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Electrocardiographic Abnormalities in Heart Failure Patients at a Teaching Hospital in Kumasi, Ghana

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Abstract

The resting 12-lead Electrocardiogram (ECG) is very useful in the diagnosis, prognosis and treatment of heart failure. There are limited data on the prevalence of ECG abnormalities in heart failure in Ghana. This retrospective study was therefore designed to determine the prevalence of ECG abnormalities among heart failure patients attending a cardiac clinic at the Komfo Anokye Teaching Hospital (KATH), Kumasi, Ghana. Medical records of 398 patients diagnosed with heart failure were selected from the cardiac clinic, using simple random sampling. The demographic, clinical and chest X-ray characteristics of the patients were examined. The 12-lead resting ECGs were obtained from 394 of the patients. The ECGs were abnormal in 93% (n=367) of the patients. The main ECG abnormalities included: left ventricular hypertrophy (43.7%), left axis deviation (39.6%), left bundle branch block (19.2%), and left atrial enlargement (25.6%). Arrhythmias seen included: ventricular extrasystoles (11.2%), atrial fibrillation (8.9%), complete heart block (5.3%), and ventricular tachycardia (3.6%).

In conclusion, our study has shown that ECG abnormalities are very common among heart failure patients attending cardiac clinic in Kumasi, Ghana.

Keywords: Arrhythmia; Atrial fibrillation; Non-sustained ventricular tachycardia; Atrial flutter; Heart failure

Introduction

The resting 12-lead Electrocardiogram (ECG) is widely available in the developed world. The ECG is a non-invasive and relatively easy bedside test to perform. It is mostly used cardiovascular diagnostic test, and it is performed by cardiologists and other physicians who are not cardiologists. However, the ECG is largely unavailable in many healthcare facilities in sub-Saharan African.

The ECG is an essential test in the evaluation of patients with heart failure. The European Society of Cardiology and the National Institute for Clinical Excellence of UK recommend the use of the ECG in the diagnosis of patients with suspected heart failure [1,2].

The ECG is very useful in the diagnosis and prognosis of heart failure. It also provides important information for decisions about treatment of heart failure. The ECG may identify the aetiology of the heart failure. It may also determine the precipitating factor of the heart failure in patients presenting with acute heart failure.

The ECG shows the heart rate and the rhythm, electrical conduction and chamber enlargement. Studies have shown that heart failure is very unlikely (likelihood <2%) if patients present acutely and the ECG is completely normal [3-9]. In patients with a non-acute presentation, a normal ECG has a somewhat lower negative predictive value (likelihood, 10-14%) [4-6,9].

There are limited data on the prevalence of ECG abnormalities in heart failure in Ghana. This study was therefore designed to determine the prevalence of ECG abnormalities among heart failure patients attending a cardiac clinic at the KATH, Kumasi, Ghana.

Materials and Methods

This was a retrospective study carried out at the cardiac clinic of Komfo Anokye Teaching Hospital (KATH), Kumasi, Ghana. Ethical approval was obtained from the appropriate ethical committee. Medical records of 398 patients diagnosed with heart failure were selected from the cardiac clinic, using simple random sampling. The demographic, clinical, chest X-ray and 12-lead resting Electrocardiographic (ECG) characteristics of the patients were examined. Heart failure was diagnosed, using the modified Framingham criteria for the diagnosis of heart failure [10-12].

Major criteria included

Paroxysmal nocturnal dyspnoea, raised jugular venous pressure, clinical cardiomegaly, basal crepitations, S3 gallop, clinical acute pulmonary oedema, pulmonary upper lobe blood diversion on chest X-ray (or pulmonary oedema on chest X-ray).

Minor criteria included

Tachycardia, orthopnoea, exertional dyspnoea, nocturnal cough, hepatomegaly, pleural effusion, diuretic use.

