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Factors Associated with Electrocardiographic Abnormalities among Heart Failure Patients at Kampala International University Teaching Hospital, Ishaka, Uganda.

Yves Tibamwenda Bafwa, Dafiewhare Onokiojare Ephraim, Charles Lagoro Abonga and Sebatta Elias

Department of Internal Medicine of Kampala International University, Uganda.

ABSTRACT

The prevalence of cardiovascular diseases is increasing rapidly in Sub-Saharan Africa. A multicenter prospective cohort study of 1,006 patients with acute heart failure in a Sub-Saharan Africa Survey showed that 814 patients had ECGs readings among which 97.7% had abnormalities. There is paucity of data on ECG abnormalities among heart failure patients in many developing countries, Uganda inclusive. A cross sectional study was conducted at KIU-TH between January and March 2020 which recruited 122 heart failure patients. Questionnaires were administered to respondents to obtain factors associated with ECG abnormalities. A 12-lead ECG machine was used to obtain ECG findings. Data were analyzed using bivariate and multivariate logistic regression analyses to establish the association between each independent variable and the ECG abnormalities. The mean age of study respondents was 62.4 ± 20 years and 54.9% of the respondents were females. The factors associated with ECG abnormalities were age ≥ 50 years (aOR = 23.1, 95% CI: 1.81 – 294.33, p= 0.016), smoking (aOR = 23.6, 95% CI: 1.19 – 465.86, p= 0.038), hypertension (aOR = 11.9, 95% CI: 1.05 – 135.65, p= 0.046) and being in NYHA functional class III and IV (aOR = 168.7, 95 % CI: 6.85 – 4155.5, p=0.002).Respondents aged above 50 years, smokers, hypertensive and those staged in NYHA functional class III and IV were at high risk of having abnormal ECG.

Keywords: Electrocardiographic Abnormalities, ECG, Heart Failure, Uganda.

INTRODUCTION

With more than 100 years of development, the history of electrocardiograph (ECG) has been complicated and unorganized [1]. [2], observed while dissecting a frog, that electric stimulation of frog nerves could cause muscle contraction, which he called “animal electricity”. This discovery revealed the biological basis of electrophysiology. Later, the first ECG of a human being was recorded in 1869 with a siphon instrument by Muirhead in London [1]. With the introduction of chest x-ray in 1895 by Roentgen and the electrocardiograph (electrocardiogram) in 1902 by Einthoven who was inspired by the work of Waller, objective information about the structure and function of the heart was provided. Electrocardiography has played an important role in the diagnosis of heart diseases [3].

The progression of physics led to the invention of the 12-lead electrocardiogram as it is now known. The ECG (called, the electrokardiogram (EKG) in German language), measures how the electrical activity of the heart changes over time as action potential is propagated through the heart during a cardiac cycle. It shows electrical differences across the heart when depolarization and repolarization of the atrial and ventricular cells occur [4] (The normal ECG tracing is described in Appendix A). Heart failure is associated with widespread electrophysiological remodelling of the cardiac conduction system, resulting in electrocardiographic (ECG) abnormalities such as reduced RR variability, prolongation of the QRS and PR intervals, and atrial fibrillation [5].

The study was done to establish the relationship between patient factors and ECG abnormalities among heart failure patients at KIU-TH.

METHODOLOGY

Study Design

Research design is the "overall plan or strategy for conducting the research" [6]. Survey design was adopted for this study. Here, samples of the target population were chosen for study, analysis and discovery of occurrences as they were. Survey design is suitable for this type of research that involves a special population of only people diagnosed to have heart failure.

Study Area

This study was conducted at Kampala International University Teaching Hospital, Ishaka

Target Population

The target population for this study were adult heart failure (HF) patients in Western Uganda. Adult HF patients are in different stages of the disease and live in different communities. Some HF patients are either undiagnosed or misdiagnosed at different places where people seek healthcare. The population of HF patients in this community is therefore very scattered and infinite.

Sample Population

The sample of the accessible population chosen for this study consisted of adult HF patients who received medical care at KIU-TH during the duration of the study and met the inclusion criteria for the study. This sample was chosen because clients report to KIU-TH for health care and the hospital has the medical staff members who can appropriately diagnose HF. In addition, facility for determining ECG and other necessary clinical investigations were readily available.

