



Original Research

Profile of Major Risk Factors in Acute Coronary Syndrome (ACS) at Pusat Pelayanan Jantung Terpadu (PPJT) Dr. Soetomo Public Hospital Surabaya Between the Period of January–December 2019Ikhsanuddin Qothi^{1*}, Muhamad Robi'ul Fuadi², Agus Subagjo³¹Medical Program, Faculty of Medicine, Universitas Airlangga, Indonesia.²Clinical Pathology Department, RSUD Dr. Soetomo, Surabaya, Indonesia.³Cardiologist, Cardiology Department, RSUD Dr. Soetomo, Surabaya, Indonesia.

ARTICLE INFO

Article history:

Submitted August 2021

Reviewed August 2021

Revised August 2021

Available online September 2021

**Corresponding author:*

ikhsanuddin.qothi-

2018@fk.unair.ac.id

Keywords:

Acute coronary syndrome

Coronary heart disease

Major risk factors

Profile

ABSTRACT

Background: Coronary heart disease (CHD) is a leading cause of death worldwide. One type of CHD that most often causes clinical manifestations and death is Acute Coronary Syndrome (ACS). In 2013 the prevalence of SKA in Indonesia reached 1.5% and it is estimated that it will continue to increase every year. **Objective:** This study aims to determine the profile of major risk factors for ACS sufferers in the Pusat Pelayanan Jantung Terpadu (PPJT) Dr. Soetomo Public Hospital Surabaya in the period January-December 2019. **Methods:** This study used a retrospective descriptive method to analyze the patient's electronic medical record (e-MR). **Results:** Out of 623 patients diagnosed with ACS, 429 were excluded from the research. 194 patients who met the inclusion criteria were studied with the following details: 19 UAP patients, 43 N-STEMI patients, and 132 STEMI patients. It was found that 73% of ACS patients were male, with the 55-64 years' age group dominating by 46%. Based on blood pressure and serum cholesterol examination data, it was found that 51% of patients had hypertension and 77% of patients had dyslipidemia (40% hypercholesterolemia, 42% hypertriglyceridemia, 40% low HDL-C levels, and 34% high LDL-C levels). 60% patients had type-2 diabetes mellitus and 52% of patients had a history of smoking. **Conclusion:** 73% of ACS patients in this study were men. Most common age groups were 55-64 years old (46%), had hypertension by 51%, had dyslipidemia by 77% (40% hypercholesterolemia, 42% hypertriglyceridemia, 40% low HDL-C levels, 34% high LDL-C), had type-2 diabetes mellitus by 60%, and had a smoking history by 52%.

Introduction

Cardiovascular disease is the leading cause of death in the world. According to World Health Organization (WHO), in 2016 cardiovascular disease caused 17.9 million deaths, or equivalent to 31% of all deaths, worldwide and is predicted to keep increasing up to 23.6 million deaths by 2030.

[1]

Coronary heart disease (CHD) can be classified into three groups: stable asymptomatic coronary heart disease, stable angina, and acute coronary syndrome [2]. Acute coronary syndrome (ACS) is the most common clinical manifestation of CHD and is the most likely to cause death, ACS is described as progressive CHD and often undergoes sudden

change from stable to unstable or acute ^[3]. Epidemiological data show that ACS caused 10 million deaths and 120 million disabilities between 1990-2010 in Asia-Pacific ^[4]. Recent studies showed an increase of 42% in ACS incidence rate compared to that in 1990. Meanwhile, back in 2013, ACS was responsible for 7.3-8.8 deaths worldwide ^[5]. In 2013 ACS prevalence in Indonesia is known to be at 1.5% or equivalent to 2,650,340 cases. ^[6]

Statistically, in the age group of <60 years, ACS occurs 7-10 years earlier in males than in females ^[9]. Hypertension has long been known as a significant risk factor for coronary heart disease ^[12]. On the other hand, dyslipidemia is one of the major risk factors of coronary heart disease and plays a role before other risk factors arise ^[11]. Dyslipidemia is marked by an increase in total cholesterol level, LDL-C, and triglycerides, also a decrease in HDL-C ^[12]. According to a study regarding the risk factors of heart disease in the age group of ≥55 years old, hypertension is the most commonly found risk factor of CHD (33.1%), followed by increased lipid concentration (17.7%), smoking habit (10.7%), and diabetes mellitus (8.6%) ^[13]. Another study noted that one in three deaths in people >35 years old is caused by coronary heart disease, including ACS ^[14]. The easiest way to prevent coronary heart disease, especially ACS is by determining its etiology and try to reduce or avoid it.

Diabetes Mellitus (DM) and hypertension are related and may increase the risk of cardiovascular diseases ^[15]. As many as 32.3% of DM patients have cardiovascular and stroke complications which later became the leading mortality cause among them ^[16]. Even though DM patients have 2-4 times higher risk of cardiovascular diseases, recent studies showed that most DM patients are at low risk of cardiovascular complications. ^[17]

Dyslipidemia and hypertension are related to the incidence of cardiovascular diseases. Individuals with a history of dyslipidemia and hypertension are 18.1 times more at risk of CHD, whilst individuals with a history of dyslipidemia without hypertension have a 2.5-fold increase of CHD risk ^[18]. At the same time, another study stated that dyslipidemia and CHD are unrelated ^[19]. Indian research said that individuals with a history of hypertension are at five times higher risk of CHD ^[20]. The longer an individual suffers from hypertension, the higher their risk of CHD is ^[21]. However, another study conducted in West Sumatra concluded that there is no significant relation between hypertension and CHD. ^[22]

