Ischemic Electrocardiogram Patterns among Population of Universitas Gadjah Mada Health and Demographic Surveillance System Sleman: The Community-Based Learning and Community Service by Cardiology and Vascular Medicine Residency Program at Universitas Gadjah Mada

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ABSTRACT

Screening for coronary heart disease in the community can be performed by a simple method, namely an electrocardiography (ECG) examination. However, the ECG-based screening program has not been routinely performed in the Indonesian population, probably due to a scarcity of human resources e to interpret the ECG results. The ECG pattern recognition needs prolonged training, completed during Cardiology and Vascular Medicine Residency Program. Most Cardiology and Vascular Medicine Residency Program activities are performed in teaching hospitals. The involvement of cardiology and vascular medicine residents' involvement in interpreting ischemic ECG pattern during populational survey is necessary to fulfill their national standard competence and perform community service during the residency education program. Therefore, besides clinical services in teaching hospitals, community services in the population must be implemented during the residency program. The Universitas Gadjah Mada Health and Demographic Surveillance System (HDSS) Sleman is a longitudinal and community-based surveillance by the Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada in Sleman Regency, Yogyakarta since 2014 to obtain data regarding community health status, including cardiovascular diseases. The study aimed to investigate the ischemic ECG abnormal pattern and the feasibility of integrating community-based learning and community service by UGM HDSS Sleman, Yogyakarta, Indonesia residents. The results showed that among 787 subjects of the HDSS Sleman population, the prevalence of ischemic ECG pattern was only minority (n=48, 6%) and mostly among females (10.2%). The ischemic ECG pattern was associated with cardiovascular risk factors: hypertension (12.3% vs. 5.5%, p=0.035) and obesity (10.1% vs. 5.2%, p=0.035). By interpreting ECG patterns, residents can directly implement education and consultation to promote the community's cardiovascular disease prevention programs. This study highlights the feasibility of integrating community-based learning and community service performed by cardiology and vascular medicine residents during the residency education program embedded in the residency program curriculum.

Keywords: Community-based learning, Community service, Electrocardiography, Ischemic heart disease

1 Introduction

The burden of cardiovascular diseases is increasing in Indonesia, as marked by its contribution as the leading cause of death and disability [1]. A population study among Indonesians showed that the prevalence of increased 10-year cardiovascular disease (CVD) and cardiovascular risk factors are relatively higher

compared to other developing countries [2, 3]. Therefore, identifying populations with high CVD risk is essential to perform screening and primary prevention programs at the community level [3].

Screening for coronary heart disease in the community can be performed by a simple method, namely an electrocardiography (ECG) examination. Several extensive populational studies have identified the prevalence of ischemic ECG patterns and their association with cardiovascular risk factors [3]. However, the ECG-based screening program has not been routinely performed in the Indonesian population, probably due to scarcity of human resources to interpret the ECG results. In fact, ischemic ECG pattern recognition needs prolonged training completed during Cardiology and Vascular Medicine Residency Program.

Most Cardiology and Vascular Medicine Residency Program activities are performed in teaching hospitals. The involvement of cardiology and vascular medicine residents in interpreting the ischemic ECG pattern during the populational survey is necessary to fulfil their national standard competence, as well as to perform community service during the residency education program. Based on the National Standard for Cardiology and Vascular Medicine Residency Education Program, six standard competencies must be fulfilled, one of which is a competency to apply cardiovascular science and knowledge into the community and perform cardiovascular preventive and promotive roles in the community [4]. Therefore, besides clinical services in teaching hospitals, community services in the population must be implemented during the residency program. In addition, the Sleman Health and Demographic Surveillance System (HDSS) is a longitudinal and community-based surveillance by the Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada in Sleman Regency, Yogyakarta since 2014 to obtain data regarding community health status, including cardiovascular diseases [5].

The aims of this study were (1) to investigate the ischemic ECG abnormal pattern and (2) to assess the feasibility of integrating community-based learning and community service by cardiology and vascular medicine residents in the population of UGM HDSS Sleman, Yogyakarta, Indonesia.

2 Research Methodology

The authors conducted a nested cross-sectional study on the Sleman HDSS population in September – December 2021. The authors performed the community service and survey involving 44 villages in 5 areas of Sleman regency. In each activity in one village (involving 25-40 participants), the team consisted of enumerator staff and one cardiology resident. The team did anamnesis, HDSS-standardized questionnaires, demography, anthropometry assessments, collected blood samples for laboratory testing, and performed a 12-lead ECG examination. Based on the activities, we determined the cardiovascular risk factors in all subjects.

The cardiology and vascular medicine residents performed a physical examination, supervised a 12-lead ECG examination, and interpreted the 12-lead ECG result. They subsequently conducted education and consultation with the subjects regarding the cardiovascular risk factor found in each subject and the 12-lead ECG result (Figure 1). The ECG results were interpreted by residents and classified according to the Minnesota coding criteria into normal, ischemic, arrhythmias, conduction defects, and other ECG abnormalities (left/right axis deviation, atrial enlargement, and ventricular hypertrophy patterns) [6].

The study has been approved by the Medical and Health Research Ethics Committee Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada – Dr. Sardjito General Hospital, no ref: KE/FK/0551/EC/2021.

For statistical analysis, we performed a descriptive study to analyze the prevalence of cardiovascular risk factors and ECG patterns in all subjects. In addition, the comparison of ischemic ECG patterns between subjects with and without cardiovascular risk factors was conducted by a chi-square test.

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3   Results and Discussion

A total of 787 subjects with a range of ages from 31 to 85 years participated in the study. They comprised 368 males (47%) and 419 females (53%). The cardiovascular risk factors found in the survey were hypertension (n=442, 56%), diabetes mellitus (n=143, 18%), high cholesterol level (n=428, 54%), active smoker (n=294, 37%), and obesity (n=619, 79%) (Table 1).