Inclusion Criteria

Criteria for being included in the study were being diagnosed to have HF, age of 12 years and above, attending clinical care at KIU-TH, Ishaka and giving written consent to participate in the study during the study period.

Exclusion Criteria

All patients were excluded from participation in the study if they had any overt mental disorders or were unable to withstand the interview, did not consent to participate or changed their mind during the study. Respondents with known allergy to the gel used in the ECG procedure were excluded from the study.

Sample Size Determination

Sample size was calculated using a formula for single population proportion with correction for finite population [7]. That is:

$n = N^*X / (X + N - 1)$ (Equation 1)

Where:

N= population size, estimated at 160 HF patients attending the Internal Medicine Department (Both MOPD, Inpatients Department and Private ward) at KIU-TH from January 2019 to March 2019 (Unpublished data).

X = $Z_{\alpha/2}^2 * p*(1-p) / MOE^2$,

$Z_{\alpha/2}$ = critical value of the Normal distribution at $\alpha/2$ for α of 0.05= 1.96,

p= proportion of ECG abnormalities among HF patients in Uganda (Mulago, Kampala): 37.1% [8].

MOE= margin of error considered at 5%,

$X = (1.96^2 \times 0.371 \times 0.629) / 0.05^2 = 358$

Substituting, $n = 160*358 / (358 +160-1) = 111$

To cater for attrition, an additional 10% was added to the sample size which gave a sample size of 122 heart failure patients.

Sampling Techniques

This study employed cluster, purposive and convenience sampling techniques. Cluster sampling was used to categorize places where adult HF patients are usually seen in groups. These places are healthcare units; hence each healthcare unit in Bushenyi District was categorized as cluster. The study focused on adult patients with HF. Adult HF patients receive healthcare from different healthcare facilities and each healthcare facility that provide such care in Bushenyi District was considered as a cluster where adult HF patients could readily be seen. Cluster sampling technique divides a population into relatively smaller groups (clusters) and some of the clusters randomly selected as the sample. All members of the chosen cluster are studied. It is used to select groups rather than individual members where a sampling frame cannot be constructed. The technique was chosen because it saves time and money, and it is suitable if a sampling frame cannot be obtained. In this study, a sampling frame is not obtainable because not all adult HF patients attend healthcare facilities and some who attend are misdiagnosed by healthcare workers.

Purposive sampling technique was adopted for selecting the cluster sample. In purposive sampling, one consciously chose who to include in the sample. KIU-TH was chosen as the cluster for this study because it is the only tertiary healthcare facility in Bushenyi District. In addition, it provides services to HF patients who visit on their own volition and those who are referred from other lower healthcare units. KIU-TH has sufficient human resource for health and facilities for proper diagnosis of HF. This study focused on gathering information from HF patients only. Purposive sampling technique selects "typical" and useful cases only, it saves time and money. These factors guided the adoption of purposive sampling for selection of KIU-TH as a good cluster for this study.

The convenience sampling technique was adopted for selecting individual respondents in the chosen cluster. Convenience sampling technique consist of selecting, on first come first served basis, those who happen to be available. This sampling technique is used for pilot or exploratory studies and in infinite populations when it is not possible to determine the sampling frame. It collects data at the spur of the moment without rigidity of procedure. It takes advantage of those who happen to be there at the moment of unexpected events. Hence, the convenience sampling technique was chosen for this study where respondents were consecutively enrolled until the desired sample size was attained. Respondents were enrolled into the study as they were diagnosed at the hospital entry points (MOPD, Accident and Emergency Department). Those who were admitted, but missed at the entry points, were enrolled from the Medical, Private and Semi-Private Wards. Every patient who met the selection criteria was eligible to participate.

Data collection

Data Collection Instruments

a. Questionnaire

The study used questionnaires as the main tool for data collection. The choice of questionnaire as the main data collection tool was guided by the study objectives. The main aim of the study was to determine the clinical characteristics and factors associated with ECG abnormalities among HF patients. A questionnaire is a collection of items to which a respondent is expected to react to [6]. It is used for collection of many information over a short period of time and it is suitable for studying large literate populations in limited time and where the required information can easily be described in writing. The questions contained in the questionnaire focused on study objectives that explored sociodemographic factors (age and gender); behavioral factors (smoking and alcohol use); medical factors (type of heart failure, medication and NYHA classification at enrollment) and comorbidities (Hypertension, diabetes mellitus, COPD and obesity) among adult HF patients.

