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Prediabetes, Dyslipidemia, and Hypertension in Acute Coronary Syndrome Patients: A Cross-sectional Study at a Tertiary Hospital in Cirebon District, Indonesia

Yogi Puji Rachmawan[1,2], Witri Pratiwi[3]*, Aussie Nenden Hanifah[3]

[1]*Department of Heart Failure and Cardiometabolic Disease, Hasna Medika Cardiovascular Hospital, Cirebon, Indonesia;* [2]*Department of Cardiovascular Medicine, Faculty of Medicine, Universitas Swadaya Gunung Jati, Indonesia;* [3]*Department of Community Medicine and Public Health, Faculty of Medicine, Universitas Swadaya Gunung Jati, Indonesia*

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***Correspondence:** Witri Pratiwi; Department of Community Medicine and Public Health, Faculty of Medicine, Universitas Swadaya Gunung Jati, Indonesia. E-mail: we3.borneo@gmail.com
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Abstract

BACKGROUND: Cardiovascular disease ranks first as the cause of death worldwide, including in Indonesia. Several risk factors, such as prediabetes, dyslipidemia, and hypertension, are known to be associated with an increased risk of cardiovascular disease.

AIM: This study aims to describe prediabetes, dyslipidemia, and hypertension as risk factors in acute coronary syndrome (ACS) patients.

MATERIALS AND METHODS: We conducted a cross-sectional study at a tertiary hospital in Cirebon district, Indonesia. All patients who were hospitalized with ACS from January to December 2021 and met the inclusion and exclusion criteria were enrolled. Secondary data regarding age, sex, risk factors, and type of ACS were collected through patient medical records. Data are presented through tables and graphs.

RESULTS: A total of 60 ACS patients were recruited in this study, most were male (63.3%). Nearly half of the sample had N-STEMI (46.7%). A total of 35% of the sample had prediabetes (35%) and more than half (58.3%) had hypertension. As many as two-thirds of the samples had dyslipidemia. In young ACS patients (≤45 years), 35.8% had prediabetes, 67.9% dyslipidemia, and 56.6% hypertension.

CONCLUSION: Prediabetes, dyslipidemia, and hypertension in ACS patients are the most common risk factors, both young and >45 years old. Early prevention of these risk factors from a young age needs to be prioritized to prevent ACS at a later age.

Introduction

Cardiovascular disease is responsible for 30% of deaths worldwide, of which seven and a half million are caused by coronary heart disease (CHD). Data also showed that the death rate reaches 8 million/year due to ACS. CHD is the second highest cause of death in 2019 in Indonesia and the prevalence of ST Elevation Myocardial Infarction (STEMI) increased by 15% at that year [1]. The incidence of ACS increases due to several factors, such as age, where the incidence in males increases 7–10 years earlier than in females. The data also showed that ACS caused an increase in the length of stay in the hospital with a significant economic burden and a significant decrease in the patient's quality of life [2].

The risk of ACS is strongly influenced by several traditional CHD factors such as diabetes, smoking, hypertension, dyslipidemia, and family history. These factors play a role in the initial pathophysiological process of atherosclerosis [2]. Interestingly, from these factors, we can conclude a group of risk factors called the metabolic syndrome, which is closely related to the accelerated progression of atherosclerosis. Metabolic syndrome criteria include obesity, hypertension, increased fasting blood glucose, and dyslipidemia [3].

Several studies showed that not only diabetes but prediabetes is also a condition that is thought to be related to the incidence of ACS [4]. Data regarding the relationship of prediabetes, hypertension, and dyslipidemia to the incidence of ACS in Indonesia are still quite limited. Therefore, we conducted this study with the objective to see an overview of prediabetes, hypertension, and dyslipidemia in the ACS patients at a tertiary hospital in Cirebon, Indonesia.

Material and Methods

A cross-sectional study was conducted at a tertiary hospital in suburban area, Cirebon District,

West Java, Indonesia. The sample in this study was ACS patients who were hospitalized from January to December 2021. Data were collected through medical records. The inclusion criteria were ≥18-year-old patients diagnosed with unstable angina pectoris (UAP), STEMI, and non-ST Elevation Myocardial Infarction (N-STEMI). We excluded ACS patients with incomplete medical record data.

Prediabetes status was determined through the results of fasting blood glucose 100–125 mg/dL or HbA1c 5.7–6.4% [5]. Sample was categorized as dyslipidemia if they met one of the criteria, namely LDL levels ≥140 mg/dL or HDL ≤40 mg/dL or triglycerides ≥150 mg/dL [6]. Hypertension was defined as systolic pressure ≥140 mmHg and/or diastolic ≥90 mmHg [7]. This research has received ethical approval no. 42/EC/FKUGJ/IV/2022.

