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Electrocardiograph (ECG) Findings on Rheumatic Heart Disease Patient in Port Sudan

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Abstract: ***Background: Rheumatic heart disease (RHD) is regarded as a main cause of acquired heart disease in young people worldwide. Objective: To evaluate the ECG changes in rheumatic heart disease patient, To estimate incidence of atrial fibrillation in patients of rheumatic heart disease, to study clinical correlation of atrial fibrillation in term of mitral valve area in mitral stenosis. Methods: The 115 rheumatic heart disease patients who visited the cardiology referral clinic at Digna Price Hospital in Port Sudan, Sudan, between 2018 and 2020 are the subjects of this convenience study. When each of them had received information about the study, they all signed informed consent forms. The fundamental pieces of information that were acquired through an interview questionnaire included age, gender, ethnicity, and blood pressure, 12 leads ECG was down to each patient. Results: Only 18.3% of the rheumatic heart disease patients in this study had atrial fibrillation, while the majority of their electrocardiograph (ECG) rhythms (81.7%) were sinus rhythm. Significant correlations between mitral stenosis and variations in ECG rhythm were discovered in this study (p value =.000). The presence of AF was significantly correlated with left a trial diameter and congestive heart failure (p value =.001, 008).***

Keywords: ECG, rheumatic heart disease

1. Introduction

Background:
Rheumatic heart disease (RHD) is regarded as a main cause of acquired heart disease in young people worldwide. RHD is an immunological response to group A beta-haemolytic streptococcal infection. [(1)] With a population of 34 million, a poverty rate of 46.4%, a per capita income of US$1 270, and a human development index of 0.414, Sudan is the third-largest country in Africa. Social divisions created by political turmoil have resulted in internal relocation of thousands of families in the Darfur region. [(2)]

Rheumatic heart disease progresses from being subclinical (no murmur) to being clinically definite (present murmur), causing heart failure, and ultimately necessitating surgery till death. [(3)]

Objective:
To evaluate the ECG changes in rheumatic heart disease patient, to estimate incidence of a trial fibrillation in patients of rheumatic heart disease, to study clinical correlation of atrial fibrillation in term of mitral valve area in mitral stenosis.

Electrocardiogram (ECG):
The most crucial and critical diagnostic tool for rheumatic heart disease is the echocardiogram; an ECG test measures the frequency and intensity of the heart's electrical activity. It displays irregular heartbeats (arrhythmias or dysrhythmias) and occasionally can identify cardiac muscle injury. Myocarditis can cause heart conduction abnormalities, which can be normal. An electrocardiogram (EKG) is therefore required. First-degree, second-degree, or third-degree AV block are only a few of the different types of heart blocks that can be seen on an Electrocardiogram. [(4)] and the discovery of endocarditis as a complication.

Atrial Fibrillation (AF):
RHD frequently leads to atrial fibrillation as a consequence. A poor prognosis is associated with atrial fibrillation in any form, whether it is present with or without valve operation. The incidence of atrial fibrillation depends on the kind of valvular involvement [(5-7)] Those with combined mitral valve disease and tricuspid regurgitation had a higher rate of atrial fibrillation (70%) than those with isolated MS (29%) or isolated MR (16%). [(5)] Heart failure, stroke, peripheral thromboembolism, and early death are atrial fibrillation complications. [(6)] Small, single-center randomized trials have shown the effectiveness and superiority of rhythm control over rate control with nondihydropyridine calcium channel blockers or-blockers for the treatment of symptomatic atrial fibrillation and maintenance of sinus rhythm, but these techniques are not transferable to a larger population. [(7)] Age, left ventricular ejection fraction, left atrial size, left atrial

strain, and right atrial pressure are all risk factors for atrial fibrillation. [8]

When there is atrial fibrillation or atrial flutter, direct-acting oral anticoagulants, such as vitamin K antagonists, direct thrombin or factor Xa inhibitors, are advised for anticoagulation (stroke prevention). [9]