Standard Weight scale

Electronic weighing scale with high precision strain gauge sensor system (Clikon model) was used for measuring the weight of each respondent. The weight was measured to the nearest 100 grams with each respondent not wearing heavy cloths and standing bare-footed on the weighing scale in an upright position. Electronic weighing scale with high precision strain gauge sensor system was used in order to obtain accurate weight measurements by completely eliminating errors that could arise from use of manual weighing scales. Such errors may arise from observer position and variability in gauge strain with repeated use over time.

b. Standard Height pole

Portable standard height pole mounted vertically against a wall was used for height measurement. Each respondent's height was measured with the respondent standing upright, backing the height pole and his/her buttocks touching the height pole/wall. Care was taken to ensure that the lateral angles of the respondent's eyes were at the same level with the middle of the pinna. The height was read off with the horizontal piece directly touching the vertex of each respondent's head. The portable standard height pole was chosen because it gives better results than other crude locally used methods. Its results are comparable with results generated from anywhere with similar tool.

c. Sphygmomanometer

Manual sphygmomanometer with appropriate cuff sizes wrapped around

the arms for each patient was used for the measurement of respondents blood pressure.

d. Stethoscope

Stethoscope 3 M Littmann ® Classic II SE was used for the cardiovascular examination during data collection.

e. Pulse Oximeter

The blood oxygen saturation and the pulse rate of each respondent were taken by using a fingertip pulse oximeter model MP-1000C with a measurement range of 77% to 99%. It has the advantages of small size, low power consumption, easy operation and being easy to carry (https://tp-wireless.com/a/chanpinfangan/healthcare/2020/06113/548, consulted on 27/06/2020).

f. ECG Machine

The "DRE/True ECG Plus machine" was used as for determining the ECG in each respondent. It is an excellent cost-effective portable ECG machine with an internal storage upgrade up to 200 ECGs, card reader, SD card and a flash drive. The machine has automatic measurement and interpretation for adults and pediatrics (https://www.dremed.com/dre-true-ecgl-singnle-channel-ecgekg/id/1974, consulted on 7/12/2019).

Validity and reliability of the data collection instruments

Inclusion and exclusion criteria were strictly adhered to questionnaire. Pre-testing of the questionnaire was conducted among five adult HF patients at Ishaka-Adventist Hospital and the outcomes guided the adjustment of some questions. That contributed towards improvement of both validity and reliability of the final questionnaire used for this study. Validity was further strengthened by content and context experts who reviewed the instrument and confirmed that each construct was correctly measured. Experts in the field rated each items on the questionnaire on the scale of relevance: very relevant (4), quite relevant (3), somewhat relevant (2) and not relevant (1). Validity was determined using Content Validity Index (CVI).

CVI = items rated ≥ 3 by both judges/Total number of items in the questionnaire (equation 2).

The questions rated three and above were 42 out of 51; hence CVI = 42/51 = 0.8235 = 82%.

The data collectors ensured that the questionnaires were filled correctly by allowing enough time for the filling-in of questions. The questionnaires were in both English and local language for ease of communication. With the help of translators, unfamiliar technical terms were explained to the respondents consistently. The ECG was done according to the SOP and the interpretation was done by the principal investigator. The supervisors verified interpretation of each ECG finding and final confirmation of the ECG findings was done by the cardiologist to ensure reliability.

Data processing, Analysis and Interpretation

Data from completed questionnaires were arranged, summarized and entered into the Microsoft Excel version 2010 and then exported to STATA version 14.2 for analysis. The baseline characteristics of respondents were analyzed using means for continuous variables with normal distribution and proportions for categorical variables.

Informed consent and respect for respondents

Voluntary recruitment was done and an informed consent was signed by each respondent. Informed consent from each respondent or from the guardian in the case of patients aged below 18 years was obtained after fully explaining the details of the study to them in English and local languages. Assent was also sought from minors after their legally authorized guardians or parents had consented. Respondents were free to withdraw from the study at any time without coercion or compromise of care they were entitled to.