Determining risk factors based on laboratory results is very important. This is because laboratory data collection can objectively show the relationship between risk factors and ACS occurrence. Dyslipidemia can be determined by measuring blood lipid concentration ^[23]. Diabetes mellitus can be determined by measuring blood glucose level and HbA1c level ^[24]. In comparison, hypertension can be determined by measuring the patient's blood pressure ^[25]. Examinations of HDL-C, total/HDL-C, and triglycerides/HDL-C have been proven to have a relationship in showing the risk of heart disease ^[26]. A Framingham study mentioned that LDL-C, triglyceride, and HDL-C are the strongest predictors of atherosclerosis. ^[27]

The prevalence of ACS has increased each year significantly ^[5]. This increase will undoubtedly cause various impacts, one of which is the loss of an individual's productive time. The loss of adequate time will indeed correlate to other problems, including social and economic issues. Therefore, this study is conducted to understand the profile of the major risk factors of ACS so that it can be used both as additional information and/or as epidemiological data. This study is proposed to

provide medical personnel with an overview regarding the management of ACS so that it can reduce the mortality rate of ACS or coronary heart disease in general. This study can also provide an overview of the risk factors of coronary heart disease to the community. It is hoped that the description can be followed up by the people in the community by taking various preventive measures as early as possible so that, in the end, it can reduce the incidence of CHD in the future.

Material and Methods

This study used a retrospective descriptive method to analyze the patients' electronic medical records (e-MR). The subject of this study were patients hospitalized in Pusat Pelayanan Jantung Terpadu (PPJT) Dr. Soetomo Public Hospital Surabaya, within January-December 2019 who had been diagnosed with ACS or who met one of the criteria of having clinical history of persistent angina which lasted for > 20 minutes while at rest, experiencing abnormal changes in ECG such as ST depression, change in T waves, ST-segment elevation, or even normal ECG, and experiencing changes in concentration of cardiac biomarkers in the form of increased or decreased troponin serum which caused the cardiac biomarkers to be above the normal limit in general. The subject of this study has to meet the inclusion criteria of had been hospitalized in PPJT Dr. Soetomo Public Hospital Surabaya between the period of January 2019 to December 2019 and later been diagnosed with the acute coronary syndrome of unstable angina pectoris (UAP), ST-Elevation Myocardial Infarction (STEMI), and Non-ST Elevation Myocardial Infarction (N-STEMI) based on examination, ECG, and laboratory result; has a complete medical record; and has undergone thorough laboratory examination, including blood glucose level and/or HbA1c and serum cholesterol examinations, as well as blood pressure examination. The exclusion

criteria for this study are patients who do not meet the criteria of an acute coronary syndrome of unstable angina pectoris (UAP), ST-Elevation Myocardial Infarction (STEMI), and Non-ST Elevation Myocardial Infarction (N-STEMI); patients whose medical record is indecipherable or damaged; patients who did not undergo complete laboratory examination, including blood glucose level and/or HbA1c and serum cholesterol examinations, as well as blood pressure examination; and patients with a history of kidney disease or failure. The subjects who met the inclusion and exclusion criteria will then be included. The data will then be analyzed using descriptive method to determine the distributions and percentages of each variable, which will then be described in narratives. The software used to analyze the data in this study is Microsoft Excel 2016 and SPSS 22.0. This study also considers the anonymity and confidentiality of the patients' identity and medical records' data.

Results

This is a retrospective study in which data was obtained from patients' electronic medical records to learn the major risk factors of ACS patients in PPJT Dr. Soetomo Public Hospital Surabaya between January and December 2019. The result of this study will be presented in the form of tables and pie charts containing the patients' demographic data of age and sex and risk factors data consisting of hypertension, type 2 diabetes mellitus, dyslipidemia, and smoking habit. Those data were obtained from the result of history taking which had been inscribed on the medical record along with physical examination or laboratory examinations (HbA1c, blood glucose, and serum cholesterol level).

The number of patients diagnosed with acute coronary syndrome who was being treated in the inpatient unit of PPJT Dr. Soetomo Surabaya from January 2019 to December 2019 is 623 patients, consisting of 561 patients with myocardial infarction (STEMI and N-STEMI) and 62 patients with unstable angina pectoris. After being selected using the inclusion and exclusion criteria, 194 patients, which consists of 19 patients with unstable angina pectoris, 43 patients with N-STEMI, and 132 patients with STEMI, met both criteria and are eligible to become samples of this study. The other 429 patients had to be excluded as they did not have complete data of the additional examinations.

Age

Based on this study, the highest number of acute coronary syndrome (ACS) patients is 89 patients (46%) who are between 55-64 years old, followed by 66 (34%) patients who are between 45-54 years old, 34 (18%) patients who are ≥ 65 years old, 3 (2%) patients who are between 25-34 years old, 2 (1%) patients who are between 35-44 years old, and 0 (0%) who are <25 years' old. The youngest subject of this study is 28 years old, while the eldest subject is 83 years old.

Table 1. Age group distribution of patients with ACS in Pusat Pelayanan Jantung Terpadu (PPJT) Dr. Soetomo Public Hospital Surabaya between January-December 2019

Age Group	Frequency (n)	Percentage (%)
<25 years old	0	0%
25-34 years old	3	2%
35-44 years old	2	1%
45-54 years old	66	34%
55-64 years old	89	46%
≥ 65 years old	34	18%
Total	194	100%
Minimum	28 years old	
Maximum	83 years old	

Sex

Based on this study, most ACS patients are male at 141 (73%) patients, while 53 (27%) are female ACS patients. Thus, the male to female ratio of ACS patients in this study is 2.7:1.

