



Drug Utilization of Statin Therapy in Patients with Acute Coronary Syndrome at the Cardiology and Cardiovascular Outpatient Clinic of Airlangga University Hospital

**Eunike Christiane Hartanto, Deny Wilson Amanda Sitorus, Wenny Putri Nilamsari*,
Budi Susetyo Pikir, Marcha Debby Saraswati**

Universitas Airlangga, Indonesia

Email: eunikechristiane@gmail.com, denywilson09@gmail.com, wenny-p-n@ff.unair.ac.id*,
bsp49@fk.unair.ac.id, hi.marchads@gmail.com

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ABSTRACT

Acute coronary syndrome (ACS) remains a major cause of cardiovascular morbidity and mortality, and intensive low-density lipoprotein cholesterol (LDL-C) reduction with high-intensity statin therapy is essential for secondary prevention. This study aimed to evaluate statin utilization, treatment appropriateness, drug-related problems, and LDL-C target attainment among patients with ACS. A retrospective observational study was conducted at the Cardiology and Cardiovascular Outpatient Clinic of Universitas Airlangga Hospital, Surabaya, Indonesia. Medical records of patients treated from July to December 2023 were reviewed, and 51 eligible patients receiving statin therapy were included using total sampling. Data were analyzed descriptively. Moderate-intensity statins predominated; simvastatin 20 mg was the most frequently prescribed statin during the first month, whereas atorvastatin 20 mg predominated during the second month, while atorvastatin 40 mg use remained limited. Inappropriate statin therapy was identified in 45 patients (88.24%), including inadequate statin intensity and insufficient treatment duration. Only two patients (3.9%) achieved the recommended LDL-C target of ≤ 55 mg/dL, both after receiving atorvastatin 40 mg. Suspected statin-associated muscle symptoms occurred in four patients (7.84%), while several potential drug-drug interactions were documented. These findings demonstrated that statin therapy for secondary prevention remained suboptimal, highlighting the need for guideline-concordant prescribing, regular LDL-C monitoring, and systematic management of identified drug-related problems.

INTRODUCTION

ACS is a clinical manifestation of coronary artery disease caused by an abrupt reduction in coronary blood flow and remains a major contributor to cardiovascular morbidity and mortality worldwide. ACS encompasses three clinical entities, namely unstable angina, non-ST-segment elevation myocardial infarction (NSTEMI), and ST-segment elevation myocardial infarction (STEMI), which differ in the extent of coronary obstruction and myocardial injury but all require immediate medical intervention (Olvera et al., 2023; Tkacs et al., 2020). The underlying mechanism of ACS involves the progressive development of atherosclerosis, beginning with lipid accumulation within the arterial wall, followed by fibroatheroma formation, fibrous cap thinning, and eventual plaque rupture (Pahwa and Jialal, 2023). (Bakti, 2023) Plaque rupture exposes thrombogenic material to circulating blood, initiating platelet

adhesion, activation, and aggregation, followed by activation of the coagulation cascade and fibrin formation. The resulting thrombus may abruptly obstruct coronary blood flow, leading to myocardial ischemia, infarction, and irreversible cardiomyocyte necrosis if reperfusion is not achieved promptly (Crea & Libby, 2017).

LDL-C plays a pivotal role in the initiation and progression of atherosclerosis. Elevated LDL-C promotes lipid accumulation within coronary arteries, accelerates plaque progression, and increases the risk of plaque instability and rupture (Raggi et al., 2018). Consequently, intensive LDL-C reduction has become the primary therapeutic target for secondary prevention following ACS. According to the 2019 European Society of Cardiology/European Atherosclerosis Society (ESC/EAS) guideline, patients with a history of ACS are classified as being at very high cardiovascular risk and should achieve an LDL-C reduction of at least 50% from baseline, together with an LDL-C target of <55 mg/dL (Visseren et al., 2019). Greater reductions in LDL-C are consistently associated with greater reductions in recurrent cardiovascular events, emphasizing the importance of optimal lipid-lowering therapy in this population (François et al., 2022). Statins remain the first-line lipid-lowering therapy for secondary prevention because they inhibit HMG-CoA reductase, thereby reducing hepatic cholesterol synthesis and increasing LDL receptor-mediated clearance of circulating LDL-C (Ogah, 2015). In addition to lowering LDL-C, statins exert pleiotropic effects by improving endothelial function, stabilizing atherosclerotic plaques, inhibiting vascular remodeling, and reducing oxidative stress and vascular inflammation (“Correction to: 2018 AHA/ACC/AACVPR/AAPA/ABC/ACPM/ADA/AGS/APhA/ASPC/NLA/PCNA Guideline on the Management of Blood Cholesterol: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines (Circulation. (2019) 139 (E1082-E1143) DOI: 10.1161/CIR.0000000000000625),” 2019). When LDL-C targets are not achieved despite maximally tolerated high-intensity statin therapy, current ESC/EAS guidelines recommend sequential treatment intensification with ezetimibe, followed by PCSK9 inhibitors (Visseren et al., 2019).