RESULTS

Table 1. Baseline Characteristics of Study Respondents (N = 122)

Variable	N = 122
Sociodemographic characteristics	
Female, n (%)	67 (54.9)
Age, mean (SD)	62.4 (±20)
Age categories (years), n (%)	
< 20	6 (4.9)
20-29	3 (2.5)
30-39	6 (4.9)
40-49	16 (13.1)
50-59	19 (15.6)
60-69	18 (14.7)
70-79	25 (20.5)
≥ 80	29 (23.8)
Greater Bushenyi, n (%)	107 (87.7)
Peasant farmer, n (%)	54 (44.3)
No formal education, n (%)	63 (51.7)
Behavioral characteristics	
Smoking history, n (%)	44 (36.1)
Alcohol use history, n (%)	
Never	85 (69.7)
Not harmful alcohol use	15 (12.3)
Hazardous drinking	22 (18.0)
Medical characteristics	
Duration of heart failure, n (%)	
< 1 year	67 (54.9)
> 1 year	55 (45.1)
Medication: ARBs / ACEIs, n (%)	56 (45.9)
Hypertension, n (%)	60 (49.2)
BMI, Mean (SD)	23.3 (±5.2)
BMI categories, n (%)	
Underweight	24 (19.7)
Normal	53 (43.4)
Overweight	28 (23.0)
Obesity	17 (13.9)
NYHA functional class, n (%)	
NYHA I-II	38 (31.1)
NYHA III-IV	84 (68.9)

The mean age of the respondents was 62.4 ± 20 years. Table 1 shows that the majority 67 (54.9%) of the respondents were females. The majority 107 (87.7%) were from great Bushenyi, 63 (51.6%) of them had no formal education; 44 (36.1%) were smokers and 37 (30.3 %) had history of alcohol use. About half of them were hypertensive 60 (49.2%) and 55 (45.1%) had a duration of HF of more than a year. The angiotensin receptor blockers or angiotensin converting enzyme inhibitors were the base of medication (45.9%). The majority 84 (68.9%) of respondents were decompensated and staged in NYHA class III and IV at enrollment while 45 (36.9%) of respondents were obese or overweight.

To test the association between sociodemographic, behavioral and medical factors of HF patients and ECG abnormalities, bivariate analysis (Crude Odds Ratio) and multivariate analysis (adjusted Odds Ratio) were done. Odd ratio is the most commonly used and suitable measure of association in cross-sectional studies. In cross-sectional studies, the odds ratio is also referred to as the prevalence odds ratio when prevalent cases are included.

Table 2: Factors Associated with ECG Abnormalities among Heart Failure Patients at KIU-TH, Ishaka

Variables	Abnormal Electrocardiogram		cOR (95% CI)	P-value
	No n (%)	Yes n (%)		
Female gender	9 (13.4)	58 (86.6)	1.1 (0.39 - 3.06)	0.860
Age (years) ≥ 50	7 (7.7)	84 (92.3)	5.7 (1.94 - 16.79)	**0.001**
Highest education level				0.398
No formal education	10 (15.9)	53 (84.1)	2.1 (0.36 – 12.49)	-
Primary	4 (12.5)	28 (87.5)	2.8 (0.40 – 19.60)	-
Secondary	1 (5.0)	19 (95.0)	7.6 (0.57 – 101.79)	-
Tertiary	2 (28.6)	5 (71.4)	1.0	-
Smoking	2 (4.6)	42 (95.4)	5.0 (1.09 – 23.00)	**0.015**
Alcohol (Hazardous drinking)	4 (18.2)	18 (81.8)	0.7 (0.21 – 2.56)	0.575
Duration of heart failure > 1 year	8 (14.5)	47 (85.5)	1.7 (0.44 – 6.41)	0.464
Medications				
Digoxin	1 (16.7)	5 (83.3)	0.8 (0.09 – 7.30)	0.846
Beta blockers	3 (16.7)	15 (83.3)	0.8 (0.20 – 3.03)	0.722
ARBs / ACEIs	4 (7.1)	52 (92.9)	3.2 (0.98 – 10.4)	**0.040**
Diuretics alone	7 (11.9)	52 (88.1)	1.4 (0.50 – 3.96)	0.521
Statins	2 (10.5)	17 (89.5)	1.4 (0.30 – 6.92)	0.630
Aspirin/Clopidogrel	4 (9.1)	40 (90.9)	2.0 (0.61 – 6.56)	0.232
Hypertension	3 (5.0)	57 (95.0)	5.5 (1.50 - 20.43)	**0.003**
COPD	1 (10.0)	9 (90.0)	1.5 (0.18 - 12.66)	0.696
Diabetes mellitus	4 (17.4)	19 (82.6)	0.7 (0.21 - 2.45)	0.603
HIV	1 (20.0)	4 (80.0)	0.6 (0.07 - 6.04)	0.703
BMI				0.143
Normal	9 (11.7)	68 (88.3)	1.0	-
Overweight	7 (25.0)	21 (75.0)	0.4 (0.13 – 1.20)	-
Obesity	1 (5.9)	16 (94.1)	2.1 (0.25 – 17.94)	
NYHA functional class				**< 0.001**
NYHA I-II	13 (34.2)	25 (65.8)	1.0	-
NYHA III-IV	4 (4.8)	80 (95.2)	10.4 (3.11 - 34.78)	-