Table 2. Sex distribution of patients with ACS in Pusat Pelayanan Jantung Terpadu (PPJT) Dr. Soetomo Public Hospital Surabaya between January-December 2019

Sex	Frequency (n)	Percentage (%)
Male	141	73%
Female	53	27%
Total	194	100%

Lipid Profile

Based on this study, 149 (77%) of the ACS patients also have dyslipidemia, while 45 (23%) others have normal serum cholesterol levels. Based on total cholesterol level measurement, there are 77 (40%) patients with hypercholesterolemia, while the total cholesterol level of the rest of the 117 (60%) patients is normal. Based on triglyceride level measurement, 82 (42%) patients have hypertriglyceridemia, while 112 (58%) others are normal. Based on HDL-Cholesterol (HDL-C) level measurement, 77 (40%) patients have low HDL-C levels, while 117 (60%) patients have normal HDL-C levels. Based on LDL-C level, 65 (34%) patients were found to have high LDL-C levels, and 129 (66%) patients have average LDL-C levels.

Table 4. Lipid profile distribution of patients with ACS in Pusat Pelayanan Jantung Terpadu (PPJT) Dr. Soetomo Public Hospital Surabaya between January-December 2019

Parameter	Interpretation	Frequency (n)	Percentage (%)
Serum Cholesterol	Dyslipidemia	149	77%
	Normal (Non-dyslipidemia)	45	23%
	Total	194	100%
Total Cholesterol	Hypercholesterolemia	77	40%
	Normal	117	60%
	Total	194	100%
Triglycerides	Hypertriglyceridemia	82	42%
	Normal	112	58%
	Total	194	100%
HDL-Cholesterol	Low	77	40%
	Normal	117	60%
	(HDL-C) Total	194	100%
LDL-Cholesterol	High	65	34%
	Normal	129	66%
	(LDL-C) Total	194	100%

Diabetes Mellitus

In this study, 116 (60%) patients were found to have type 2 diabetes mellitus, while the blood glucose level of 78 (40%) patients was found to be normal.

Table 5. Diabetes Mellitus distribution of patients with ACS in Pusat Pelayanan Jantung Terpadu (PPJT) Dr. Soetomo Public Hospital Surabaya between January-December 2019

Diabetes Mellitus	Frequency (n)	Percentage (%)
Type 2 Diabetes Mellitus	124	54%
Normal	106	46%
Total	230	100%

History of Smoking

This study found that 101 (52%) patients have a history of smoking while 93 (48%) patients do not.

Table 6. History of smoking distribution of patients with ACS in Pusat Pelayanan Jantung Terpadu (PPJT) Dr. Soetomo Public Hospital Surabaya between January-December 2019

History of Smoking	Frequency (n)	Percentage (%)
Yes	101	52%
No	93	48%
Total	194	100%

Discussion

The data was obtained from the EMR of patients with the acute coronary syndrome (ACS) who was being treated in the inpatient ward of Pusat Pelayanan Jantung Terpadu (PPJT) Dr. Soetomo Public Hospital between the period of January-December 2019.

This study found that most ACS patients are from the age group of 55-64 years old, with 89 patients, which is equivalent to 46%, followed by the age group of 45-54 years old with 66 patients, which is equivalent to 34%. This result is in line with the result of a study by Saputri, et al in 2018^[28] which stated that coronary heart disease is most common among people between 51-60 years old with a percentage of 42.6%. The result is also similar to a study by Nadasya, et al in 2019^[29] which stated that coronary heart disease is most common among people between 50-60 years old with a percentage of 58%. Iskandar conducts another study which is in line with this study, et al in 2015^[30] on RSU Meuraxa Banda Aceh which compared the manifestation between CHD and non-CHD patients, which the age group of 50-69 years' old became the highest number of CHD patients with 46.7% (28 patients).

A study carried by Nohair, et al in 2017^[31] showed a different result by stating that the highest number of CHD patients are among the age group of 40-49

years old with 67 patients or equivalent to 28.8%, followed by patients from the age group of 20-29 years' old with 61 patients or equivalent to 26.2%. Another study conducted by Ghani in 2016^[32] also stated that people among the 25-34 years' old age group became the highest number of CHD patients with 175,365 patients (24.3%). Similar results were found in a study by Syukri et al in 2013^[33] on RSUP Prof. Dr. R. D. Kandou Manado, which showed the age group of 61-70 years old are the highest age group for CHD patients with 69 patients or equivalent to 30%.

Age is one of the risk factors that might cause CHD. Generally, the risk of CHD increases with age, especially if they are also exposed to other risk factors^[34]. Individuals 40-60 years old will have an increased risk of CHD due to their history of disease and degenerative process of the blood vessels. Both processes can increase the risk of myocardial infarction up to 5 folds^[35]. Another study mentioned that people older than 65 years old have a higher risk of CHD due to the degenerative process, which might alter the heart and blood vessels. The changes might decrease the heart's contractility, especially with effort. Moreover, the degenerative process will also increase the stiffness of blood vessels so that it will increase the risk of atherosclerotic plaque formation, which will lead to CHD.^[36]

This study found that most patients with the acute coronary syndrome (ACS) are male, with 141 people or equivalent to 73% percentage. In comparison, the number of female ACS patients is 53 people or equal to 27% percentage. The ratio of male to female patients is 2.7:1. This result corresponded with a study conducted by Ralapanawa et al. in 2019^[6] which stated that ACS is more often to be found in males with 199 patients (67%) than in females with 101 patients (33%), thus making the male to female patients' ratio to be 2:1. A study by Nohair et al in 2017^[31] also stated a comparable result that coronary heart disease was found in 157 (67%) male patients and in 76 (33%) female patients, thus making the male to female patients' ratio to be 2:1. Another study by Shabana et al. in 2020^[37] stated that coronary heart disease is more likely to be found in males with 290 (58%) patients than in females with 210 (42%) patients, making the male to female patients' ratio to be 1.2:1. Previous studies already mentioned that the difference in male to female CHD incidence is due to the different number of collected samples. However, in general, the aforementioned studies agreed that male is still the majority of CHD patients.