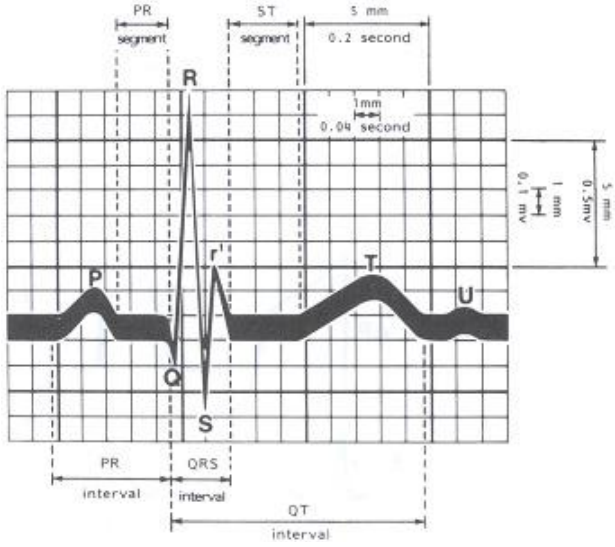
Acute rheumatic fever is known to cause first-or third-degree heart blocks, which affect one-fifth to three-fifths of patients. [10, 11]

Endocarditis:
Even though it's a serious illness, IE still has significant death rates, which are close to 30% after one year. [12] In Western nations, where IE has developed into a healthcare-related condition in older individuals soon after heart valve surgery, the epidemiology and management of IE have undergone significant change over the past two decades. Due to a lack of statistics from low-income nations, the exact cost of IE is yet unknown. RHD was discovered to be the underlying valve disease in only a few studies from LMICs, accounting for 5.4% to 77% of cases. [13] Oceanic Islanders had a much greater incidence of IE than non-Oceanic (mostly European) inhabitants in New Caledonia, a French Pacific island. Streptococcus spp. (also known as oral streptococci) IE was present in almost 35% of the Oceanic islanders with RHD, making it the most prevalent underlying valve disease. [14] Thus, IE traits may vary between nations where RHD is still endemic and those where it has almost completely disappeared.

2. Methods

The 115 rheumatic heart disease patients who visited the cardiology referral clinic at Digna Price Hospital in Port Sudan, Sudan, between 2018 and 2020 are the subjects of this convenience study. When each of them had received information about the study, they all signed informed consent forms. The fundamental pieces of information that were acquired through an interview questionnaire included age, gender, ethnicity, and blood pressure.

The 12 leads ECG Technique:
The plane in front of By placing an electrode on each of the patient's four extremities while they are lying down and resting, the ECG is captured. A stream of electricity flowing from the right to the left will be reflected as an upward deflection in lead I of the recording because bipolar lead I records the difference of potential between the left arm and right arm, with the left arm acting as the positive pole. The left leg serves as the positive pole in Lead II, which records the difference in potential between the right arm and left leg. Lead III documents the probable distinctions between the left arm and left leg, with the latter being once more positive. The "augmented leads" aVR, aVL, and aVF record the potential difference between the right arm, left arm, or leg, respectively. The precordial leads, the ground lead, is created by adding the other two unused limb leads, V1 through V6, which are situated on the left lateral and anterior chest, The V1 electrode location is situated next to the sternum in the fourth right intercostal region. The fourth left intercostal gap, next to the sternum, is where the V2 electrode location is situated. The electrode position for V3 is situated in the middle of a line that connects the electrode positions for V2 and V4. The fifth left intercostal gap along the midclavicular line is where the V4 electrode location is situated. In the anterior axillary line, the V5 electrode position is situated at the same level as the V4 electrode position. The V6 electrode position shares the same plane as the V4 and V5 electrode sites on. In each case, the electrode acts as the positive pole, and the negative pole is created by electrically connecting all the limb leads, causing an upward deflection on the recording when an electrical current is traveling toward one of the precordial leadsEach lead is recorded individually by the ECG device, either sequentially or, in some instruments, concurrently. The recording paper moves at a constant, present pace of 25 millimeters per second as the stylus moves, depending on the voltage it is reflecting. As a result, the horizontal axis on the recording paper represents time, and the vertical axis reflects voltage. A grid with lines spaced 1 mm apart in the vertical and horizontal axes is used to record the signal. Each 1 mm on the horizontal axis corresponds to 0.04 seconds (40 msec), and every 5 mm, which is indicated by a bold line, corresponds to 0.2 seconds. The recording must be carefully calibrated so that a vertical deflection of 1 mm corresponds to 0.1 mV and a vertical deflection of 5 mm, again illustrated by a more bold line, corresponds to 0.5 mV.