Despite these recommendations, the implementation of guideline-directed lipid-lowering therapy remains suboptimal. Previous studies have demonstrated that many patients undergoing secondary prevention fail to achieve the recommended LDL-C targets (Wang et al., 2020). Failure to attain LDL-C goals is frequently associated with drug-related problems, including clinical inertia, inappropriate statin intensity or dosing regimens, and poor adherence to statin therapy (Cannon et al., 2021). Medication adherence also remains a major challenge, with approximately 57% of patients becoming nonadherent within six months after myocardial infarction and fewer than one-quarter continuing statin therapy after five years (Bansilal et al., 2016). Furthermore, statins are susceptible to clinically relevant drug–drug interactions, particularly with calcium channel blockers, anti-infective agents, immunosuppressants, and other medications, potentially increasing the risk of myopathy and rhabdomyolysis (Christiano et al., 2023). Collectively, these factors may compromise treatment effectiveness, limit LDL-C target attainment, and increase the risk of recurrent cardiovascular events (Heiran et al., 2022).

Despite strong guideline recommendations, the implementation of statin therapy in routine clinical practice remains suboptimal (Wiklund et al., 2013). Suboptimal statin intensity, failure to optimize lipid-lowering therapy according to guideline recommendations, drug-

related problems (DRPs), and poor medication adherence continue to limit optimal LDL-C reduction among patients with ACS. Consequently, a substantial proportion of patients fail to achieve the recommended LDL-C target, placing them at increased risk of recurrent cardiovascular events and mortality. However, real-world evidence describing statin utilization, treatment adequacy, drug-related problems, and LDL-C target attainment among Indonesian patients with ACS remains limited. Therefore, this study aimed to evaluate statin utilization among patients with ACS attending the Cardiology and Cardiovascular Outpatient Clinic of Universitas Airlangga Hospital, with particular emphasis on treatment adequacy, drug-related problems, and LDL-C target attainment. This study provides real-world evidence that may support guideline-concordant statin therapy and contribute to improving secondary prevention among patients with ACS (Navar et al., 2017).

METHOD

Study Design and Setting

This retrospective observational study evaluated statin utilization patterns among patients with ACS receiving secondary prevention therapy at the Cardiology and Cardiovascular Outpatient Clinic of Universitas Airlangga Hospital, Surabaya, Indonesia. Data were collected between March and July 2024 from medical records of patients treated from July to December 2023. The study protocol was approved by the Ethics Committee of Universitas Airlangga Hospital (Approval No. 025/KEP/2024).

Study Population

The study population comprised all patients diagnosed with ACS who attended the Cardiology and Cardiovascular Outpatient Clinic of Universitas Airlangga Hospital between July and December 2023 and received statin therapy as part of secondary prevention.

Sampling Method

A total sampling approach was used, whereby all eligible medical records of patients with ACS who met the inclusion criteria during the study period were included in the analysis.

Data Collection Procedure

Data were retrospectively extracted from patients' medical records using a standardized data extraction form. The collected variables included demographic characteristics (age, sex, and comorbidities), clinical information, documented statin-associated adverse events, laboratory findings including LDL-C levels, and statin therapy characteristics. Treatment-related variables comprised the prescribed statin intensity, dosing regimen, frequency of administration, and the total number of concomitant medications prescribed during the study period.