Heart failure was diagnosed if the patient had two major and one minor or one major and two minor criteria. Resting 12-lead ECGs were obtained from 394 of the heart failure patients. The ECGs were examined for the heart rate, the rhythm, electrical conduction, chamber enlargement, arrhythmias, and other abnormalities. Left ventricular hypertrophy was diagnosed using Scott's criteria (Table 1) [13].

Limb leads	R in 1+ S in 3	More than 25mm
	R in a VL	More than 7.5 mm
Chest leads	S in V_1 or V_2 + R in V_5 or V_6	More than 35mm
	R in V_5 or V_6	More than 26 mm
	R + S in any v lead	More than 45mm

Table 1: Left ventricular hypertrophyusing Scott's criteria

Statistical analysis

Data from the patients' medical records were entered into a Microsoft Excel (2010) sheet. Data were cleaned and abnormal variable and wrong entry removed or changed. Data were then exported into SPSS 12.0 software for analysis. Descriptive analysis of baseline parameters was provided. Measure of central tendency using mean was calculated, and measure of spread using standard deviation and range were also calculated.

Results

Three hundred and ninety-eight (398) heart failure patients were studied. The demographic characteristics of the patients have been published elsewhere [14]. ECGs were obtained from 394 patients. The ECGs were abnormal in 93 % (n=367) of the patients, and normal in 7% (n=27) of the patients. Figure 1 shows the heart rate of the heart failure patients. The heart rate of the patients ranged from 28-197 beats/minute with the mean (± standard deviation) heart rate of 84.9 (± 25) beats/minute. The QRS duration ranged from 60-194 milliseconds with the mean (± standard deviation) QRS duration of 98.7 (27.6) milliseconds.

Tables 2 and 3 shows the prevalence of arrhythmia and other ECG abnormalities seen in the heart failure patients. The main ECG abnormalities included: left ventricular hypertrophy (43.7%), left axis deviation (39.6%), left bundle branch block (19.2%), and left atrial enlargement (25.60%). Arrhythmias seen included: ventricular extrasystoles (11.2%), atrial fibrillation (8.9%), complete heart block (5.3), and ventricular tachycardia (3.6%).

Discussion

Our study found out that 93% (n=367) of the ECGs examined were abnormal, and only 7% (n=27) of the ECGs were normal. This finding is similar to what was reported by Khan et al. who found only 136 (<2%) normal ECGs out of 9315 ECGs of heart failure patients [9]. This study has clearly shown that ECG abnormalities are highly prevalent among patients with heart failure in Kumasi, Ghana. Other studies have also shown that ECG abnormalities are not only common in heart failure patients, but also in patients with higher risks for cardiovascular disease [3-7,9,15,16].

ECG left ventricular hypertrophy has been recognized as a risk factor for cardiovascular disease and cardiac death for some time [17-19]. Studies have shown higher prevalence in blacks than the caucasian race [20-22]. The reason for the higher prevalence rate of left ventricular hypertrophy among black populations is not clear. In this study, the most common ECG abnormality was LVH which was seen in 43.7 % of the heart failure patients. Earlier study among hypertensive heart failure patients in Kumasi, Ghana found a higher prevalence of left ventricular hypertrophy (91.5%) [15]. Uncontrolled hypertension leads to left ventricular pressure overload which eventually results in left ventricular concentric hypertrophy. Left ventricular hypertrophy therefore, tends to be present in almost all hypertensive patients who present with heart failure.

The prevalence of atrial fibrillation in our study was 8.9%. Higher prevalence rates have been reported by earlier studies [9,22,23]. A study in Kano, Nigeria found a prevalence rate of atrial fibrillation among heart failure patients as 19% [23]. Another study in South-West Nigeria reported a prevalence rate of 20.7% [24]. Khan et al. found a higher prevalence rate (27%) of atrial fibrillation and atrial flutter among heart failure patients in a multi-centre study [9]. Identification of atrial fibrillation in heart failure is very important because current guidelines recommend that these patients should receive anticoagulants, unless contraindicated [1].