Conventionally, the P wave is the first upward displacement from the baseline and it represents atrial depolarization. The P wave shouldn't be wider than 0.11 seconds or taller than 2.5 mm (i.e., less than three small boxes high and wide).

The QRS complex symbolizes the depolarization of the ventricles. After the P wave but before an upward deflection, the Q wave is the first negative deflection from the baseline. The Q wave often represents ventricular septal depolarization and has duration of less than 0.03 seconds. Following the P wave, the R wave is the first positive deflection and reflects the depolarization of the ventricular mass. The negative deflection after the positive R wave, which symbolizes later ventricular depolarization, is the S wave. Following the QRS complex, the T wave, which reflects ventricular repolarization, can be positive or negative in deflection. The T wave's size is similar to that of

the QRS complex, and its polarity is similar to that of the primary QRS polarity.

The U wave, which typically has the same polarity as the T wave, may occasionally follow the T wave.

Whether a Q or a R initiates the P wave, the time between the P wave and the beginning of the QRS is known as the PR interval. This interval represents the amount of time needed for the atria to depolarize and for the atrioventricular node and bundle branches to conduct electrical current before the ventricle depolarizes. The time span between the start of the Q wave and the end of the S wave, which includes ventricular depolarization, is known as the QRS interval. The QT interval, which includes both ventricular depolarization and repolarization, is the period between the start of the Q wave and the end of the T wave.

The study was characterized using frequency, means for a number of quantitative characteristics, and student's t-test utilizing SPSS version 21 for data collection and analysis. Cross tabulation, the chi square test, odd ratio, and regression were used on certain data to compare some variables. The P value was considered significant when it was equal to or less than 0.05.

The ethics committee received a letter of authorization from the Digna Price Hospital.

3. Results

Most of ECG rhythm of rheumatic patient in this study were sinus rhythm (81.7%) while only (18.3%) with atrial fibrillation. (table 1)

ECG Rhythm	Frequency	%
AF	21	18.3
Sinus Rhythm	94	81.7
Total	115	100

The mean heart rate (HR) of this study was 80.2 ±SD 12.03.

Only one patient had stroke and arterial fibrillation in this study.