Data Processing and Analysis

Data were entered into a standardized electronic database and checked for completeness, consistency, and accuracy prior to analysis. Statistical analyses were performed using descriptive methods to summarize the study variables. Categorical variables are presented as frequencies and percentages. Patient characteristics included age, sex, diagnosis, and comorbidities. Statin utilization was evaluated according to the prescribed statin agent, statin intensity, dosing regimen. DRPs were identified by assessing the appropriateness of statin therapy, including inappropriate statin intensity, inappropriate dosing regimen, potential drug-drug interactions, and documented statin-associated adverse events. LDL-C target

attainment was evaluated using the ESC-recommended treatment goal of <55 mg/dL for patients at very high cardiovascular risk

RESULTS AND DISCUSSION

This study evaluated statin utilization among patients with ACS receiving secondary prevention therapy at the Cardiology and Cardiovascular Outpatient Clinic of Universitas Airlangga Hospital. The evaluation included statin prescribing patterns, prescribed dose and intensity, frequency of administration, concomitant medication use, DRPs, and LDL-C target attainment (Xavier et al., 2016). A total of 328 medical records with a diagnosis of ACS were initially screened for eligibility. After applying the predefined inclusion and exclusion criteria and reviewing records from the hospital electronic medical record system and outpatient pharmacy database, 51 patients met the eligibility criteria and were included in the final analysis.

Patient Characteristics

The characteristics of patients in this study are shown in Table 1. Among the total study population, most patients were aged <65 years (62.75%). A similar finding was reported by Kumar et al., who found that most patients with ACS were younger than 65 years, with the highest proportion occurring in the 55–64-year age group (Kumar et al., 2023). The age distribution of patients with ACS has shifted over recent years, with an increasing incidence among younger individuals. This trend has been attributed to lower awareness and poorer control of cardiovascular risk factors among younger populations (Gupta et al., 2016). Male patients accounted for the majority of the study population (86.27%). This finding is consistent with the ACS Registry Data of a Single Medical Center, which also reported a predominance of male patients with ACS (Aryan et al., 2020). This sex difference has been largely attributed to hormonal factors, as women have higher circulating estrogen levels before menopause. Estrogen exerts cardioprotective effects by improving endothelial function and maintaining vascular homeostasis, thereby reducing the susceptibility to ACS.

ACS comprises three clinical entities, namely STEMI, NSTEMI, and UA (Bavry et al., 2009). In the present study, most patients were diagnosed with UA (58.82%), followed by STEMI (27.45%) and NSTEMI (13.73%). Regarding coronary revascularization, 49 patients (96.1%) underwent PCI, whereas 2 patients (3.9%) did not undergo the procedure. The absence of PCI in these patients was attributed to coronary stenosis of less than 70%, which did not meet the indication for intervention. In addition, PCI may have been recommended but declined by the patients. Hypertension and diabetes mellitus were the most common comorbidities among patients with ACS. Hypertension was the most prevalent comorbidity (58.52%), followed by diabetes mellitus (44.44%) and dyslipidemia (35.19%). These findings are generally consistent with those reported by Lin et al. (2017), who also identified hypertension, diabetes mellitus, and dyslipidemia as the most frequently observed comorbidities in patients with ACS. The coexistence of hypertension and diabetes mellitus has been associated with a poorer cardiovascular prognosis, partly because these conditions reduce the likelihood of achieving recommended secondary prevention targets, particularly blood pressure and LDL-C goals (Jakobsson et al., 2015).

Table 1. ACS patients' clinical profiles and sociodemographic data

Characteristics	Category	N = 51	%
Age	<65 years	32	62,75
	≥65 years	19	37,25
Gender	Male	44	86,27
	Female	7	13,73
Diagnosis	Unstable Angina	30	58,82
	ST-segment Elevation	14	27,45
	Myocardial Infarction		
	Non-ST-Segment Elevation Myocardial Infarction	7	13,73
Percutaneous Coronary Intervention (PCI)	PCI	49	96,08
	Non-PCI	2	3,92
National Health Insurance	Yes	51	100,00
	No	1	1,96
Comorbid	Hypertension	49	96,08
	Diabetes Mellitus	28	54,90
	Dyslipidemia	17	33,33
	Smoking	14	27,45
	Chronic Kidney Disease	13	25,49

