Lipid Profile and Treatment of Dyslipidemia in Acute Coronary Syndrome Patients at RSUD Dr. Soetomo Year 2019–2021

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Abstract

Coronary heart disease (CHD) is the primary cause of death worldwide and the second in Indonesia. Acute coronary syndrome (ACS) is the most common clinical manifestation of CHD. In more than 90% of cases, the underlying cause of ACS is the narrowing of blood vessels due to atherosclerosis. A major risk factor for atherosclerosis is dyslipidemia. LDL-C is known to be the most pro-atherogenic component of cholesterol. This study was conducted to provide an overview of the lipid profile and treatment of dyslipidemia in patients with ACS who were hospitalized at RSUD Dr. Soetomo period January 2019–December 2021. This study was a descriptive observational with a retrospective study. The study materials were taken from the patient's electronic medical record with the total sampling method. Out of 1061 patients diagnosed with ACS, only 259 patients met the inclusion criteria. It was found that 74.1% of patients were men, with the 55-59 age group dominating (21.6%). The most common type of diagnosis was STEMI (69.1%). The most widely prescribed anti-dyslipidemia drug was atorvastatin (95.8%). Most of the patients had dyslipidemia; 67.6% had non-optimal LDL-C levels (≥100 mg/dL); 46.7% had abnormal TG levels (≥150 mg/dL); 35.1% had increased TC levels (≥200 mg/dL); and 49.8% had low HDL-C levels (<40 mg/dL). The non-optimal LDL-C levels were more commonly found in men (70.8%), in the 40-44 years age group (93.3%), and in the STEMI diagnosis group (71.5%). As many as 98.1% of ACS patients had not reached the therapeutic target of LDL-C levels and 93.4% had not reached the therapeutic target of non-LDL-C levels.

Keywords: acute coronary syndrome, atherosclerosis, dyslipidemia, LDL-C, lipid profile

1. Introduction

Coronary heart disease (CHD) is the most frequent type of heart disease (Virani et al., 2021). The American Heart Association (2021) reports that approximately 20.1 million (7.2%) people aged ≥20 years in the United States have CHD. CHD is more frequent in men than women of all ages, and the incidence rises with age. The prevalence and mortality of CHD have decreased significantly over time. Nevertheless, based on WHO (2020), ischemic heart disease remains the world's leading cause of death, with a percentage of 16%. Based on the Sample Registration System (2018) results in Indonesia, in 2016, ischemic heart disease was the most common cause of death after stroke, with a percentage of 13.3%.

Acute coronary syndrome (ACS) is a set of clinical symptoms of acute myocardial ischemia with a clinical spectrum that includes unstable angina pectoris (UA), ST-elevation myocardial infarction (STEMI), and non-ST elevation myocardial infarction (NSTEMI) (PERKI, 2018). In more than 90% of cases, the underlying

cause of ACS is the narrowing of the arteries due to atherosclerosis (Kumar et al., 2018). Atherosclerosis is the accumulation of fat and/ or fibrous material in the intima lining of arteries, thus disrupting blood flow and can cause tissue ischemia (Libby et al., 2019).

Atherosclerosis is a multifactorial disease (Fruchart et al., 2004). Dyslipidemia is the main risk factor that triggers atherosclerosis. Increased LDL-C levels and decreased HDL-C levels can increase the risk of atherosclerosis. Increased TG levels are also known to increase the risk of atherosclerosis, but this relationship will not be significant after adjustment for non-HDL-C levels, therefore dyslipidemia therapy is used as the primary prevention of atherosclerotic cardiovascular disease (Mach et al., 2019). According to Kumar et al., (2018) the main cholesterol component associated with an increased risk of atherosclerosis (most pro-atherogenic) is LDL-C. However, facts show that LDL-C levels in most hypercholesterolemic patients in Indonesia, Asia, and worldwide who receive lipid-lowering drug therapy are still not following the recommended LDL-C levels (Chiang et al., 2016; Munawar et al., 2013; Park et al., 2011). Several studies have shown differences between a person's gender and age in LDL-C levels in the blood (Feng et al., 2020; Ferrara et al., 1997; and Wei et al., 2014).