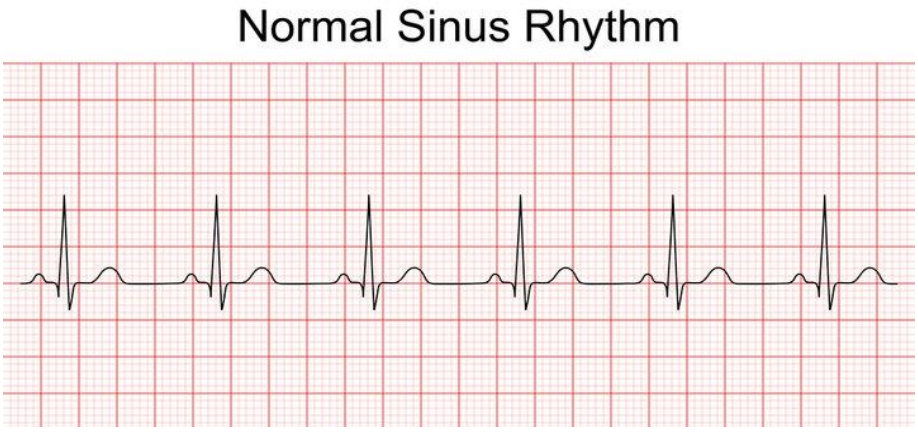


Figure 1: Normal sinus rhythm ECG

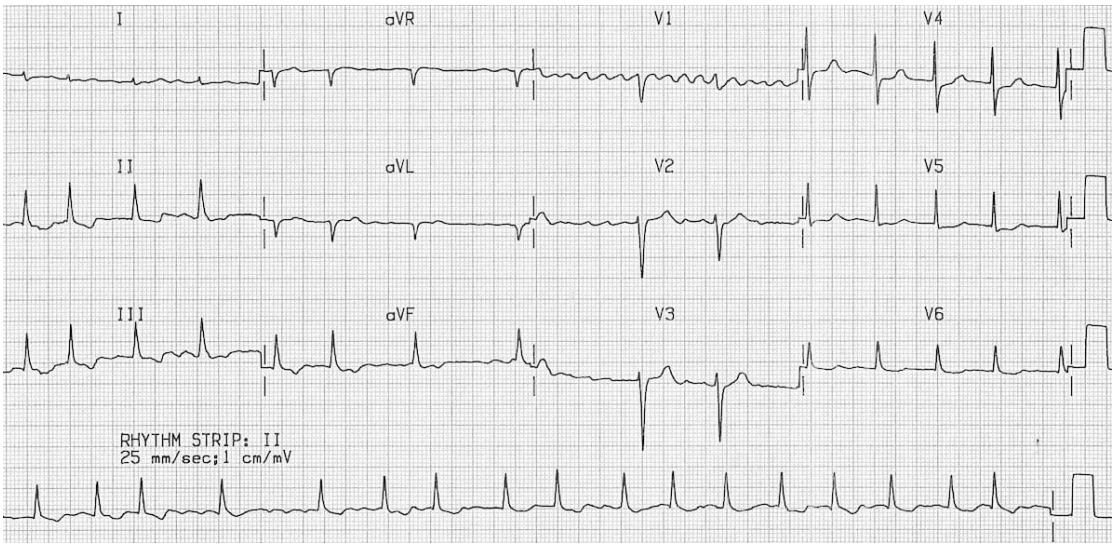


Figure 2: ECG of patient with Atrial fibrillation

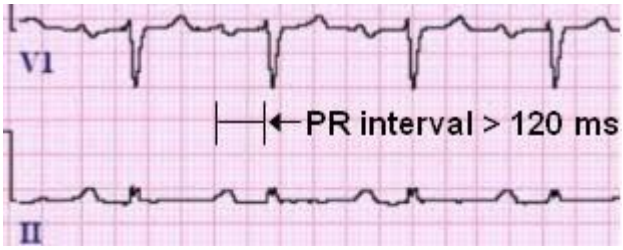


Figure 3: ECG with prolonged PR interval.

Out of a total of 44 individuals with mitral disease, only 4 people in this study had AF without having mitral valve disease (figure 4)

Significant correlations between mitral stenosis, variations in ECG rhythm, were found (p value =.000).

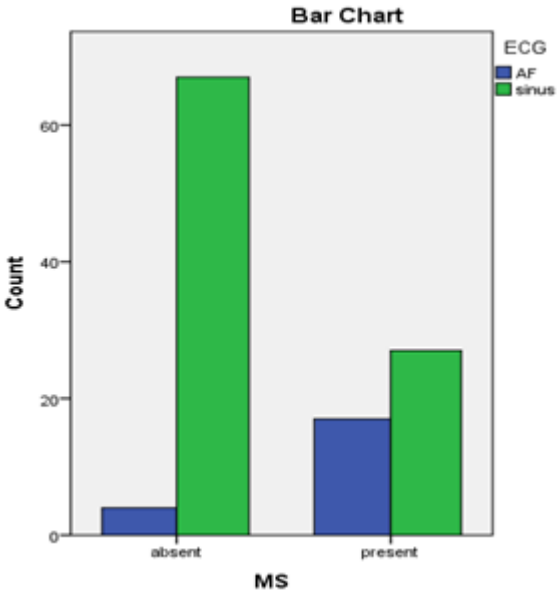


Figure 4: The relation between presence of MS and AF.