The normal ECG interpretation was found in 530 subjects (67%). The ischemic ECG pattern was found only in a minority of subjects, namely in 48 subjects (6%). Other abnormal ECG patterns were arrhythmias (n=34, 4%), conduction delay (n=59, 7%), and other abnormalities (n=116, 15%). The previous population study indicated a similar finding that only a minority of subjects depicted abnormal ECG patterns [7, 8].

According to cardiovascular risk factors, we compared and analyzed the ischemic pattern (Table. 2). Based on sex, in females, 10.2% had an ischemic ECG pattern, whereas, in males, 7.6% had an ischemic ECG pattern, p=0.002. In hypertension, 12.3% had an ischemic ECG pattern, whereas among non-hypertensive, 5.5% had an ischemic ECG pattern, p=0.035. In diabetes mellitus, 11.5% of subjects had an ischemic ECG pattern, and 8.6% in non-diabetes mellitus, p=0.335. In a subject with high cholesterol levels, the prevalence of ischemic ECG patterns was similar to those without high cholesterol levels (9.5% vs. 8.6%, p=0.968). Active smokers had fewer ischemic ECG patterns than non-smokers (7.3% vs. 10.1%, p=0.001). In addition, a higher prevalence of ischemic ECG pattern was found in obese subjects compared to lean subjects (10.1 % vs. 5.2%, p=0.035).

Our results demonstrate that the ischemic ECG pattern was associated with cardiovascular risk factors of hypertension and obesity in the UGM HDSS Sleman, Yogyakarta population. Previous studies showed that metabolic risk factors, such as hypertension and obesity, were associated with increased odds of having ischemic ST-T abnormalities [9, 10]. In addition, ECG is a convenient modality to identify left ventricular hypertrophy, a common complication in hypertensive patients. Therefore, it is essential to reduce metabolic risk factors to prevent CVD. In addition, blood pressure control and weight loss have become the target of CVD prevention in hypertensive and obese patients [11].

Previous studies have found that ECG abnormalities were associated with an increased risk of CVD events, suggesting that risk prediction can be improved by adding ECG abnormalities to the traditional risk factors [12, 13]. ECG is safe and widely available in health facilities in Indonesia. It implicates the possibility of CVD risk screening with ECG in the asymptomatic population. However, ECG screening has not been recommended because there were insufficient clinical trials to conclude clinical outcomes after ECG screening [14].

Based on the result of the ECG pattern, which indicated myocardial ischemic, cardiology, and vascular medicine, residents directly delivered education, consultation, and promotion of efforts about the risk of cardiovascular diseases in the community, especially among those with cardiovascular risk factors (Figure 1). The combination of the community-based education program and clinical teaching is a plausible strategy in cardiology and vascular medicine residency education, successfully implemented [12]. Community service can be performed, along with data collecting and analysis can also be accomplished through a community service program. In addition, our study proved that by performing community service, cardiology, and vascular medicine, residents could complete the national competency and perform community data analysis. These would be shown in Table 1 along with the following activities shown in Figure 1.

Table 1*: Cardiovascular risk factors among subjects*

Cardiovascular risk factors	N (number)	Percentage (%)
Males	368	47
Females	419	53
Hypertension	442	56
Normotension	345	44
Diabetes mellitus	143	18
No diabetes mellitus	644	82
High cholesterol level	428	54
Normal cholesterol level	359	46
Active smoker	294	37
Non-smoker	493	63
Obesity	619	79
Lean	169	21

Table 2: *The ischemic ECG pattern comparison based on cardiovascular risk factors among subjects*

Cardiovascular risk factors	Ischemic ECG pattern, n (%)	P value
Males	18 (7.6)	0.002
Females	30 (10.2)	
Hypertension	34 (12.3)	0.035
Normotension	14 (5.5)	
Diabetes mellitus	10 (11.5)	0.335
No diabetes mellitus	38 (8.6)	
High cholesterol level	27 (9.5)	0.968
Normal cholesterol level	21 (8.6)	
Active smoker	14 (7.3)	0.001
Non-smoker	34 (10.1)	
Obesity	42 (10.1)	0.035
Lean	6 (5.2)	

Figure 1: *The activities of cardiology and vascular medicine residents during supervision of 12-lead ECG examination and education/consultation of ECG result for subjects in this study.*

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4   Conclusions

This study provides the prevalence of ischemic ECG patterns in the population of UGM HDSS Sleman, Yogyakarta, Indonesia, which was only a minority and mostly among females. The ischemic ECG pattern was associated with cardiovascular risk factors such as hypertension and obesity. By interpreting ECG patterns, the education, consultation, and promotion of cardiovascular disease prevention programs could be directly implemented in the community. This study highlights the feasibility of integrating community-based learning and community service performed by cardiology and vascular medicine residents during the residency education program embedded in the curriculum.

5   Declarations

5.1   Study Limitations

Our study had some limitations. First, the ischemic ECG pattern recorded in the population was considered resting ECG. However, the ischemic pattern may occur during exercise. The exercise stress test was not feasible in community service settings. Second, there was inter-observer and intra-observer bias in ECG readings by cardiology and vascular medicine residents. Third, the bias was reduced by confirmatory ECG reading by trained cardiologists.

5.2   Acknowledgments

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5.3   Funding Source

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5.4   Ethical Approval

The research has received ethical approval from the Medical and Health Research Ethics Committee Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada-Dr. Sardjito General Hospital, no: KE/FK/0551/EC/2021.

5.5   Informed Consent

Participants of this research signed an informed consent form.

5.6   Publisher's Note

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