Results

There were 60 ACS patients who met the inclusion and exclusion criteria as study sample. The characteristics of the sample are summarized in Table 1. Most of the sample were male (63.3%). The sample age ranged from 20 to 80 years, with mean age 58.57 ± 11.182 years. There were 35% ACS patients who had prediabetes, 66.7% dyslipidemia, 58.3% hypertension, and 10% had all three risk factors.

Based on the type of ACS, N-STEMI was the most common type (46.7%) while the proportion of samples with UAP was 33.3% and STEMI was 20%. The data can be seen in Figure 1.

Among ACS patients aged ≤45 years (ACS in young age), there were 28.6% who had prediabetes and 57.1% who had dyslipidemia. The proportion of hypertension in ACS patients aged ≤45 years was 71.4% and it was higher compared to >45 years age group (56.6%). The data can be seen in Table 2 and Figure 2.

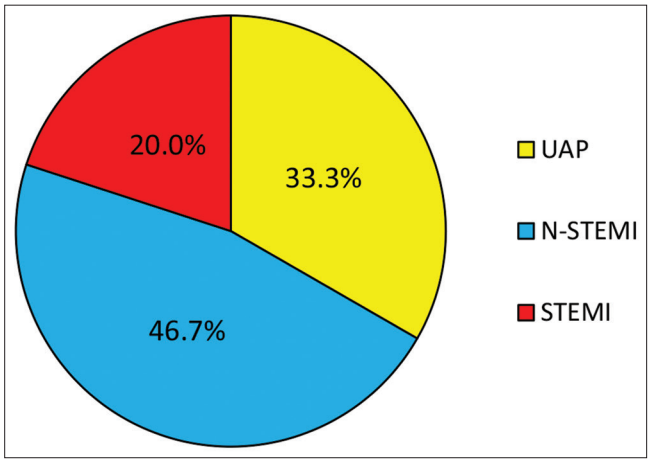


Figure 1: Type of acute coronary syndrome (n = 60)

Based on gender, the proportion of males who experienced dyslipidemia (68.4%) and hypertension (60.5%) was higher than females. Meanwhile, prediabetes were more common in female ACS patients than in males (Figure 3).

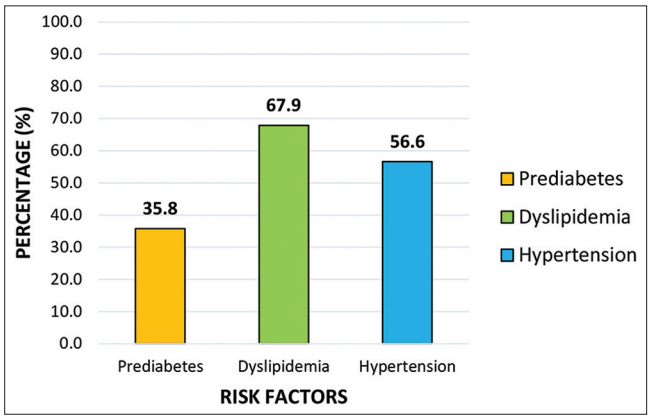


Figure 2: Proportion of risk factors among acute coronary syndrome patients aged >45 years

Table 1: Characteristics of ACS patients

Characteristics	Overall (n = 60)	Types of ACS		
		UAP (n = 20)	N-STEMI (n = 28)	STEMI (n = 12)
Gender				
Male	38 (63.3)	13 (34.2)	14 (36.8)	11 (28.9)
Female	22 (36.7)	7 (31.8)	14 (63.6)	1 (4.5)
Age (years)				
Min-Max	20–80	20–74	43–75	33–80
Mean ± SD	58.57 ± 11.182	55.9 ± 13.463	59.86 ± 8.691	60 ± 12.358
≤45	7 (11.7)	3 (42.9)	2 (28.6)	2 (28.6)
>45	53 (88.3)	17 (32.1)	26 (49.1)	10 (18.9)
Prediabetes				
Yes	21 (35.0)	11 (52.4)	6 (28.6)	4 (19.0)
No	39 (65.0)	9 (23.1)	22 (56.4)	8 (20.5)
Dyslipidemia				
Yes	40 (66.7)	12 (30.0)	21 (52.5)	7 (17.5)
No	20 (33.3)	8 (40.0)	7 (35.0)	5 (25.0)
Hypertension				
Yes	35 (58.3)	10 (28.6)	19 (54.3)	6 (17.1)
No	25 (41.7)	10 (40.0)	9 (36.0)	6 (24.0)
Prediabetes + Dyslipidemia + Hypertension				
Yes	6 (10.0)	4 (66.7)	2 (33.3)	0
No	54 (90.0)	16 (29.6)	26 (48.1)	12 (22.2)

N-STEMI: Non-ST elevation myocardial infarction; STEMI: ST-elevation myocardial infarction; UAP: Unstable angina pectoris.

