovascular risk. Geneva, 2007.
- [3] World Health Organization. Prevention of recurrent heart attacks and strokes in low and middle income populations. Evidence-based recommendations for policy makers and health professionals. Geneva, 2003.
- [4] C. Michael Gibson, M.S., M.D. ; Assistant Editor(s)-in-Chief: Rim Halaby, Introduction to ECG https://www.wikidoc.org/index.php/Introduction_to_ECG
- [5] S.Z. Mahmoodabadi, A. Ahmadian, and M. D. Abolhasani, "ECG Feature Extraction using Daubechies Wavelets," Proceedings of the fifth IASTED International conference on Visualization, Imaging and Image Processing, pp. 343-348, 2005.
- [6] Juan Pablo Martínez, Rute Almeida, Salvador Olmos, Ana Paula Rocha, and Pablo Laguna, "A Wavelet-Based ECG Delineator: Evaluation on Standard Databases," IEEE Transactions on Biomedical Engineering Vol. 51, No. 4, pp. 570-581, 2004.
- [7] Li, M., et al. (2019). Statins for the primary prevention of coronary heart disease. <https://www.hindawi.com/journals/bmri/2019/4870350/>.
- [8] College of Medicine and Health Academy, Nigeria, 17 Jul 2021; Note on Cardiovascular Disease and its Types ; Published 28 Jul 2021.
- [9] What is cardiovascular disease? (2017). <https://www.heart.org/en/health-topics/consumer-healthcare/what-is-cardiovascular-disease>
- [10] Coronary artery disease (CAD). (2019). http://www.cdc.gov/heartdisease/coronary_ad.htm.
- [11] Jacobson, T. A. (2013). Lipoprotein(a), cardiovascular disease, and contemporary management. <https://www.ncbi.nlm.nih.gov/pubmed/24182706>.
- [12] Heart disease. (2019). <https://www.cdc.gov/heartdisease/>.
- [13] Goldman L, et al., eds. Approach to the patient with suspected arrhythmia. In: Goldman-Cecil Medicine. 26th ed. Elsevier; 2020. <https://www.clinicalkey.com>. Accessed March 27, 2020.
- [14] National Heart, Lung, and Blood Institute: "Heart and Vascular Diseases."
- [15] American Heart Association: "Peripheral Vascular Disease," "Aneurysm, Aortic."
- [16] What causes an arrhythmia? National Heart, Lung, and Blood Institute. <http://www.nhlbi.nih.gov/health/health-topics/topics/arr/causes>. Accessed March 27, 2020.
- [17] American Heart Association: "The American Heart Association Diet and Lifestyle Recommendations," "Cardiac Catheterization," "Cardiac Computed Tomography (Multidetector CT, or MDCT)," "Cardiac Medications," "Cardiac Procedures and Surgeries," "Chest X-Ray," "Echocardiogram (Echo)," "Exercise Stress Test," "Electrocardiogram (ECG or EKG)," "Heart Attack Symptoms in Women," "Holter Monitor," "How to Help Prevent

- Heart Disease at Any Age," "Life After a Heart Attack," "What Is Coronary Angioplasty?"
- [18] Electrocardiogram. National Heart, Lung, and Blood Institute. <http://www.nhlbi.nih.gov/health/health-topics/topics/ekg>. Accessed March 27, 2020.
- [19] Goldman L, et al., eds. Approach to the patient with suspected arrhythmia. In: Goldman-Cecil Medicine. 26th ed. Elsevier; 2020. <https://www.clinicalkey.com>. Accessed March 27, 2020.
- [20] AskMayoExpert. Ambulatory heart rhythm monitoring. Mayo Clinic; 2021.
- [21] NHS. Electrocardiogram (ECG). Retrieved on the 9th of October, 2020, from: <https://www.nhs.uk/conditions/electrocardiogram/>
- [22] Bonow RO, et al., eds. Electrocardiography. In: Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine. 11th ed. Saunders Elsevier; 2019. <https://www.clinicalkey.com>. Accessed March 27, 2020.
- [23] William C. Shiel. Electrocardiogram (ECG or EKG). Retrieved on the 9th of October, 2020, from: https://www.medicinenet.com/electrocardiogram_ecg_or_ekg/article.htm
- [24] Hopkinsmedicine. Electrocardiogram. Retrieved on the 9th of October, 2020, from: <https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies>.
- [25] Sources of these results and explanation of samples from Al-Zahraa Teaching Hospital __ in Wasit
- [26] NHS. Electrocardiogram (ECG). Retrieved on the 9th of October, 2020, from: <https://www.nhs.uk/conditions/electrocardiogram/>
- [27] William C. Shiel. Electrocardiogram (ECG or EKG). Retrieved on the 9th of October, 2020, from: https://www.medicinenet.com/electrocardiogram_ecg_or_ekg/article.htm
- [28] Hopkinsmedicine. Electrocardiogram. Retrieved on the 9th of October, 2020, from: <https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/>
- [29] ElectrocardiogramQueen's University. Analysis and Interpretation of the Electrocardiogram. Retrieved on the 9th of October, 2020, from: https://elentra.healthsci.queensu.ca/assets/modules/ts-ecg/normal_ecg.html