In this study, there was a significant correlation between the presence of AF and congestive heart failure (p value =.008); 7 patients out of 17 had the condition. (Figure 5).

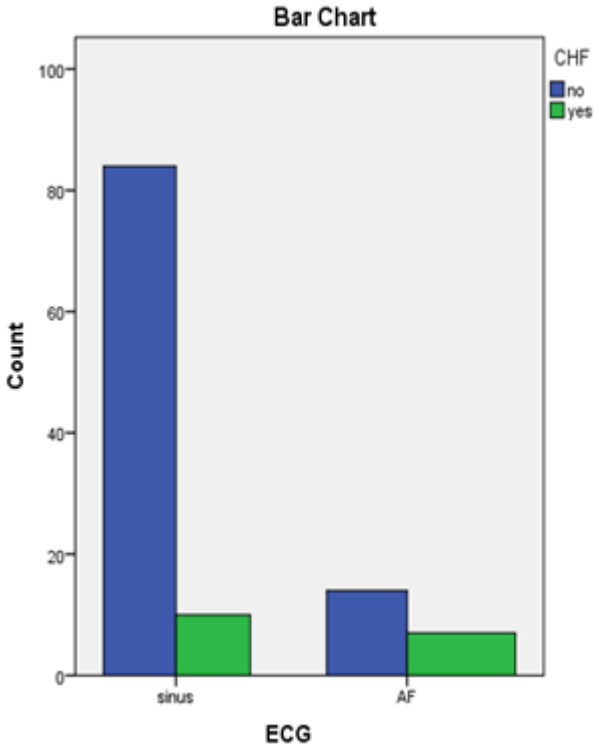


Figure 5: Presence of congestive heart failure and AF rhythm

The mean ejection fraction was same between sinus and AF patients (p value =.208) table (2)

Table 2: The mean EF of sinus and AF patients

The mean EF	ECG	
	Sinus	AF
Mean	58.1	52.9
±SD	12.1	10.9

There was significant relation between left atrial diameter (LAD) and ECG changes table (3)

Table (3) The difference median of LAD between sinus and AF rhythm

Table 4: The independent comparison of EF with MS, MR, AR

LAD				
		Median (Q_1, Q_3)	Difference	P-Value
ECG	Sinus n= 94	35 (30, 42.5)	-19 (-15,-18.5)	0.001
	AF n= 21	54 (45, 61)		

4. Discussion

There was poor data about ECG findings in rheumatic heart disease.

In this result 21 out of 115 cases (18.3%), (with mitral or other valves), with diameters. The incidence of atrial fibrillation was 41 out of 94 cases (43.61%). The highest incidence of atrial fibrillation was in the age group of 21-30 yrs (55%) and the incidence was more in females (72.72%) as compared to males (27.27%). The incidence of atrial fibrillation in patients with pure mitral stenosis was 48.2% and in cases of predominant mitral regurgitation 43.3%. [(15)]

The feature of rheumatic heart disease from ECG recordings A PR elongation was seen in 47.2% of the instances, and a prolonged QRS was seen in 26.4% of the cases. In 44.3% of the instances, the QTc was prolonged. Moreover, 62.2% of the subjects were found to have bradycardia. Significance. The final goal of this research can lead to new medical equipment and services that can screen RHD based on ECG. [16]

Have been acknowledged as being an important step in managing and combating RHD. According to a research done at the Buea Regional Hospital in Cameroon, between 70 and 95 percent of respondents had little to no understanding about RHD [17]. Lack of proper information regarding RHD may have an impact on patients delaying treatment, which increases the likelihood of developing chronic RHD [18]. Rheumatic fever (RF) and RHD awareness levels among primary healthcare providers in Khartoum, Sudan, and Cape Town, South Africa, have been found to be appalling in previous research . [19, 20] A met a-analysis of data from Tanzania and Uganda revealed that one of the biggest barriers to effective RHD control was caregivers' lack of understanding of RF/RHD. [21]

5. Conclusions

The majority of the study's ECG rhythms were sinus rhythms.

The existence of an AF rhythm brought on by mitral stenosis, which causes the left atrial diameters to rise.

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