Profile of Statin Therapy and LDL-C Achievement

Data Therapy Statin

According to the 2023 ESC Guidelines, patients with ACS are classified as being at very high cardiovascular risk and are therefore recommended to receive high-intensity statin therapy as part of long-term secondary prevention. However, the present study demonstrated that moderate-intensity statins remained the predominant treatment regimen. As shown in **Figure 1**, the distribution of statin regimens changed between the first and second months of therapy. During the first month, Simvastatin 20 mg was the most frequently prescribed regimen, accounting for 45.10% (23 patients) of all statin prescriptions, followed by Atorvastatin 20 mg at 33.33% (17 patients) and Atorvastatin 40 mg at 21.56% (11 patients). In the second month, the proportion of patients receiving Simvastatin 20 mg decreased to 23.53% (12 patients), whereas the use of Atorvastatin 20 mg increased to 54.90% (28 patients). The proportion of patients receiving Atorvastatin 40 mg remained unchanged at 21.56% (11 patients) throughout the observation period. The shift from Simvastatin 20 mg to Atorvastatin 20 mg suggests a modification of statin therapy during follow-up, while the use of high-intensity statin therapy remained unchanged. Despite this adjustment, most patients continued to receive moderate-intensity statins, which is inconsistent with the 2023 ESC recommendations for patients with ACS at very high cardiovascular risk. High-intensity statins are recommended because they can achieve an LDL-C reduction of at least 50% from baseline and facilitate attainment of the recommended LDL-C target of ≤ 55 mg/dL (Byrne et al., 2023). The statin prescribing pattern observed in the present study is consistent with findings from previous studies conducted in Indonesia. (Bakti, 2023) reported that 98% of patients received atorvastatin 20 mg, while another study found that 39.9% of patients were treated with simvastatin 20 mg (Huang et al., 2024). Despite these findings, the use of high-intensity statin therapy in the present study remained relatively low. In comparison, Huang et al. (2024) reported that 66.2% of patients in Indonesia received atorvastatin 40 mg, indicating a

substantially higher utilization of high-intensity statin therapy than that observed in the present study.

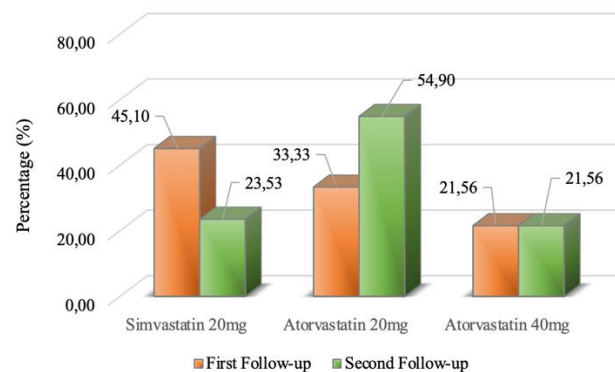


Figure 1. Distribution of Patients According to Statin Regimen

LDL-C Target Achievement

According to the 2019 ESC Guidelines for the Management of Dyslipidaemias, patients with ACS are classified as being at very high cardiovascular risk and should achieve an LDL-C level of ≤ 55 mg/dL together with a $\geq 50\%$ reduction from baseline (Mach et al., 2020). The proportion of patients who achieved the recommended LDL-C target is presented in **Figure 2**. As shown in **Figure 2**, only 3.9% (2 patients) achieved the recommended LDL-C target of ≤ 55 mg/dL, whereas 96.1% (49 patients) failed to achieve the target. Both patients who achieved the LDL-C goal received high-intensity statin therapy with atorvastatin 40 mg and had completed approximately 5 weeks of treatment. Despite the use of high-intensity statin therapy in these patients, overall LDL-C target attainment remained markedly low. This finding suggests that lipid-lowering therapy among patients with ACS in routine clinical practice has not yet been fully optimized. Failure to achieve the recommended LDL-C target may increase the risk of recurrent cardiovascular events and indicates the need for more intensive lipid management in this very high-risk population. In Indonesia, the 2023 National Formulary recommends discontinuing atorvastatin 20 mg or atorvastatin 40 mg once an LDL-C level of ≤ 70 mg/dL has been achieved. In the present study, 9 patients (18%) had LDL-C levels of ≤ 70 mg/dL. Consequently, according to the current National Formulary policy, these patients would no longer be eligible to continue atorvastatin 20 mg or atorvastatin 40 mg therapy. Huang et al. (2025), similarly reported that only 1.9% of patients achieved the LDL-C target. Another study demonstrated that optimizing statin therapy combined with regular clinical evaluation significantly improved the proportion of patients achieving statin treatment targets, increasing from 14% to 33% (Maron et al., 2025).