Lipid profile plays an important role in atherosclerosis (Mach et al., 2019). However, lipid profile data in patients with ACS, especially in East Java, Indonesia, are still limited. Therefore, the researcher intends to conduct this study to provide an overview of the lipid profile in patients with ACS and the dyslipidemia therapy received by the patients, as well as to describe the distribution of LDL-C levels based on sex, age, and classification of ACS diagnosis. The study's findings are anticipated to be used as a reference in managing dyslipidemia in patients with ACS. The researcher also hopes this research can be a foundation for further research.

2. Material and Method

This study was a descriptive observational with a retrospective study. The materials used in this study were secondary data taken from the patient's electronic medical record with the total sampling method. The inclusion criteria of this study were patients diagnosed with ACS who were hospitalized at RSUD Dr. Soetomo period January 2019–December 2021 and had complete lipid profile laboratory examination.

3. Results

Out of 1061 patients suffering from ACS in RSUD Dr. Soetomo period January 2019–December 2021, only 259 patients had complete lipid profile laboratory examinations. Characteristics of the patients are listed in table 1.

ACS patients were mainly found in men (74.1%), while 25.9% were women. ACS is mostly found in patients aged between 55-59 years (21.6%) and found the least in patients aged <40 years (5.4%). The oldest patient was 84 years old, and the youngest was 28 years old. The most frequently encountered diagnosis of ACS was STEMI patients (69.1%), followed by NSTEMI patients (27.4%). In contrast, the least frequently encountered diagnosis was patients with UA (3.5%). The most widely prescribed anti-dyslipidemia drug was atorvastatin (95.8%).

Most of the patients had dyslipidemia. The patient’s lipid profile data are summarized in table 2. As many as 67.6% of ACS patients had non-optimal LDL-C levels (≥100 mg/dL). TG levels were abnormal (≥150 mg/dL) in 46.7% of ACS patients. TC levels were increased (≥200 mg/dL) in 35.1% of ACS patients. HDL-C levels were low (<40 mg/dl) in 49.8% of ACS patients. If LDL-C levels distribute by sex, most of the ACS

patients, both male and female, had non-optimal LDL-C levels. If LDL-C levels distribute by age, in almost all age classes, most ACS patients had non-optimal LDL-C levels, except for patients aged 65-69. If LDL-C levels distribute by diagnosis, all of the group diagnoses mostly had non-optimal LDL-C levels. The distribution of LDL-C levels can be seen in table 3. According to guidelines for the management of dyslipidemia by ESC (2019), 98.1% of ACS patients had not reached the therapeutic target of LDL-C levels and 93.4% of patients had not reached the therapeutic target of non-LDL-C levels. Target achievement of dyslipidemia therapy can be seen in table 4.

Table 1. Characteristics of ACS Patients

Characteristics	Frequency	Percentage (%)
Sex		
Men	192	74.1%
Women	67	25.9%
Age		
<40	14	5.4%
40-44	15	5.8%
45-49	38	14.7%
50-54	45	17.4%
55-59	56	21.6%
60-64	44	17.0%
65-69	29	11.2%
≥70	18	6.9%
Diagnosis		
UA	9	3.5%
STEMI	179	69.1%
NSTEMI	71	27.4%
Anti-dyslipidemia		
Atorvastatin	248	95.8%
Simvastatin	5	1.9%
Unknown	6	2.3%

Table 2. ACS Patient's Lipid Profile

Lipid Profile	Classification	Frequency	Percentage (%)
LDL-C (mg/dL)			
<100	Optimal	84	32.4%
100-129	Near optimal	78	30.1%
130-159	Borderline high	56	21.6%
160-189	High	28	10.8%
≥190	Very high	13	5.0%
TG (mg/dL)			

<150	Normal	138	53.3%
150-199	Borderline high	59	22.8%
200-499	High	60	23.2%
≥500	Very high	2	0.8%
HDL-C (mg/dL)			
<40	Low	129	49.8%
40-59	Borderline	107	41.3%
≥60	High	23	8.9%
TC (mg/dL)			
<200	Desirable	168	64.9%
200-239	Borderline high	55	21.2%
≥240	High	36	13.9%

*The patient's lipid profile levels are classified based on ATP III classification.

