

Hypertension with Left Ventricular Hypertrophy: Does It Induce Atrial Fibrillation?

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Abstract—Atrial fibrillation (AF) is an abnormal cardiac rhythm with rapid and irregular electrical activity. Atrial fibrillation can be caused by anatomical and/or non-anatomical abnormalities of the cardiac. One of the non-anatomical causes of atrial fibrillation is hypertension. Prolonged and uncontrolled hypertension can alter myocardial and blood vessel structure. It also can affect cardiac conduction system which in turn will affect the cardiac structure. One of the structural alterations that can cause AF is left ventricular hypertrophy (LVH). This study was an observational analytic study with cross-sectional observations. Samples were taken from 60 medical records of patients with AF. The data was analyzed by descriptive method followed by the chi-square test. Most patients' age was over 50 years of age (88%). Patients that had hypertension were 42 patients (70%). Eighteen (30%) had LVH with 17 patients (94.4%) had hypertension with LVH. The chi-square test obtained in this study was $P = 0.007$ value ($P < 0.05$). There was a significant relationship between hypertension and left ventricular hypertrophy in atrial fibrillation patients.

Keywords—atrial fibrillation, hypertension, left ventricular hypertrophy

I. INTRODUCTION

Hypertension is a condition defined as blood pressure 140/90 or higher for age 13-50 years old and blood pressure 160/90 for people older than 50 years old [1]. Hypertension is still a growing disease in the global population. In Indonesia, it is causing a great challenge in primary health care. Blood pressure control is still not adequate even though effective antihypertensive drugs are readily available [1].

Hypertension can cause many organ damages, such as blood vessels, heart, retina, central nerve system, and renal. Chronic and uncontrolled hypertension can change myocardial and blood vessel structure. The structural changes can cause left ventricular hypertrophy (LVH), left atrial dilatation,

impaired with cardiac conduction system, and cause systolic and diastolic dysfunction [2,3].

Hypertension with LVH will increase the prevalence of atrial fibrillation (AF) [3,4]. In hypertrophy, cardiac muscle becomes fibrotic or infiltrated by collagen [4]. That structural changes can cause difficulty in conducting impulse from atrial to ventricle, therefore increasing depolarization of atrial [4]. These changes are predisposing risks to atrial fibrillation [3]. Although AF can happen in normal structure cardiac, it mostly happens in structurally impaired cardiac [2,5]. Some diseases that predispose AF are ischemic heart disease, hypertension, mitral valve disorder, pericarditis, pulmonary embolism, pneumonia, and chronic obstructive pulmonary diseases (COPD) [2,5].

Atrial fibrillation is the most common type of arrhythmia in everyday practice [5]. It increases the risk of thromboembolic formation that can cause stroke [5,6]. Other than that, AF can also cause reduce quality of life, dementia, and heart failure [6]. Reentry process that underlying AF is a predisposing factor to ventricular extrasystole, it is 40-50 times higher in patient who had hypertension with LVH rather than hypertension alone [7,8].

Based on those facts, we aimed to assess the correlation of hypertension with LVH with the prevalence of AF.

II. METHODS

A. Study Population and Sample Size

This study was an observational analytic study conducted on medical records of AF patients with hypertension and LVH that underwent medical treatment in Dustira Hospital from 2016-2017. The data was collected from 60 medical records. The study used retrospective cross-sectional design. The sample was taken by consecutive random sampling. This study

complies with the Declaration of Helsinki and was approved by the local Ethics Committee.

B. Measurements

We collected demographic data and medical history from medical records. The data needed from medical records including history of AF with/without hypertension and AF with/without LVH.

Atrial fibrillation criteria were chosen based on electrocardiography result, hypertension based on blood pressure measurement, and LVH from echocardiography result.

C. Inclusion and Exclusion Criteria

1) *Inclusion criteria:* Medical records of AF patients with/without hypertension and with/without LVH that had blood pressure, electrocardiography and echocardiography results.

2) *Exclusion criteria:* Patients with unstable hemodynamic and difficulty breathing and/or hyperthyroidism were excluded from the study.

D. Statistical Analysis

The data was analyzed by the Statistical Package for the Social Sciences software version 24.0 (SPSS Inc. Chicago, IL, USA). Qualitative data was expressed as number and percentage later analyzed by the chi-square test. Quantitative data was presented as mean. A *P*-value of less than 0.05 was considered as statistically significant.