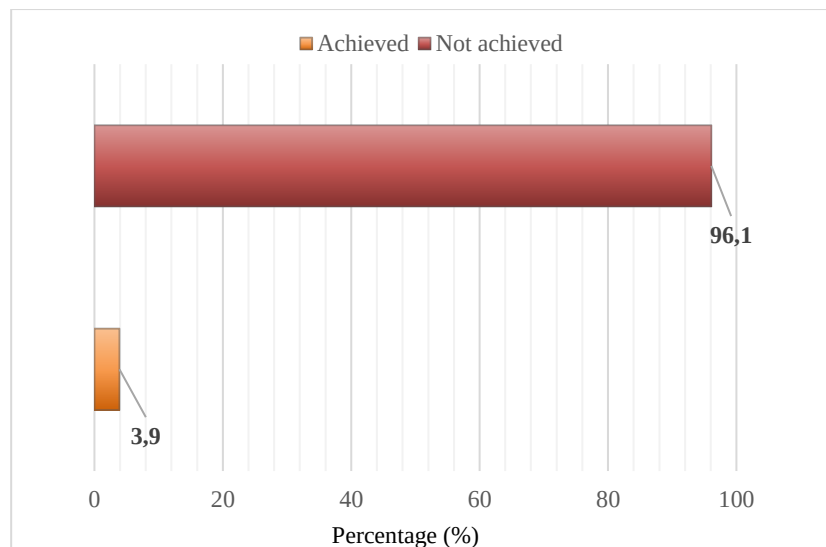


Figure 2. Distribution of Patients Achieving the LDL-C Target

Drug Related Problem

Appropriateness of Statin Therapy According to ASCVD Risk

The appropriateness of statin therapy was assessed according to the prescribed statin intensity, dosing regimen, and treatment duration. To ensure a valid assessment of LDL-C target attainment, the analysis included only patients who had received statin therapy for at least two months before LDL-C measurement. As shown in **Figure 3**, Among the 45 patients (88.24%) who received inappropriate statin therapy, 40 patients were prescribed moderate-intensity statins, whereas the remaining 5 patients received high-intensity statin therapy. However, these five patients were prescribed only seven tablets of atorvastatin 40 mg to cover a 30-day treatment period, which was considered insufficient to maintain continuous high-intensity therapy.

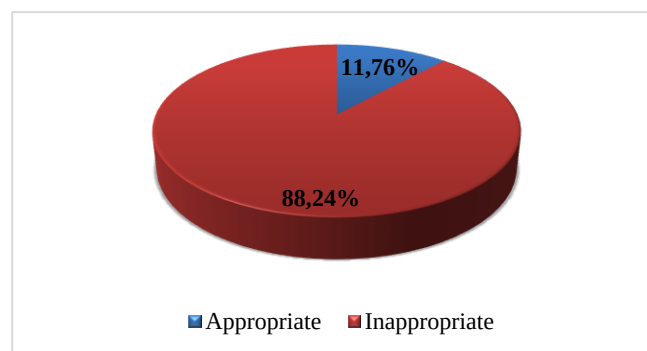


Figure 3. Appropriateness of Statin Therapy in Patients with Acute Coronary Syndrome