Table 3. Distribution of LDL-C levels

Distribution	Optimal		Near optimal		Borderline high		High		Very high	
	n	%	n	%	n	%	n	%	n	%
Sex										
Men	56	29.2%	62	32.3%	40	20.8%	22	11.5%	12	6.3%
Women	28	41.8%	16	23.9%	16	23.9%	6	9.0%	1	1.5%
Age										
<40	4	28.6%	3	21.4%	2	14.3%	1	7.1%	4	28.6%
40-44	1	6.7%	7	46.7%	4	26.7%	2	13.3%	1	6.7%
45-49	15	39.5%	9	23.7%	10	26.3%	4	10.5%	0	0.0%
50-54	14	31.1%	15	33.3%	7	15.6%	7	15.6%	2	4.4%
55-59	17	30.4%	19	33.9%	12	21.4%	6	10.7%	2	3.6%
60-64	11	25.0%	14	31.8%	11	25.0%	5	11.4%	3	6.8%
65-69	16	55.2%	4	13.8%	9	31.0%	0	0.0%	0	0.0%
>70	6	33.3%	7	38.9%	1	5.6%	3	16.7%	1	5.6%
Diagnosis										
UA	4	44.4%	2	22.2%	2	22.2%	1	11.1%	0	0.0%
STEMI	51	28.5%	56	31.3%	42	23.5%	19	10.6%	11	6.1%
NSTEMI	29	40.8%	20	28.2%	12	16.9%	8	11.3%	2	2.8%

Table 4. Target Achievement of Dyslipidemia Therapy

Lipid Profile	Classification	Frequency	Percentage (%)
LDL-C (mg/dL)			
<55	Reached	5	1.9%
≥55	Not reached	254	98.1%

Non-HDL-C (mg/dL)			
<85	Reached	17	6.6%
≥85	Not reached	242	93.4%

4. Discussion

Male gender is a risk factor for ACS and also atherosclerosis, which is known to be the principal cause of ACS in more than 90% of cases (Kumar et al., 2018; Singh et al., 2022). At reproductive age, men are reported to experience CHD more often than women. However, in postmenopausal women, the prevalence increase exceeds men (Kumar et al., 2018). In the productive age, men have lower estrogen levels than women, but when entering menopause, women's estrogen levels decrease to lower (Iqbal and Zaidi, 2009). Estrogen can prevent atherosclerotic cardiovascular disease (ASCVD) through its ability to influence blood lipid profile levels, reduce the expression of adhesion molecules on endothelial cells, reduce levels of chemokines that play a role in the process of atherogenesis, and can trigger vasodilation in atherosclerotic blood vessels (Nathan and Chaudhuri, 1997). Habits and lifestyle also contribute to the occurrence of ACS. Smoking is a risk factor for ACS. Not only conventional cigarettes but e-cigarettes also contribute to the development of atherosclerosis (Damay et al., 2022). The prevalence of patients who smoke is higher in men than women. Therefore, ACS patients are more commonly found in men than women (Qothi et al., 2022).

Atherosclerosis is a progressive disease. Atherosclerosis does not cause clinical symptoms until the lesion occludes more than 70% of the lumen (critical stenosis), usually in elderly patients. Age is an independent risk factor for atherosclerosis. Elderly patients will be more susceptible to atherosclerotic cardiovascular disease if exposed to other risk factors, such as hyperlipidemia, hypertension, smoking, lack of physical activity, and diabetes mellitus (Head et al., 2017; Kumar et al., 2018; Saputri et al., 2020). Blood vessels will experience changes when someone gets older. A study by Kaligis et al. (2016) found that there is an independent association between age and intima-media thickening. Old blood vessels will be thickening in the tunica intima and media, causing the elasticity of blood vessels decreases, thus increasing the degree of stiffness of blood vessels. In addition, there is an increase in adhesion molecules and chemokines in old blood vessels. These changes can accelerate the process of atherosclerosis (Wang and Bennett, 2012).