Age plays a role as one of the major risk factors of CHD development. A study found that in >45 years of age, males have a higher tendency to develop CHD while females will have an increased risk of CHD after 55 years old, which is also known to be the period of menopause in most females. Some previous studies also found that the prevalence, incidence, and mortality of CHD are higher in males than in females^[36]. Another study also found that the development of cardiovascular diseases in females tends to be 7-10 years later than in males. This might be due to the effect of endogenous estrogen in the fertile female, which will inhibit atherosclerotic formation^[37]. Estrogen has some

advantages and effects in inhibiting atherosclerotic plaque formation, vasodilatation, blood pressure regulation, antioxidant properties, and inflammatory process, reducing the risk of CHD^[38]. The post-menopausal female has 1.5 higher risks of CHD compared to the female who has not undergone menopause^[39]. However, a study by Ghani in 2016^[32] with 7.222.329 samples which are ≥ 15 years old from 33 provinces in Indonesia, found that CHD is more often to be found in the female with 362,285 (50.2%) patients compared to in male with 360,044 (49.8%) patients.

Several factors are contributing to the development of CHD, including habits and lifestyle. The prevalence of female smokers is relatively lower than male smokers, contributing to the reduced incidence and mortality of CHD in females. In addition, the social status of females in some cultures or regions that require females to do household chores and take care of children caused females to tend to have lower physical activity but higher stress than males. A WHO data also stated that a body mass index (BMI) ≥ 25 kg/m² (overweight) is more likely to be found in males, whilst a BMI of ≥ 30 kg/m² is more likely to be found in females^[36].

Hypertension also became a contributing risk factor in 98 (51%) patients with ACS in this study, while 96 (49%) other patients do not have hypertension. A survey by Shabana et al in 2010^[35] stated that hypertension contributed to 300 (60%) patients, which is in line with this study. Another study by Syukri et al in 2013^[33] on RSUP Prof. Dr. R. D. Kandou Manado also showed the similar result of hypertension contributing to 52 (55%) patients with CHD. A study by Supriyono in 2008^[40] stated that 52 (65%) patients with ACS have the previous history of hypertension. However, a study by Nohair et al in 2017^[31] showed a different result which

stated that hypertension only contributed to 29 (12.4%) CHD patients.

Hypertension is one of the risk factors which contribute to ACS by causing oxidative and mechanical stress on the blood vessels' wall ^[10]. Hypertension will cause endothelial damage and atherosclerotic plaque formation. In addition, hypertension also makes the plaque unstable so that it falls off quickly. If left protracted, hypertension will cause left ventricular hypertrophy due to increased heart load ^[41]. If the high blood pressure is sustained for a long time, endothelial cells damage will occur. Reactive Oxygen Species (ROS) formed by normal blood vessels' wall acts as signals that regulate the vessels' contraction and relaxation. In the case of endothelial damage, ROS will become uncontrollable, thus will lead to oxidative stress. Production of ROS will activate COX-1 to produce prostanoid, leading to endothelial dysfunction, which will further increase and worsen atherosclerotic plaque formation and susceptibility ^[42]. Atherosclerotic plaque formation will disrupt the blood flow to the myocardium, which in turn will provoke symptoms of angina pectoris, coronary insufficiency, and myocardial infarction more often than in normal patients ^[40]. Hypertension can also increase the stiffness of the blood vessels if left for a longer time. Hypertension has various causes; other risk factors that correlate with hypertension are consuming high-fat diets and smoking ^[43].

This study showed that dyslipidemia plays a major role in patients with acute coronary syndrome (ACS). There are 149 (77%) patients with ACS who were found to have dyslipidemia, among those 77 (40%) patients have hypercholesterolemia, 82 (42%) patients have hypertriglyceridemia, 77 (42%) patients have low HDL-C levels, and 65 (34%) patients have high LDL-C level. This finding is similar to a study by Shabana in 2020 ^[35] which result showed that in 500 patients with ACS, 255

(51%) of them were found to have dyslipidemia, however there are some differences in lipid profile distribution among those patients. In Shabana's study ^[35], 250 (80%) patients with ACS have hypercholesterolemia, 400 (80%) patients have hypertriglyceridemia, 320 (64%) patients have low HDL-C level, and 260 (52%) patients have high LDL-C level. A study by Nohair et al in 2017 ^[31] also showed slight differences as this study focused on the increase of LDL-C level and the decrease of HDL-C level from baseline. The study used 233 samples and concluded that 192 (82%) patients have high LDL-C levels while 71 (30%) patients have low HDL-C levels ^[31].

A study by Zahrawardani, Herlambang, and Anggraheny in 2013 ^[43] on RSUP Dr. Kariadi Semarang showed a similar result in total cholesterol level with 59 (46%) patients have hypercholesterolemia while 47 (29%) patients have hypertriglyceridemia. A study by Supriyono in 2008 ^[40] also showed the similar result that 57 (71.3%) out of 80 patients have dyslipidemia, although there are some differences in the distribution value. Among those patients, 45 (56.3%) patients have hypercholesterolemia, 36 (47.4%) patients have hypertriglyceridemia, 36 (55.4%) patients have low HDL-C levels, and 37 (60.7%) patients have high LDL-C levels ^[40].