III. RESULTS

We randomized the sample diagnosed with AF to 60 medical records that fulfilled inclusion criteria. Table 1 shows the baseline characteristics of them. Of the total study population, 45% were males and 55% were females with a mean age of 64.15 years old. Most of them were in 61-70 years of age category (35%) and 88.3% of subjects were older than 50 years old.

Table 2 shows that 70% of subjects had hypertension with 41.7% of them had hypertension grade 1 and 28.3% had hypertension grade 2. From the echocardiography done to the subject, 30% of subjects had LVH with 27% of them had moderate LVH.

Bivariate analysis was done to analyze the correlation between hypertension with LVH in AF patients. The result shows that hypertension with LVH is significantly correlated to the presence of AF in patients with *p* value=0.007 (Table 3).

TABLE I. DEMOGRAPHIC CHARACTERISTIC OF SUBJECTS WITH ATRIAL FIBRILLATION

Variable	n = 60	Percentage (%)
<i>Age (years)</i>		
Mean ± SD	64.15 ± 12.406	
Median	64.00	
Range	32.00-93.00	
<i>Age category (years)</i>		
31-40	3	5.0%
41-50	4	6.7%
51-60	13	21.7%
61-70	21	35.0%
>70	19	31.7%
<i>Sex</i>		
Male	27	(45.0%)
Female	33	(55.0%)

TABLE II. PREVALENCE OF HYPERTENSION AND LVH ON THE SUBJECTS

Variable	n = 60	Percentage (%)
<i>Hypertension</i>		
Yes	42	70
No	18	30
<i>Hypertension Degree</i>		
Normotension	18	30
1 st degree	25	41.7
2 nd degree	17	28.3
<i>Left Ventricle Hypertrophy</i>		
Yes	18	30
No	42	70
<i>Severity of LVH</i>		
No LVH	42	70
Mild	2	3
Moderate	16	27

TABLE III. CORRELATION OF HYPERTENSION WITH LVH TO ATRIAL FIBRILLATION BASED ON CHI-SQUARE TEST

	LVH		No LVH		P value
	n	%	n	%	
Hypertension	17	94.4	25	59.4	0.007
Normotension	1	5.6	17	40.5	
Total	18	100	42	100	

IV. DISCUSSION

Atrial fibrillation happens more in elderly, in this study 88,3% of subjects were older than 50 years old. Similar result has been reported that AF happens more in the population older than 50 years old [7]. Atrial fibrillation prevalence increases with the aging process [7,9]. In this study, AF occurred more in females rather than males. Some studies reported no significant difference of sex prevalence in AF [10].

There are some risk factors associated with the incidence of AF. Ischemic heart disease, hypertension, mitral valve disorder, pericarditis, pulmonary embolism, pneumonia, and chronic obstructive pulmonary diseases (COPD) are some of the diseases that predispose AF [10,11]. Although most AF happened because of cardiac structural changes, it also can happen in normal structure cardiac. In some cases, there is no known cause of AF [2,6].

In patients with hypertension, there are changes in stroke volume and total peripheral resistance [12]. The increase in

systemic vascular resistance increases cardiac afterload [12,13]. Cardiac muscle will pump harder as a compensation to maintain normal stroke volume [12,13]. Chronic increase of afterload will cause hypertrophy of the cardiac, starting at the left ventricle that pump the blood to systemic circulatory [4,11].

With LVH, the cardiac organ has difficulty to maintain normal sinus rhythm. Hypertrophy causing structural inhomogeneity with collagen infiltration or fibrosis of the myocardial [4]. That structural changes cause difficulty in conducting impulse from atrial to ventricle, therefore increasing depolarization of atrial [4,5]. Reentry process that underlying AF is a predisposing factor to ventricular extrasystole, it is 40-50 times higher in patients who had hypertension with LVH rather than hypertension alone [7,8]. This theory and previous studies are consistent with our present study which shows that hypertension with LVH increases the prevalence of AF.

A. Study Limitation

Medical records weren't easily accessed due to the limited number of administration staffs. A lot of missing data from medical records due to weren't completely filled contributed to prolong the study progress.

V. CONCLUSION

We conclude that hypertension plays a significant role in causing LVH which in turn will increase the risk of AF.

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