Most of the sample in this study were elderly patients. As people get older, the degree of blockage caused by atherosclerosis will be wider and at one point, it will completely block the lumen (Yang et al., 2021). Total blockage of the coronary arteries will cause STEMI (Kumar et al., 2018). Therefore, in this study, the most frequently encountered diagnosis was STEMI.

Dyslipidemia is the main risk factor for atherosclerosis which is the cause of more than 90% of ACS cases (Kumar et al., 2018). Dyslipidemia is the imbalance of lipids components marked by increased TC, LDL-C, and/ or TG levels and decreased HDL-C levels in the blood (PERKENI, 2019). Increased LDL-C levels and decreased HDL-C levels can increase the risk of atherosclerosis. Increased TG levels are also known to increase the risk of atherosclerosis, but this relationship will not be significant after adjustment for non-HDL-C levels (Mach et al., 2019). LDL particles are the most pro-atherogenic because they come from VLDL and IDL particles enriched with cholesterol. LDL particles carry most cholesterol in the circulation, clearly proven to cause CHD. One of the potential mechanisms by which HDL particles are anti-atherogenic is their role in the reversal of cholesterol transport from peripheral tissues to the liver. Furthermore, HDL particles have antioxidant, anti-inflammatory, antithrombotic, and anti-apoptotic properties that may contribute to their ability to prevent atherosclerosis (Feingold et al., 2021).

LDL-C is the main cholesterol component associated with an increased risk of atherosclerosis (most pro-atherogenic) (Kumar et al., 2018). This study shows men tend to have higher LDL-C levels than women, so they are more prone to ACS. Older people tend to have lower LDL-C levels, maybe due to lifestyle changes and weight loss with age, so that can reduce blood lipid profile levels (Ferrara et al., 1997). STEMI patients tend to have higher LDL-C levels because of the effect of LDL-C itself determined by the absolute magnitude and total duration of exposure to LDL-C particles (Mach et al., 2019).

Based on PERKI's ACS management guidelines (2018), the principle of lipid-lowering drug therapy for ACS patients is high-intensity statins regardless of initial LDL-C concentration, without considering diet modifications, and should be given as soon as possible. Based on this study, almost all patients have received the appropriate drug, a high-intensity statin drug, that is atorvastatin. This study could not evaluate other aspects related to the suitability of dyslipidemia therapy in ACS patients with PERKI guidelines (2018), including dosage, method, and duration of drug administration, due to limited data in electronic medical records.

This study used real-world data. The lipid profile data used in this study reflect the patient's lipid profile levels at the time of initial admission to the hospital and after receiving dyslipidemia therapy. The interval between the time of patient took the drug and the laboratory test varied. The interval time average was one day, so the lipid profile data obtained could not provide an accurate illustration of the optimal results of dyslipidemia therapy received by the patient. The lipid-lowering drug effect can be optimally assessed after the patient has taken statin drugs for at least four weeks (ACC, 2018). Research by Melasari et al. (2021) shows that giving atorvastatin for 30 days to dyslipidemia patients can reduce LDL, TG, and TC levels and can increase HDL levels. According to the management of dyslipidemia guidelines by ESC (2019), almost all patients had not reached both the primary and secondary therapeutic targets of dyslipidemia. This study could not further evaluate the optimal target therapy for dyslipidemia because there was no data on the patient's lipid profile after receiving statin therapy for at least four weeks.

5. Conclusion

Based on this study, the incidence of ACS was higher in men than women, with the 55-59 age group dominating. The most common type of diagnosis was STEMI. The most widely prescribed anti-dyslipidemia drug was atorvastatin. Most of the patients had dyslipidemia. The non-optimal LDL-C levels were more commonly found in men patients, in the 40-44 years age group, and in the STEMI diagnosis group. Almost all of the patients had not reached the target therapy of dyslipidemia.

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