Dyslipidemia is the second most common risk factor of heart disease ^[44]. Primarily, CHD incidence is correlated to LDL-C level and inversely proportional to HDL-C level. LDL-C (Low-Density Lipoprotein-Cholesterol) is known as bad cholesterol. Therefore, a high level of LDL-C will cause the thickening of the wall of blood vessels through atherosclerotic plaque formation. Various studies using animals and clinical trials concluded that hyper-LDL-C is the major risk factor of CHD ^[45]. Epidemiological studies found that people with high LDL-C levels are 3 times more at risk of CHD than

normal people ^[45]. Furthermore, a high LDL-C level will speed up atherosclerotic plaque formation. HDL-C (High-Density Lipoprotein-Cholesterol) is known as good cholesterol, which is in charge of transporting fat from circulation to the liver. Various studies suggest that the lower the HDL-C level, the more likely an individual is to have CHD. HDL-C level can be increased by stopping smoking, doing physical exercises, and lowering body weight [46].

Triglycerides are the type of fat consisting of three types of fats: saturated fats, monounsaturated fats, and polyunsaturated fats. A high level of triglycerides is a risk factor for CHD. Triglycerides play a role in increasing blood viscosity. Therefore, the higher the triglycerides level, the more viscous the blood will be ^[46]. A study by Ginsberg in 2004 ^[47] concluded that people with triglycerides levels of 209-315 mg/dL would be five times more at risk of CHD compared to people with triglycerides levels of 118-172 mg/dL after 40 years in 100 males with an average age of 22 years old.

This study also considers type 2 diabetes mellitus as one of the risk factors which has an enormous contribution in patients with the acute coronary syndrome (ACS). Among the samples in this study, 116 (60%) patients have a history of type 2 diabetes mellitus. A survey by Zahrawardani, Herlambang, and Anggraheny in 2013 ^[43] on RSUP Dr. Kariadi Semarang showed a similar result with type 2 diabetes mellitus contributing to 82 (64%) patients with ACS. A study by Arnold, et al in 2014 ^[48], showed the comparable result of 1,970 (69%) patients with ACS have a history of type 2 diabetes mellitus. Another study by Idrus in 2017 ^[49] also showed a similar result of 47 (73.4%) patients with ACS have a history of type 2 diabetes mellitus. However, a study by Ghani et al in 2016 ^[32] suggested a different result. Based on the study, which involved 722,329 people aged ≥ 15 years old from 33 provinces in Indonesia, only 8,706 (1.2%)

samples have a previous history of type 2 diabetes mellitus ^[32]. Another study by Nohair et al in 2020 ^[31] also showed that among 233 patients, only 24 (10.3%) patients have a history of type-2 diabetes mellitus.

Diabetes mellitus is one of the risk factors of coronary heart disease. People with diabetes mellitus tend to have an earlier onset of tissue degeneration process and endothelial dysfunction. These processes will cause the thickening of the capillary and coronary basement membrane, which will cause the narrowing of the blood flow to the heart ^[49]. The high blood glucose level in patients with diabetes mellitus will cause the glucose to attach to the wall of the blood vessels. The attached glucose will then be oxidized and reacted, forming Advanced Glycosylated End-products (AGEs). If this happens continuously, the walls of the blood vessels will be damaged. The damaged vessels' wall will cause lipid to accumulate inside the blood vessels, which will later form atherosclerotic plaque ^[50]. Furthermore, in diabetic patients, there will be an increase in blood viscosity which will correlate to the rise of atherosclerosis and might lead to coronary heart disease ^[32]. Adults with diabetes mellitus are 2-4 times more at risk of developing CHD than normal adults ^[51].

This study also found the history of smoking to contribute in patients with ACS. Among 194 samples, 101 (52%) patients have a previous history of smoking. A study by Sabia, et al in 2012 ^[52] found 35 (63.6%) patients have a history of smoking. This finding is in line with a study by Supriyadi in 2008 [40] on RSUP Dr. Kariadi Semarang and RS Telogorejo Semarang, which found 51 (63.5%) patients have a history of smoking. Based on bivariate analysis from the data, it was suggested that at >45 years of age, a smoker will have a 2.4 times increased risk of cardiovascular disease than a non-smoker ^[40].

Another study conducted by Djunaidi and Indrawan in 2014^[53] on RS Dr. Mohammad Hoesin Palembang showed that 71 (59%) patients with CHD have history of smoking. The bivariate analysis from that study also suggested that smokers have a 4-5 increased risk of CHD compared to non-smoker^[53]. However, a study by Iskandar et al in 2015^[30] suggested that 33 (55%) patients with CHD do not have a history of smoking. A study by Shabana^[35] also suggested that 353 (70.6%) patients with CHD do not have smoking history.

Smoking correlates to endothelial dysfunction, inflammatory process, lipid modification, and altered anti-thrombotic and pro-thrombotic factors^[42]. Smoking can provoke atherogenesis through its direct effect on the arterial wall, carbon dioxide on the smoke, which will cause arterial hypoxia, nicotine, and its mobilization effects of catecholamine, which will cause thrombocyte reaction, and the glycoprotein of the cigarette, which might cause arterial wall hypersensitivity^[54]. Cigarettes affect hypertension by stimulating the sympathetic nervous system, causing endothelial damage, and increasing the stiffness of blood vessels^[42].