Table 2: Risk factors among acute coronary syndrome patients in young age (≤45 y.o)

Sample No.	Prediabetes	Dyslipidemia	Hypertension
1	-	-	+
2	-	+	+
3	-	+	-
4	-	-	+
5	-	+	+
6	+	-	+
7	+	+	-
Total	2 (28.6%)	4 (57.1%)	5 (71.4%)

Discussion

This study shows that ACS patients are dominated by males (63.3%) than females. The results of this study are in line with previous studies in Banjarmasin, Indonesia, and other country [8], [9]. Females have a lower risk of experiencing ACS compared to males, especially during the premenopausal phase. This is due to the role of estrogen in vascular protection. Estrogen has a dependent effect on endothelial mediators such as nitric oxide, prostaglandin, and endothelium-derived hyperpolarizing factor which plays a role in vascular elasticity. In the menopause phase, this protective role will be reduced and leading to progressive atherosclerosis. Estrogen withdrawal at menopause has many negative effects on cardiovascular function and metabolism, including alterations in body fat distribution, endothelial dysfunction, vascular inflammation, sympathetic tone, and a higher insulin resistance. These conditions can contribute to the occurrence of hypertension [10].

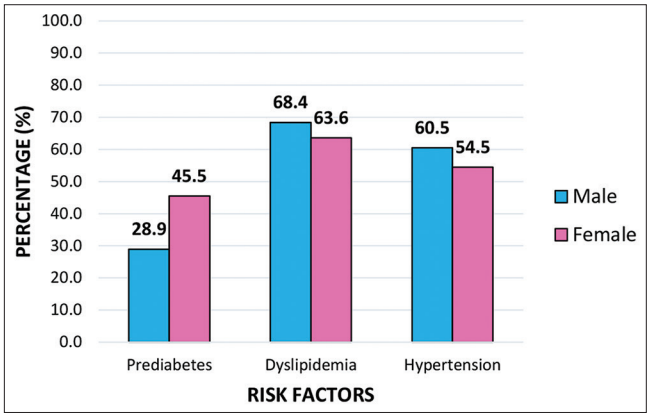


Figure 3: Proportion of risk factors of acute coronary syndrome patients (male versus female)

Several studies have shown that hypertension, dyslipidemia, and diabetes were more common in males than females [9]. Previous research in Indonesia also found that hypertension at young age was more common in males than females [11]. The results of this study also obtained the same results. Interestingly, we found higher proportion of prediabetes in females than in males. It is different from previous studies which showed that prediabetes was more common in males than females [12]. However, the results of this study are possible in line with existing data which showed that the prevalence of diabetes in Indonesia in females was higher than in males. The prevalence of obesity, sweet eating habits, and different activity patterns in male and female populations may be related to it [13]. However, further research is needed to explain it.

The data in this study show that one-third of ACS patients had prediabetes. We know that diabetes is one of the main causes of atherosclerosis, but recently, it became clear that the pathophysiology of atherosclerosis progresses before the onset of diabetic symptoms. The progress of atherosclerosis in prediabetes is influenced by the role of platelets and leukocytes in hyperglycemia. Hyperglycemia conditions facilitate the formation of thrombus and damage to vascular endothelial cells. These findings suggest that prediabetes is not merely a step closer to diabetes, but it is a stage of diabetes with progressive atherosclerosis and shows similar risk of developing ACS [14].

Interestingly, this study also found 7 ACS patients at a young age, consisting of 2 with prediabetes, 4 with dyslipidemia, and 5 with hypertension. Assuming we rule out other risk factors such as smoking and family history of CAD, these results suggest that prediabetes, dyslipidemia, and hypertension can occur at a young age and may be associated with an increased risk of CHD and ACS. Further studies with larger sample studies are needed to see this relationship.

Dyslipidemia and hypertension were found to be the most common risk factors for ACS in this study. Both of these risk factors are related to the process of atherosclerosis. Dyslipidemia is known to be a strong predictor of cardiovascular disease. It is related to endothelial damage which will also manifest as an increase of blood pressure. Evidence suggests that hypertension has similar pathophysiology with CVD. Thus, dyslipidemia, a strong predictor of CVD, may also a good predictor of incident hypertension. Based on molecular mechanism, abnormality of lipid levels will cause endothelium dysfunction which will interfere with activity and production of nitric oxide, endothelin-1, and endothelin A and B receptor expression. This will disrupt the ability of vascular response both constriction and dilatation [15].

Study limitation

The limitation of this study is the small number of samples. Some medical records were incomplete so they were excluded. Further research can be carried out by collecting medical record data >1 year to obtain a larger sample size.

Conclusion

Prediabetes, dyslipidemia, and hypertension in ACS patients are the most common risk factors, both

young and >45 years old. Early prevention of these risk factors from a young age needs to be prioritized to prevent ACS at a later age.

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