P value is significant at < 0.05, cOR= crude Odds Ratio.

The results of bivariate analysis of sociodemographic, behavioral and medical characteristics of heart failure patients are shown in Table 3. Heart failure patients aged ≥ 50 years had about 6 times risk of having ECG abnormalities compared to those who were less than 50 years (cOR = 5.7, 95% CI: 1.94 - 16.79, p = 0.001). Respondents who were smokers were five times more likely to have abnormalities of ECG compared to those who had never smoked (cOR= 5.0, 95% CI: 1.09 – 23.00, p = 0.015). Heart failure patients on ARBS

or ACEIs were three times at risk of developing ECG abnormalities compared to those on other medications (cOR = 3.2, 95% CI: 0.98-10.4, p = 0.040). Hypertensive respondents were five and half times more likely to have ECG abnormalities compared to those without hypertension (cOR = 5.5, 95% CI: 1.50 - 20.43, p = 0.003**)**. Respondents who were in NYHA functional classes III and IV were ten times more likely to have ECG abnormalities compared to those in class I and II (cOR=10.4, 95% CI: 3.11 - 34.78, p < 0.001).

Table 3: Multivariate Logistic Regression Analysis of Factors Associated with Electrocardiographic Abnormalities among Heart Failure Patients

Variables	aOR (95% CI)	P-value
Female gender	0.7 (0.10 – 5.58)	0.786
Age ≥ 50 years	23.1 (1.81 - 294.33)	**0.016**
Smoking	23.6 (1.19 – 465.86)	**0.038**
Non-Hazardous alcohol use	2.3 (0.17 – 32.75)	0.525
Hazardous alcohol use	0.05 (0.00 – 1.05)	0.054
ARBS/ACEIs	3.9 (0.48 – 31.92)	0.200
Hypertension	11.9 (1.05 – 135.65)	**0.046**
Diabetes Mellitus	1.5 (0.14 – 15.92)	0.745
COPD	0.05 (0.00 – 3.55)	0.173
Overweight	0.7 (0.06 – 8.32)	0.795
Obesity	0.6 (0.02 – 18.16)	0.808
NYHA III-IV	168.7 (6.85 – 4155.5)	**0.002**

P value is significant at < 0.05, aOR= adjusted Odds Ratio.

In the multivariate analysis, the factors that were independently associated with ECG abnormalities among HF patients were age ≥ 50 years, smoking, hypertension and NYHA class III and IV. Age ≥ 50 years was 22.8 times associated with ECG abnormalities among HF patients (aOR = 23.1, 95% CI: 1.81 - 294.33, p= 0.016). Smoking was significantly associated statistically with ECG abnormalities among HF patients (aOR = 23.6, 95% CI: 1.19 – 465.86, p= 0.038). Respondents with hypertension as comorbidity were about 12 times more likely to have abnormal ECG compared to those without hypertension (aOR = 11.9, 95% CI: 1.05 – 135.65, p = 0.046) while those who were staged in NYHA class III and IV at enrollment had 165 times more risk of having abnormal ECG than those in NYHA class I and II (aOR = 168.7, 95% CI: 6.85 – 4155.5, p = 0.002).