The limitation of this study is the data collection method using secondary data of electronic medical records caused the data to be highly affected by the completeness of the medical record. Not all samples have complete data regarding their history of smoking, physical examination of blood pressure, and laboratory examinations of serum cholesterol, blood glucose level, and/or HbA1c. The incompleteness of the data affected the result of this study due to 429 data had to be excluded. Among the excluded data, history of smoking result cannot be found in 429 data, laboratory examination result for serum cholesterol of total cholesterol, triglycerides, HDL-C, and LDL-C level

cannot be found in 396 data, laboratory examination result for blood glucose level of random plasma glucose test, fasting plasma blood glucose, oral glucose tolerance test (OGTT) and/or HbA1c cannot be found in 164 data, and physical examination result of blood pressure cannot be found in 329 data. Various factors might cause the incompleteness of the medical records. However, the failure to note the history of smoking and physical examination as major risk factors of CHD on the medical record had affected this study. It caused the author to not get the required data for this study.

For future studies, the author suggests filling the electronic medical data as completely as possible so that future studies can get more complete data than this study. It is recommended that a checklist of major risk factors for each ACS patient is made to assist with further epidemiological research. It is also suggested that history of smoking as one of the major risk factors of CHD and ACS to be noted in the medical record in the form of a column of choices so that it can help determine the patient's risk of CHD and ACS as well as so that is easier for the medical personnel in charge to fill them in. Future study to understand the distribution of dyslipidemia in patients with ACS or CHD is highly needed as there are still quite some differences in the result of similar studies. Furthermore, future study regarding the relationship between ACS and sex, age, and major risk factors is also needed to understand the subject better.

Conclusion

The conclusion of this study regarding the profile of major risk factors in patients with acute coronary syndrome (ACS) in Dr. Soetomo Public Hospital between the period of January-December 2019 are as follows:

1. The distribution of patients with acute coronary syndrome between the period of January-December 2019 based on the classification is led by 132 (68%) patients with STEMI followed by 43 (22%) patients with N-STEMI and 19 (10%) patients with unstable angina pectoris.
2. The distribution of patients with acute coronary syndrome between the period of January-December 2019 based on the sex is mostly male with 141 (73%) patients.
3. The distribution of patients with acute coronary syndrome between the period of January-December 2019 based on the age group is mostly people who are between 55-64 years' old with 89 (46%) patients.
4. The distribution of patients with acute coronary syndrome between the period of January-December 2019 based on the basedon blood pressure examination is 98 (51%) patients with high blood pressure (hypertension) and 96 (49%) patients with normal blood pressure.
5. The distribution of patients with acute coronary syndrome between the period of January-December 2019 based on the serum cholesterol work up is 149 (77%) patients with dyslipidemia while 45 (23%) patients are normal, with details as follows: 77 (40%) patients with hypercholesterolemia, 82 (42%) patients with hypertriglyceridemia, 77 (40%) patients with low HDL-C level, and 65 (34%) patients with high LDL-C level.
6. The distribution of patients with acute coronary syndrome between the period of January-December 2019 based on the HbA1c and/or

blood glucose level is 116 (60%) patients has type 2 diabetes mellitus and 78 (40%) patients with normal HbA1c and/or blood glucose level.

7. The distribution of patients with acute coronary syndrome between the period of January-December 2019 based on the history of smoking is 101 (52%) patients have a history of smoking while 93 (48%) patients do not have a history of smoking.

Acknowledgement

Thanks to the various parties involved, especially the dean of the faculty of medicine Universitas Airlangga, the director of Dr. Soetomo Public Hospital, the head of the Communication and Information Installation, and the Health Research Ethics Committee Dr. Soetomo Public Hospital chairman so that this research can be completed without any significant hindrance.

References

1. WHO. 2020. Cardiovascular Diseases (CVDs) World Health Organization [Online] Available at: [https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-\(cvds\)](https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)) [Accessed 14 December 2020].
2. Juzar D.A., Danny S.S., Irmalita, Tobing D., Firdaus I., et al. 2018. Pedomana Tatalaksana Sindrom Koroner Akut. Fourth Editin. PP Perkeni, pp 15-30.
3. Muchid A., Umar F., Chusun, Purnama N.R. 2006. Pharmaceutical Care untuk Pasien Penyakit Jantung Koroner: Fokus Sindrom Koroner Akut. First Edition. Bakti Husada, Jakarta. pp. 9-27.
4. Jan S., Lee S., Sawhney J., Ong T., Chin C., Kim H., et al. 2016. Catastrophic health expenditure on acute coronary events in Asia:

- a prospective study. *Bulletin of the World Health Organization*, 94;3:193-200.
5. Ralapanawa U., Kumarasiri P.V.R., Jayawickreme K.P., Kumarihamy P., Wijeratne Y., Ekanayake., et al. 2019. Epidemiology and risk factors of patients with types of acute coronary syndrome presenting to a tertiary care hospital in Sri Lanka. *BMC Cardiovasc Disord*, 19: 229.
 6. Riset Kesehatan Dasar. 2018. [online] Available at: <https://kesmas.kemkes.go.id/assets/upload/di_r_519d41d8cd98f00/files/Hasil-risikesdas-2018_1274.pdf> [Accessed 14 May 2020].
 7. Yahya, A.F. 2010. Menaklukkan pembunuh no. 1: Mencegah dan Mengatasi Penyakit Jantung Koroner Secara Tepat. First edition. PT Mizan Pustaka, Bandung. pp. 10-210.
 8. Vedanthan R., Seligman B., Fuster V. 2014. Global perspective on acute coronary syndrome: a burden on the young and poor. *Circulation research*, 114;12:1959–1975.
 9. James S., Bueno H. 2018. *Epidemiology of Acute Coronary Syndrome*. ESC CardioMed. Third Edition. Oxford University Press, UK. pp: 1213-1218.
 10. Malakar A., Choudhury D., Halder B., Paul P., Uddin A., Chakraborty S. 2019. A review on coronary artery disease, its risk factors, and therapeutics. *Journal of Cellular Physiology*, 234;10:16812-16823.
 11. Arsana, P., Rosandi, R., Manaf A., Budhiarta A., Permana H., Sucipta K., et al. 2015. *Panduan Pengelolaan Dislipidemia Di Indonesia 2015*. First edition. PB. Perkeni, Jakarta. pp 1-6.
 12. Lin, C.F., Chang, Y., Chien S., Lin, Y., Yeh, H. 2018. Epidemiology of Dyslipidemia in the Asia Pacific Region. *International Journal of Gerontology*, 12;1:2-6.
 13. Hussain, M., Mamun., A., Peters, S., Woodward, S., Huxley, R. 2016. The Burden of Cardiovascular Disease Attributable to Major Modifiable Risk Factors in Indonesia. *Journal of Epidemiology*, 26;10:515-521.
 14. Sanchis-Gomar F., Quillis, C., Leischik, R., Lucia, A. 2016. Epidemiology of coronary heart disease and acute coronary syndrome. *Annals of translational medicine*, 4;13:256.
 15. Petrie, J., Guzik, T. and Touyz, R. 2018. Diabetes, Hypertension, and Cardiovascular Disease: Clinical Insights and Vascular Mechanisms. *Canadian Journal of Cardiology*, 34;5:575-584.
 16. Einarson T., Acs, A., Ludwig C., Panton U. 2018. Prevalence of Cardiovascular Disease in Type 2 Diabetes: a Systematic Literature Review of Scientific Evidence from Across the world in 2007–2017. *Cardiovascular Diabetology*, 17;1: 83.
 17. Bertoluci M., Rocha V., 2017, Cardiovascular risk assessment in patients with diabetes. *Diabetology & Metabolic Syndrome*, 9;1: 25.
 18. Ariyanti R., Besral B. 2019. Dyslipidemia Associated with Hypertension Increases the Risks for Coronary Heart Disease: A Case-Control Study in Harapan Kita Hospital, National Cardiovascular Center, Jakarta. *Journal of Lipids*, 2019: 1-6.
 19. Rahma H.H., Wirjatmadi R.B. 2017. Hubungan Asupan Zat Gizi Makro Dan Profil Lipid Dengan Kejadian Penyakit Jantung Koroner Pada Pasien Lansia Di Rumah Sakit Islam Jemursari Surabaya. *Media Gizi Indonesia*, 12;2: 129-133.
 20. Biswas A., Singh S., Singh R. 2017. Linkages between hypertension and coronary heart disease in India: Evidence from India human development survey-2 (2011–2012). *Indian Journal of Community Medicine*, 42;4: 200.

21. Novriyanti I., Usnizar F., Irwan. 2015. Pengaruh Lama Hipertensi Terhadap Penyakit Jantung Koroner di Poliklinik Kardiologi RSUP. Dr. Mohammad Hoesin Palembang 2012. *Jurnal Kedokteran dan Kesehatan*, 1;1:55-60.
22. Herman S., Syukri M., Efrida E. 2015. Hubungan Faktor Risiko yang dapat Dimodifikasi dengan Kejadian Penyakit Jantung Koroner di RS Dr. M. Djamil Padang. *Jurnal Kesehatan Andalas* 2015, 4;2:369-375.
23. Nomikos T., Panagiotakos D., Georgousopoulou E., Metaxa V., Chrysohoou C., Skoumas, I., et al. 2015, Hierarchical modelling of blood lipids profile and 10-year (2002–2012) all-cause mortality and incidence of cardiovascular disease: the ATTICA study. *Lipids in Health and Disease*, 14;1:108.
24. Decroli, E., Kam, A., Efendi, Y., Decroli, G. and Rahmadi, A., 2019, *Diabetes Mellitus Tipe 2*. First edition. Pusat Penerbitan Bagian Ilmu Penyakit Dalam Fakultas Kedokteran Universitas Andalas, Padang. pp 27.
25. Ripley, T. and Anna, B., 2019, *Pharmacotherapy Self-Assessment Program 2019*. First edition. American College of Clinical Pharmacy. pp.10.
26. Sandhu P.K., Musaad S., Remaley A.T., Buehler S., Strider S., Derzon J.H., et al. 2016. Lipoprotein Biomarkers and Risk of Cardiovascular Disease: A Laboratory Medicine Best Practices (LMBP) Systematic Review. *Journal of application laboratory medicine*, 1;2:214-229.
27. Catapano A., Graham I., Backer G., Wiklund O., Chapman M., Drexel H., et al. 2016. 2016 ESC/EAS Guidelines for the Management of Dyslipidaemias. *Atherosclerosis Journal*, 253:281-344.
28. Saputri, F.B., Fauziah D., Hindariati E. 2020. Prevalence Proportion of Patient with Coronary Heart Disease in Inpatient Room of RSUD Dr. Soetomo Surabaya In 2007. *Biomolecular and Health Science Journal*, 3;2: 92-95.
29. Nadasya, O. C., Putranto J., Sudiana K., Subagio A. 2021. The Profile of Coronary Heart Disease Patients in Dr. Soetomo General Hospital. *Majalah Biomorfologi*, 31;1:6-10.
30. Iskandar, Hadi A., Alfridsyah. 2017. Faktor Risiko Terjadinya Penyakit Jantung Koroner pada Pasien RSU Meuraxa Banda Aceh. *Jurnal Action: Aceh National Journal*, 2;1:32-42.
31. Nohair S. A., Mohamimeed A., Sharaf F., Naeem Z., Midhet F., Homaidan H., et al. 2017. Risk profile of coronary heart disease among the staff members of Qassim University, Saudi Arabia. *International journal of health sciences*, 11;1:1–5.
32. Ghani L., Susilawati M., Novriani H. 2016. Faktor Risiko Dominan Penyakit Jantung Koroner di Indonesia. *Buletin Penelitian Kesehatan*, 44;3:153-164.
33. Syukri E., Panda L., Rotty L.W.A. 2013. Profil Penyakit Jantung Koroner di IRINA Jantung RSUP Prof. Dr. R. D. Kandou Manado. *Jurnal E-Clinic*, 1: 1-8.
34. Dhingra R., Vasan R. 2012. Age as a Risk Factor. *Medical Clinics of North America*, 96;1:87-91.
35. Shabana, Shahid S., Sarwar S. 2020. The abnormal lipid profile in obesity and coronary heart disease (CHD) in Pakistani subject. *Lipids in Health and Disease*, 19;73:1-7.
36. Amani, R. and Sharifi, N., 2012, *Cardiovascular Disease Risk Factor, Cardiovascular System*. Fourteenth edition. IntechOpen, Iran. pp. 279-301.
37. Maas A., Appelman, Y. 2010. Gender differences in coronary heart disease. *Netherlands heart journal: monthly journal of the Netherlands Society of Cardiology and the*