Several factors contributed to inappropriate statin therapy, primarily those related to the reimbursement restrictions of the 2023 Indonesian National Formulary. The factors contributing to inappropriate statin therapy are presented in **Figure 4**. Among patients who received inappropriate therapy, 15 patients (33.33%) had no LDL-C measurement available within the previous six months and therefore did not meet the National Formulary reimbursement criteria. In addition, 6 patients (13.33%) had already achieved an LDL-C level

of ≤ 70 mg/dL, making them ineligible to continue atorvastatin 20 mg under the current National Formulary policy. For the remaining 24 patients (53.33%), the reasons for inappropriate therapy could not be identified from the available medical records. These cases may have been influenced by clinical considerations, such as statin-associated muscle symptoms (SAMS), potential drug-drug interactions, or other patient-specific factors requiring dose adjustment. There are 2 patients achieved the recommended LDL-C target of ≤ 55 mg/dL. Both patients had received high-intensity statin therapy with atorvastatin 40 mg for approximately 5 weeks before LDL-C measurement. This finding is consistent with previous studies reporting that the maximum lipid-lowering effect of statins is generally achieved within 4–6 weeks of treatment (Kakara et al., 2014). Nevertheless, these patients were still classified as receiving inappropriate therapy because they did not meet the predefined treatment eligibility criteria established in this study.

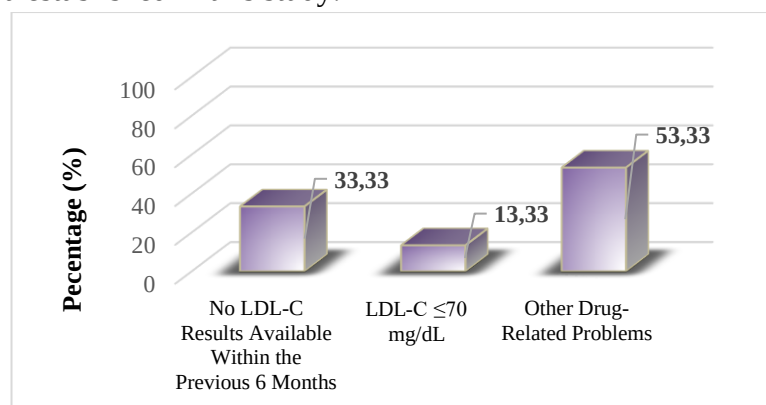


Figure 4. Factors Contributing to Inappropriate Statin Therapy

Among the 6 patients (11.76%) who received guideline-concordant statin therapy, none achieved the recommended LDL-C target. One possible explanation is suboptimal adherence to statin therapy. Previous studies have reported that adherence to statin treatment ranges from 30% to 75%. Furthermore, patients who are non-adherent to statin therapy have been shown to have up to a three times higher risk of mortality than those who adhere to treatment (Allonen et al., 2012). In addition to poor medication adherence, unhealthy lifestyle behaviors may also have contributed to the failure to achieve the recommended LDL-C target.

Statin Associated Muscle Symptoms (SAMS)

SAMS are the most frequently reported adverse effects of statin therapy, accounting for approximately 72% of all statin-related muscle adverse events. SAMS encompass a broad spectrum of muscle symptoms that occur temporally following statin initiation, regardless of whether a causal relationship with statin therapy has been established (Backes et al., 2017). Owing to the retrospective design of the present study, a definitive diagnosis of SAMS could not be confirmed because clinical evaluation and causality assessment were not available (Warden et al., 2023). Nevertheless, medical records documented several patient-reported complaints suggestive of muscle-related symptoms. The distribution of patients with SAMS is presented in **Table 2**. The documented complaints recorded in the medical records included pain in the legs, pain in the left shoulder, and lower-limb weakness. Overall, 47 patients (92.16%) had no documented muscle-related complaints, whereas 4 patients (7.84%) reported

muscle-related complaints. Observational studies have reported that SAMS occur in approximately 5%–25% of patients receiving statin therapy in the general population, regardless of causality (Warden et al., 2023). The term SAMS refers to all muscle symptoms that occur temporally in relation to statin use, irrespective of whether a causal relationship has been established. In contrast, the pharmacological definition of SAMS refers specifically to muscle symptoms that are directly caused by statin therapy. However, the mechanisms underlying SAMS have not yet been fully elucidated (Bouitbir et al., 2020).

