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Research Article

Prevalence of Regional Wall Motion Abnormalities in Patients Coronary Artery Disease at Tangerang District Hospital

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ABSTRACT

Background: Coronary artery disease (CAD) is when the coronary blood vessels cannot supply blood to the heart due to a pile of atherosclerotic plaque in the coronary arteries, so blood flow to the myocardium is disrupted. This blood flow disturbance will cause myocardial contractile dysfunction and Regional Wall Motion Abnormalities (RWMA). **Purposes**: This study aims to determine the prevalence of Regional Wall Motion Abnormalities in CAD patients based on a single-center study at Tangerang District Hospital in January - May 2024. **Methods**: Our study used a descriptive approach in 130 CAD patients grouped based on gender, age, hypertension, and diabetes mellitus. In addition, the determination of RWMA severity cases in CAD was measured by only the Wall Motion Score Index (WMSI) and Wall Motion Score Index (WMSI) followed by the Bull's-eye plot parameters. **Results**: The prevalence of CAD patients with RWMA using the WMSI method was found to be 41 patients (32%) who were predominantly male (76%) and occurred at the mean of age 61,14 years, 27% hypertension, and 17% diabetes mellitus. **Conclusion**: WMSI parameters followed by the Bull's-eye plot could identify 14.6% more RWMA cases than only WMSI.

Keywords: CAD, RWMA, WMSI, bull's-eye plot parameter

INTRODUCTION

The main blood vessels that feed the heart with blood are the coronary arteries, which are afflicted by coronary artery disease (CAD). It happens because of atherosclerotic plaque buildup on the coronary arteries' inner walls. This buildup ultimately restricts blood flow to the myocardium (1). CAD is non-communicable Diseases that cause of third lead death worldwide. Additionally, CAD is the leading cause of death in the United States (2,3). In Indonesia, coronary artery disease has the highest mortality rate (4). Plaque buildup in the coronary arteries blocks the blood supply to the myocardium, preventing the heart muscle from contracting properly and leading to heart function abnormalities (5). The Regional Wall Motion Abnormalities (RWMA) is a condition characterized by abnormal movement of the heart wall, resulting in the heart's inability to pump sufficient blood throughout the body. The prevalence of RWMA from 2000 to 2019 was approximately 22.9%, with 15.4% in males and 7.5% in

females. These data suggest that RWMA can provide increased mortality rates and a poor prognosis for affected individuals (6).

Echocardiography, or cardiac ultrasound is the gold standard examination for identifying RWMA indicator. It is a tool used to assess the anatomical structures of the heart, including the right-left atria and right-left ventricles, then evaluate the heart's pumping function, including detecting abnormal heart wall motion or RWMA. The echocardiographic parameters used to assess RWMA in CAD patients include the Global Longitudinal Strain (GLS) and Wall Motion Score Index (WMSI) (7–9).

The Wall Motion Score Index (WMSI) visually assesses the left ventricular wall abnormality movement (ventricle) by evaluating 16 myocardial segments during the systolic phase using scores of 1, 2, 3, and 4. The total score is translated severity of wall motion abnormalities (10,11). Next, Global Longitudinal Strain (GLS) represents another parameter in echocardiographic that measured characterizes the deformation of the myocardium from the base to the apex of the left ventricle. Detection of GLS based on the Bull's-eye Plot color that relates to the strain or movement of each segment (12,13). Given the background above, more data are needed related to the prevalence of RWMA in CAD patients in Indonesia, particularly at Tangerang General Hospital. Therefore, this study aims to investigate the prevalence of regional wall motion abnormalities in patients with coronary artery disease and their characteristics, particularly at Tangerang General Hospital.

METHODS

This descriptive study measures the prevalence of regional wall motion abnormalities in patients coronary artery disease (CAD) with its characteristics such as age, gender, history of hypertension, and history of diabetes mellitus. The secondary data, encompassing all patients with and without CAD, was obtained from patient medical records in the Cardiology Clinic of at Tangerang District Hospital, collected from January to Mei 2024. In addition, we identified RMWA case and its severity, such as hypokinetic, akinetic, and dyskinetic, using colors on WMSI score, and WMSI following by the plot bull’s eyes (GLS). To make reduce bias data, we exclude patients CAD who have a history of chronic heart failure (CHF). Indicator WMSI and its interpretation (6), such as:

1. Score 1 = Normal/normokinetic
2. Score 1,5 to 2 = Hypokinetic
3. Score 3 = Akinetic
4. Score 4 = Dyskinetic

The plot bull eye can be configured to display 17 segments, each displayed in an intuitive color-coded polar map (14). Indicator plot bull’s eyes and its interpretation such as:

1. Normal/normokinetic: red color (GLS)
2. Hipokinetic: red light/pink color (GLS)
3. Akinetic: faded red or faded blue color (GLS)
4. Dyskinetic: blue color (GLS)

RESULTS

A total of 213 patients (22%) diagnosed coronary artery disease during January – Mei 2024. Of these, Patients in coronary artery disease group with a history of chronic heart failure were excluded 83 patients. A total of 130 patients coronary artery disease admitted without CHF. Based on WMSI parameter, Echocardiography identified coronary artery disease group with RWMA namely, 41 patients (31,54%) while 89 patients (68,46%) without RWMA as presented in Figure 1.

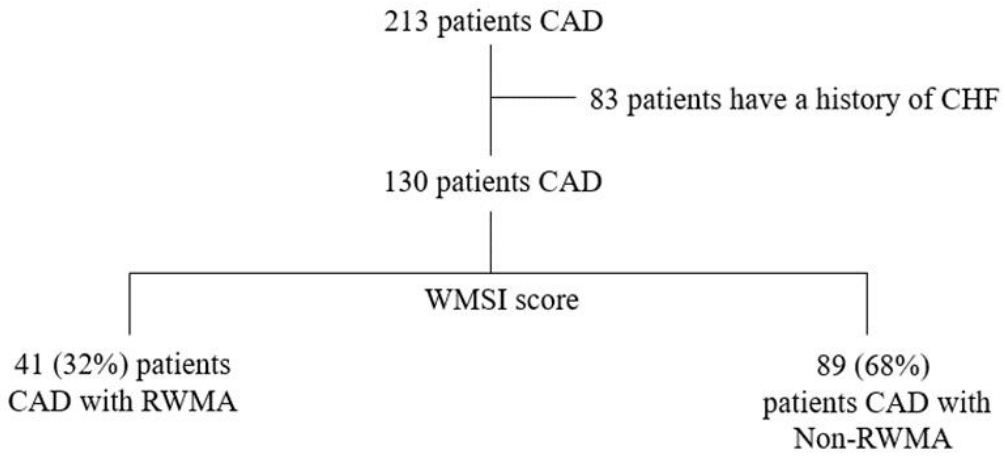

Figure 1. Study flowchart coronary heart disease (CHD) and Regional Wall Motion Abnormalities (RWMA)

Patient Characteristics

The distribution age of CAD showed 15% of adult groups (≤ 50 years) and 85% were elderly groups. Meanwhile, A total distribution of male CAD patients was 62% while 38% patients were women. In addition, 41% of patients with CAD had hypertension while 17% of patients with CAD had diabetes mellitus (Table 1).

Table 1. Baseline Characteristic Sample

Characteristics	CAD patients (n= 130)	CAD and RWMA (n= 41)
Age, mean (range) years	60.1 (30-87)	61.14 (41-80)
Gender, n (%)		
Male	80 (62%)	31 (76%)
Female	50 (38%)	10 (24%)
Hypertension, n (%)	53 (41%)	11 (27%)
Diabetes Mellitus, n (%)	22 (17%)	7 (17%)

Based on age characteristics, CAD patients with RWMA using WMSI were, on average, 60,1 years old, while the mean age of patients with CAD with RWMA was 61.14 years, with the youngest age being 41 and the oldest age being 80. The percentage of CAD patients with RWMA using WMSI based on gender was mostly male: 31 patients (76%) with RWMA. In

addition, 27% of patients with CAD with RWMA had hypertension, while 17% of patients with CAD with RWMA had diabetes mellitus.

Parameters WMSI and Bull's-eye Plot on Patients CAD with RWMA

Based on 130 CAD patients, the percentage of CAD patients with RWMA using WMSI parameters is 41 patients (32%) while using WMSI parameters and Bull's-eye Plot is 47 patients (36%) which can be seen in the table 2.

Tabel 2. Percentage of CAD with RWMA based on WMSI and Bull's-eye Plot

Parameters	Frequency (n= 130)	Percentage
WMSI	41	32%
WMSI and *Plot Bull's-eye*	47	36%

Based on Table 3, it was found that the majority of CAD patients with RWMA both based on only WMSI and WMSI with Bull's-eye Plot were found to be the most with hypokinetic severity compared to akinetic and dyskinetic.