- Netherlands Heart Foundation, 18;12:598–602.
38. Lawton J. 2011. Sex and Gender Differences in Coronary Artery Disease. *Seminars in Thoracic and Cardiovascular Surgery*, 23;2:126-130.
 39. Oemiyati R., Rustika, R. 2015. Faktor Risiko Penyakit Jantung Koroner (PJK) Pada Perempuan (Baseline Studi Kohor Faktor Risiko PTM), *Buletin Penelitian Sistem Kesehatan*, 18;1:47-55.
 40. Supriyono, M. 2008. Faktor-Faktor Risiko Yang Berpengaruh Terhadap Kejadian Penyakit Jantung Koroner Pada Kelompok Usia <45 Tahun (Studi Kasus DI RSUP Dr Kariadi dan RS Telogorejo Semarang). [online] *Core.ac.uk*. Available at: <https://core.ac.uk/download/pdf/11717772.pdf> [Accessed 20 Nov. 2020].
 41. Escobar E. 2002. Hypertension and Coronary Heart Disease. *Journal of Human Hypertension*, 16;1:61-63.
 42. Viridis A., Giannarelli C., Neves M., Taddei S., Ghiadoni L. 2010. Cigarette smoking and hypertension. *Current Pharmaceutical Design*, 16;23:2518-2525.
 43. Zahrawardani, D., Herlambang, K.S., Anggraheny, H.D., 2013. Analisis Faktor Risiko Kejadian Penyakit Jantung Koroner di RSUP Dr Kariadi Semarang. *Jurnal Kedokteran Muhammadiyah*, 1; 2:13-21.
 44. Mozaffarian D., Benjamin E., Go A., Arnett D., Blaha M., Cushman M., et al. 2015. Heart Disease and Stroke Statistics—2015 Update. *Circulation Journal*, 131;4:29-322.
 45. Truesdale KP, Stevens J, and Cai J. 2005. The Effect of Wight History on Glukose and Lipid. *American Journal Epidimiologi*. 161:1133-1143.
 46. Mahan L.K., Escott-Stump S., 2008, Krause's Food Nutrition & Diet Theraphy. Fourteenth edition. WB Saunders Company, USA. pp. 1228-1276.
 47. Ginsberg H, Le NA, Mays C, Gibson J., Brown WV., 2004. Lipoprotein metabolism in nonresponders to increased dietary cholesterol. *The American Journal of Clinical Nutrition*. 80;4:855–861.
 48. Arnold S. V., Lipska K.J., LI Y., McGuire D.K., Goyal A., Spertus J.A. 2014. Prevalence of glucose abnormalities among patients presenting with an acute myocardial infarction. *American heart journal*, 168;4:466–470.
 49. Brown D., Edwards H., Buckley T., Aitken R., 2011, *Medical Surgical Nursing: Assesment and Management of Clinical Problems*. Mosby Elsevier, Australia. Pp. 1675-1876.
 50. Sasmiyanto S. 2020. Faktor Predisposisi Perilaku Kesehatan Penderita Diabetes Mellitus Tipe 2. *Jurnal Keperawatan Silampari*, 3;2:472.
 51. Sudyo AW, Setiyohadi B, Alwi I, Simadibrata KM, Setiati S. 2007. *Buku Ajar Ilmu Penyakit Dalam Jilid III Edisi ke -4. Fourth Edition*. Departemen Ilmu Penyakit Dalam FKUI, Jakarta. pp. 189-210.
 52. Sabia, S., Elbaz, A., Dugravot A., Head J., Shipley M., Hagger-Johnson G., et al. 2012. Impact of smoking on cognitive decline in early old age: the Whitehall II cohort study. *Archives of general psychiatry*. 69; 6:627–635.
 53. Djunaidi A.R., Indrawan, B. 2014. Hubungan Usia dan Merokok pada Penderita Penyakit Jantung Koroner di Poli Penyakit Dalam RS MH Palembang Periode Tahun 2012. *Syifa' MEDIKA: Jurnal Kedokteran dan Kesehatan*. 5; 1:16.
 54. Kusmana, Hanafi, 2003, *Patofisiologi Penyakit Jantung Koroner*. Buku Ajar Kardiologi. First edition. Balai Penerbit FKUI, Jakarta. pp. 180-210.