Table 2. Distribution of Patients with Suspected SAMS

Prediction	Total Patients N (%)
Suspected SAMS	4 (7,84%)
No Suspected SAMS	47 (92,16%)

Table 3 summarizes the anatomical locations of muscle-related complaints reported by the patients. The documented complaints included pain in the right and left legs (3 patients) and pain in the left shoulder (1 patient). Berent et al. (2019), reported that the pectoral muscles were the most frequently affected (61.4%), followed by the quadriceps (59.8%), biceps brachii (54.3%), and deltoid muscles (22.5%). According to the clinical scoring system for statin-induced myalgia, muscle symptoms suggestive of SAMS include symmetrical pain in the hips or thighs (score 3), symmetrical pain in the calves, and symmetrical pain in the proximal muscles of the upper limbs (score 2).

Table 3. Distribution of Muscle Pain Complaints by Anatomical Location
(N= 4)

Location	Total Patients N (%)
Both right and left legs	3 (25%)
Left Shoulder	1 (75%)

In addition to SAMS, early clinical trials of statins reported elevated aminotransferase levels in up to 2% of patients (Björnsson, 2017). Asymptomatic elevations in liver enzyme levels, defined as aminotransferase levels exceeding three times the upper limit of normal (ULN), are common adverse effects of statin therapy and are generally resolved following dose reduction (Banach et al., 2015). In the present study, patients with available Aspartate Aminotransferase (AST) and Alanine Aminotransferase (ALT) data had no documented history of liver diseases, such as hepatitis, cholestasis, or acute liver failure, before receiving statin therapy. The AST and ALT results obtained after statin therapy are presented in **Table 4**. Among the 10 patients with available AST data, only one patient (10%) had an ALT level exceeding the normal reference range, whereas no patients showed elevated SGPT levels. Hepatocellular injury is the most common form of liver injury associated with statin therapy. It is generally characterized by elevations in AST and ALT levels, indicating hepatocellular damage. However, because AST is present in both hepatocytes and skeletal muscle cells, an elevated AST level is considered less specific for liver injury and may also reflect muscle damage. In contrast, ALT is predominantly found in hepatocytes and is therefore regarded as a more sensitive and specific biomarker of liver injury (Ashraf et al., 2020). Based on these findings, no patients in the present study met the laboratory criteria suggestive of statin-associated hepatotoxicity.

Table 4. AST and ALT Profile Among Patients Receiving Statin Therapy

Parameter	Number of Patients	Percentage of Patients (%)
AST		
0-50 (normal range)	9	90
51-100	1	10
Total	10	100
ALT		
0-50 (normal range)	11	100
>50	0	0
Total	11	100

Table 5 presents the distribution of potential drug–drug interactions (DDIs) involving statin therapy. The most frequently identified potential interactions were amlodipine–simvastatin (16 patients), followed by ticagrelor–atorvastatin (13 patients), ticagrelor–simvastatin (9 patients), warfarin–simvastatin (1 patient), and diltiazem hydrochloride combined with either simvastatin or atorvastatin (1 patient each). The two most common pharmacokinetic DDIs involving statins are those mediated by the cytochrome P450 (CYP450) enzyme system and P-glycoprotein (P-gp) transporters (Wiggins et al., 2016). In this study, interactions between statins and amlodipine or ticagrelor were mediated through CYP3A4 inhibition, whereas interactions involving diltiazem hydrochloride were associated with P-gp inhibition. Drug interactions involving the CYP450 enzyme system are generally classified as enzyme inhibition or enzyme induction. Enzyme inhibition increases the serum concentration of one or both interacting drugs and, in the case of statins, most commonly results in increased statin exposure. Similarly, interactions involving P-glycoprotein may also occur through inhibition or induction. The clinical consequences of P-glycoprotein inhibition depend on the site of interaction. Inhibition of P-glycoprotein in the gastrointestinal tract increases drug bioavailability, whereas inhibition in the liver and kidneys reduces drug elimination. In addition, inhibition of P-glycoprotein at the blood–brain barrier may increase drug penetration into the central nervous system. However, the risk of statin-induced myopathy associated with CYP3A4 inhibitors appears to be substantially greater with simvastatin and lovastatin than with atorvastatin. Unlike simvastatin and lovastatin, atorvastatin does not undergo extensive presystemic metabolism. Consequently, potent CYP3A4 inhibitors generally increase the maximum plasma concentration of atorvastatin by approximately two to four times (Zhou et al., 2014).