Table 3. Comparison of RWMA severity degree based on WMSI and Bull's-eye Plot

Severity RWMA in CAD	Parameters Echocardiography	
	WMSI (n = 41)	WMSI + *Plot Bull's-eye* (n = 47)
Hypokinetic	32 (78%)	27 (57%)
Akinetic	9 (22%)	15 (32%)
Dyskinetic	0	5 (11%)

DISCUSSION

This study aims to determine the prevalence of Regional Wall Motion Abnormalities (RWMA) cases in CAD patients from January to May 2024. Regional wall motion abnormalities (RWMA) in CAD patients can provide information about the severity of myocardial damage to heart function. The general characteristics of 130 CAD patients were the average elderly group. This aligns with another research at the Hajj Adam Malik Medan Hospital, which explains that the average age of those experiencing CAD is 58.91 years (15). Based on gender, the majority of CAD patients are 63% male patients. These results align with research at Ibnu Sina Hospital Makassar, which found that the percentage of CAD in the male gender was 67.9% greater than that of women (16).

Based on 130 CAD patients, 32% of patients had CAD and RWMA as identified by WMSI parameters. In another study with 453 CAD patients, the prevalence of CAD and RWMA was 60% (17). We suspect that the difference in prevalence CAD and RWMA could be attributed to variations in the sample sizes of CAD patients from different regions. Additionally, differences in sample characteristics such as gender, age, comorbidities, and clinical severity may also explain the variation, aiming to encompass a variety of factors as comprehensively as possible (18,19). Furthermore, we also exclude patients who have a history

of chronic heart failure (CHF). CHF can affect the heart wall's movement pattern, making it difficult to measure the abnormal movement condition of each segment in CAD patients (5).

Then, the mean cases of CAD with RWMA were found in 61,14-year-old patients in the elderly group. Another study also found that RWMA cases in CAD patients with both obstructed and non-obstructed coronary arteries occurred in the age range of 56-75 years (20). Based on gender, it was found that the majority of 76% of male patients with CAD identified RWMA. This may be because 31 out of 80 CAD patients in this study were more men (38.75%) than women with CAD (20%). Another study is also in line, which states that most CAD with RWMA patients are male (6).

Interestingly, the lower prevalence of hypertension in CAD patients with RWMA compared to all CAD patients indicates that not all CAD patients who have RWMA will develop hypertension. However, hypertension is often considered a major risk factor for cardiovascular complications (21). In contrast, the prevalence of diabetes mellitus may be similar between CAD patients with RWMA and all CAD patients. This suggests that diabetes mellitus may have a similar influence on CAD risk with or without RWMA.

Echocardiographic examination showed a difference in the proportion of CAD patients with RWMA between WMSI parameters and the combination of WMSI with Bull's-eye Plot. Based on the results, WMSI parameters followed by the Bull's-eye plot could identify 14.6% more RWMA cases than only WMSI. Both methods found that most RWMA severity at the hypokinetic level was 78% using the WMSI method, while 57% used the Bull's-eye Plot method. In contrast, dyskinetic severity was not found in the WMSI method. However, in the Bull's-eye Plot method, dyskinetic severity was found in 5 patients (11%), so the addition of the Bull's-eye Plot parameter after WMSI may provide a more accurate picture in identifying RWMA cases and the degree of severity. This is by other studies explain that the Bull's-eye plot served in identifying myocardial motion abnormalities in a small area, including being able to identify dyskinetic severity not found in the WMSI method and depict in an intuitive color-coded polar map, making it easier to interpret myocardial function (14,22) The limitations of this study are that it only focuses on the prevalence of Regional Wall Motion Abnormalities (RWMA) in coronary artery disease (CAD) patients without measuring mortality and effectiveness of therapy over a certain period. In addition, the relationship between risk factors and the development of RWMA in CAD patients has not been tested.

CONCLUSION

Of the total 130 patients, 32% had CAD with RWMA based on the WMSI parameter. In most cases, CAD and RWMA were male elderly groups. The prevalence of hypertension was a few in CAD patients with RWMA, while the prevalence of diabetes mellitus was similar in CAD patients with and without RWMA. WMSI parameters followed by the Bull's-eye plot could identify 14.6% more RWMA cases than only WMSI. While WMSI can identify hypokinetic severity (78%), the Bull's-eye Plot detects a broader range, including dyskinetic severity in 11% of cases.

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CONFLICT OF INTEREST

The authors affirm no conflicts of interest to disclose about the publication's subject matter.

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