DISCUSSION

The mean age of the respondents was 62.4 ± 20 years. Age ≥ 50 years was 23.1 times associated with ECG abnormalities among HF patients (aOR = 23.1, 95% CI: 1.81 – 294.33, p= 0.016). These results are similar to those reported by [9], [10], [11] and [12]. [9] in 2012 during their population-based study conducted in United States found that the mean age of patient with electrocardiographic abnormalities was 73.5 (2.8) years and there was a statistically significant relationship between age and ECG abnormalities (p=0.01). [10] during their cohort study in 2008 conducted in United Kingdom found that the age above 72.2 years was associated with electrocardiographic abnormalities with an HR of 1.05 (95% CI: 1.04-1.07, p<0.0001). [12] in Canada found that the median age of HF patients with abnormal ECG was 77 years and a significant relationship between age and ECG abnormalities (p=0.022). [11] in Sub-Sahara found that the mean age of heart failure patients with abnormal ECG was 52.0 years. Other authors also found that age above fifty years was associated with ECG abnormalities such as [13] in Morocco who got a mean age of 62.27 (±7.26) among HF patients with LBBB. In Brazil, [14] got that the mean age of respondents with abnormal ECG was 51 (±19) years. The reasons for similarities could be explained by the fact that ageing can directly affect the normal function of the heart and other organs; hence the high prevalence of abnormal ECG among patients above 50 years. In Nigeria, [15] got different findings concerning the age of HF patients with abnormal ECG. They found that the mean age was 42.82

(±18.31). This difference can be explained by the young age of the population in Nigeria compared to the population of Ishaka (with a mean age of 62.4 years (± 20) where this study was conducted.

The findings of the current study showed that 44 (36.1%) respondents were smokers and smoking was significantly associated with ECG abnormalities (aOR = 23.6, 95% CI: 1.19 – 465.86, p= 0.038). This result is similar to that reported in Brazil by [14] who found that smoking was significantly associated with electrocardiographic abnormalities (p<0.001). [9] reported that ECG abnormalities were associated with smoking for both HF patients with minor and major ECG abnormalities respectively seen in 12.3% of HF patients with minor ECG abnormalities and 8.3% of those with major abnormalities with a global p value=0.036. In Morocco, [13] also got that smoking was statistically associated with LBBB (p=0.05) and 54.5% of study respondents were smokers; and in the sub-Sahara Africa survey on heart failure, [11] found that 8.7% of HF patients with ECG abnormalities were smokers. This similarity based mainly on the statistical significance (p value) found in the current study and those of the above authors could be explained by the fact that exposure to nicotine and carbon monoxide induce arteriosclerotic changes in coronary artery which in turn lead to coronary artery diseases and impaired electrical activities of the heart which will reflect as electrocardiographic abnormalities.

The medical factors associated with ECG abnormalities among HF patients were hypertension and respondents who were staged in NYHA functional class III and IV. The majority 84 (68.9%) of respondents were decompensated and staged in NYHA class III and IV at enrollment II (aOR = 168.7, 95% CI: 6.85 – 4155.5, p = 0.002). [10] found that the presence of left bundle branch block was significantly associated with an adverse outcome among heart failure in stage III and IV of the NYHA classification with an OR of 4.03 (95% CI : 2.13-7.63, p<0.0001). This relationship between NYHA class III and IV with ECG abnormalities can be explained by the fact that patients in stage III and IV of the NYHA classification are in decompensation and the heart electrical conduction could be impaired especially the bundle branches. Hence there was no difference between findings in this study and others.

About half of respondents were hypertensive 60 (49.2%) and hypertension was the only comorbidity which was significantly associated with ECG abnormalities among HF patients statistically (aOR = 11.9, 95% CI: 1.05 – 135.65, p = 0.046). Heart failure patients who are hypertensives are about twelve times more likely to have ECG abnormalities compared to HF patients without ECG abnormalities. [9], found that ECG abnormalities were statistically associated with increase blood pressure (p<0.001). A study conducted by [12] showed that ECG abnormalities were asscociated with comorbidities and hypertension was present in 75.5% of patients. In UK, [10] during their study found that the most common commorbidities among respondents with LBBB were hypertension with 35.5% of study respondents. An observational retrospective study conducted in Brazil by [14,15,16,17] revealed that hypertension was the most frequent comorbidity among patients with ECG abnormalities (p<0.001) and in Morocco, [13] got that the most comorbidity among HF patients with LBBB was hypertension (40.9%). The sub-Saharan Africa survey of heart failure showed that hypertension was associated with ECG abnormalities among heart failure patients (55.8% of respondents) [15,16,17]. The relationship between hypertension and ECG abnormalities can be explained by the fact that hypertension is one of the known cause of heart failure and the change in lifestyle does not involved only population of the Western countries but also the population in the South as seen in the current study.

CONCLUSION

Patient factors associated with ECG abnormalities included age equal or above 50 years, smoking, hypertension and NYHA functional class III and IV.

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