Potential Interactions

Table 5. Potential Drug–Drug Interactions Identified in Patients Receiving Statin Therapy

Interacting Drug	Statin	Number of Interactions (n)	Enzyme Interaction Mechanism	Potential Clinical Effect	Interaction Severity	Clinical Recommendations
Amlodipine	Simvastatin	16	CYP3A4 <i>Inhibitors</i>	Increased statin exposure, resulting in an increased risk of statin-associated muscle toxicity and myopathy ^{a,b}	<i>Minor</i> Simvastatin AUC increases approximately 1.8-times ^{a,b}	Limit the simvastatin dose to 20 mg once daily. This dose corresponds to approximately 60% of the maximum recommended daily dose ^a
Ticagrelor	Atorvastatin	13	CYP3A4 <i>Inhibitors</i>	Increased atorvastatin exposure, resulting in an increased risk of statin-associated muscle toxicity and rhabdomyolysis ^{a,c}	<i>Minor</i> Atorvastatin AUC increases approximately 1.4-times ^{a,b}	Concomitant use is generally acceptable without dose adjustment
	Simvastatin	9	CYP3A4 <i>Inhibitors</i>	Reduced simvastatin metabolism, resulting in increased plasma concentrations, an increased risk of statin-associated muscle toxicity, and rhabdomyolysis ^{a,c}	<i>Moderate</i> Simvastatin AUC increases approximately 2–3-times ^a	Limit the simvastatin dose to 40 mg once daily ^a
Warfarin	Simvastatin	1	-	Increased INR, potentially increasing the risk of bleeding ^a	Varies INR may increase by up to 30% ^a	INR should be monitored more closely following statin initiation or dose adjustment. The effect on INR appears to be minimal with pitavastatin and atorvastatin ^a
Diltiazem HCl	Simvastatin	1	P-gp <i>Inhibitor</i>	Reduced simvastatin	<i>Moderate</i> Simvastatin	Limit the simvastatin dose to

atin		ors	metabolism, resulting in increased plasma concentrations, an increased risk of statin-associated muscle toxicity, and rhabdomyolysis ^{a,c}	AUC increases approximately 4.6-times ^a	10 mg once daily ^a
Atorvastatin	1	P-gp Inhibitors	Increased atorvastatin exposure, resulting in an increased risk of statin-associated muscle toxicity ^a	Minor Atorvastatin AUC increases by approximately 51% ^a	Concomitant use is generally acceptable without dose adjustment ^a

Description: Each patient can experience more than one potential drug interaction.

*(Wiggins et al., 2016)a, (Zhou et al., 2013)b, (Pejcic et al., 2019)c

This study has several limitations related to its retrospective design. First, it could not be determined whether patients who received less than 30 days of high-intensity statin therapy or moderate-intensity statins obtained additional statin medication outside the hospital to complete the prescribed treatment. Second, the reasons why some patients with ACS did not undergo PCI could not be confirmed from the available medical records. Third, it could not be determined whether the documented muscle-related complaints were attributable to SAMS. Likewise, the potential drug–drug interactions identified in this study could not be clinically confirmed. Finally, patient adherence to statin therapy could not be evaluated. These limitations may be addressed more comprehensively in future prospective studies.

CONCLUSION

The findings of this study demonstrated that statin therapy for secondary prevention among patients with ACS remained suboptimal. Moderate-intensity statins were prescribed more frequently than guideline-recommended high-intensity statins, and only a small proportion of patients received appropriate statin therapy throughout the treatment period. Inappropriate statin therapy was identified as the most common drug-related problem, while potential drug–drug interactions and statin-associated muscle symptoms (SAMS) were also observed. Consequently, achievement of the recommended LDL-C target remained very low, with only 3.9% of patients attaining an LDL-C level of ≤ 55 mg/dL. These findings highlight the need to optimize statin prescribing practices and strengthen guideline-concordant lipid-lowering therapy to improve secondary prevention among patients with ACS.

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