The prevalence rate of left bundle branch block in our study was 19.3%; this is higher than the prevalence rate reported in Kano, Nigeria [23]. Studies have shown that left bundle branch block is associated with an increased risk of cardiovascular mortality [23,25-27]. The ECG has an important role in guiding therapy. Besides patients with atrial fibrillation who might require anticoagulant treatment, several treatment modalities are now available for patients with heart failure depending on certain ECG abnormalities present [1,28,29]. For
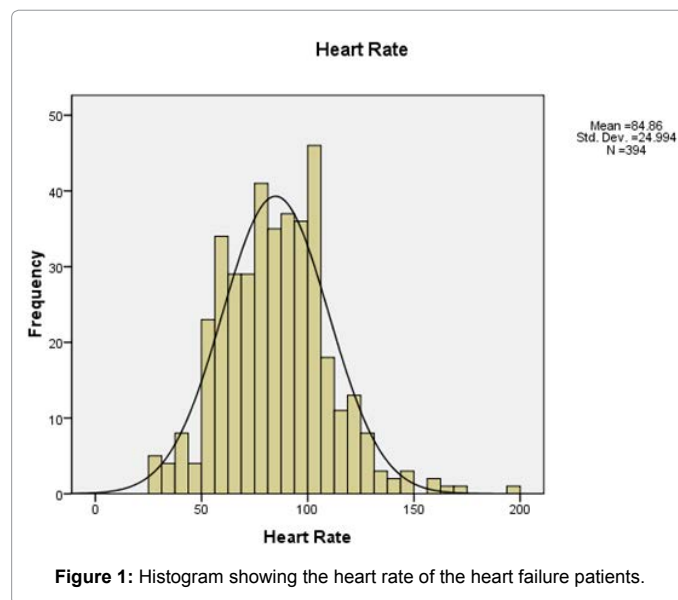

Figure 1: Histogram showing the heart rate of the heart failure patients.

Arrhythmia	N	%	Heart Rate (Beats/Minute) Mean	Range
Sinus Rhythm Disorder				
Sinus Tachycardia	81	20.5	113	101-139
Sinus Bradycardia	36	9.1	53	38-59
Supraventricular Arrhythmias				
Atrial Fibrillation	35	8.9	95	52-168
Atrial Flutter	5	1.3	100	75-150
Junctional Tachycardia	6	1.5	163	150-180
Supraventricular Extrasystoles	13	3.3	90	55-118
Ventricular Arrhythmias				
Ventricular Tachycardia	14	3.6	160	150-197
Ventricular Extrasystoles	44	11.2	91	46-151
Conduction Defects				
Complete Heart Block	21	5.3	31	22-40
Second Degree Atrioventricular Block	9	2.3	50	42-60
Complete Left Bundle Branch Block	76	19.3		
Left Anterior Hemiblock	34	8.6		
Left Posterior Hemiblock	4	1		
Complete Right Bundle Branch Block	37	9.4		

Table 2: The prevalence of arrhythmia among the heart failure patients.

ECG Abnormality	Percent
Left ventricular hypertrophy	43.70
Right ventricular hypertrophy	6.70
Left atrial enlargement	25.60
Right atrial enlargement	10.50
Biatrial enlargement	6.70
Left axis deviation	39.60
Right axis deviation	7

Table 3: Other ECG abnormalities seen in the patients.

instance, QRS duration of ≥ 120 ms in a patient with heart failure indicates the need for evaluation for device therapy, including implantable defibrillators and cardiac resynchronization therapy [29]. The ECG provides an accurate and objective measure of heart rate that may be used to guide both pharmacological and device therapy.

Conclusion

In conclusion, our study has shown that ECG abnormalities are very common among heart failure patients attending cardiac clinic in Kumasi, Ghana. The ECG is very useful not only in the diagnosis and aetiology of heart failure but also it helps in identifying important complications of heart failure that might influence the choice of treatment.

Acknowledgement

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