



# SGOT Levels in Acute Myocardial Infarction Patients with Mayor Adverse Cardiovascular Events (MACE)

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**Abstract.** SGOT is one of the most widely available biomarkers of myocardial infarction in various health care facilities in Indonesia. In the clinical course of acute myocardial infarction, major adverse cardiovascular events (MACE) may occur which include death, CHF, stroke, arrhythmia, and cardiogenic shock. To know the profile of SGOT levels in AMI patients with MACE and to determine the relationship between SGOT levels and the amount of MACE. This was a retrospective cohort study. The data was taken from the medical records of patients at RSUD Dr Sudirman, Kebumen. The inclusion criteria were AMI patients with MACE and the exclusion criteria were patients with liver disease and incomplete medical records. We used descriptive analysis to present the data and correlation between SGOT levels and the amount of MACE was carried out by Spearman's test. There were 50 samples included in this study. AMI was more common in patients aged > 50 years (92%) and mostly in men (60%). The proportion of subjects with MACE in this study were 39%, 3.125%, 34.375%, and 23% for CHF, stroke, arrhythmia and cardiogenic shock respectively. The median of SGOT levels in each MACE group were CHF 54 (26–975) U/L, Stroke 74.5 (32–117) U/L, arrhythmia 58 (23–975) U/L, cardiogenic shock 45 (23–251) U/L. There was no relationship between increased levels of SGOT and the number of MACE events (p 0.434). Highest median of SGOT levels was found in the stroke group. There was no relationship between increased levels of SGOT with the number of major adverse cardiovascular events (MACE) in patients with acute myocardial infarction.

**Keywords:** acute myocardial infarction · major adverse cardiovascular events · SGOT

## 1 Introduction

Cardiovascular Disease (CVD) is the number one cause of death in the world. Based on the World Health Organization (WHO) Global Prevalence of Cardiovascular Disease in 2016, more than 17 million people die each year from (CVD [1].

Damage to myocardial cells is characterized by an increase in cardiac biomarkers that occurs in AMI patients with ST elevation and without ST elevation [2]. The clinical

course of AMI can lead to MACE (Major Adverse Cardiovascular Events) which are a combination of clinical symptoms and outcomes. MACE can include death, stroke, recurrent infarction and repeated percutaneous coronary intervention revascularization [3].

SGOT is a serum enzyme that is released in large amounts into the blood from myocardial tissue that undergoes necrosis during myocardial infarction [4]. SGOT levels are one of the routine tests carried out in hospitals, especially in peripheral areas with limited laboratory facilities in Indonesia. This enzyme is not specific for the heart. However, the increase in SGOT levels in cases of myocardial infarction correlates with the extent of the lesion [4]. The more extensive the infarct will have a worse impact on the patient. With the background described above, this study aimed to know the relationship between increased levels of SGOT with the incidence of major adverse cardiac events in patients with acute myocardial infarction.

## 2 Method

This study was an analytic study with a retrospective cohort design. Data were taken from the medical records of patients at RSUD Dr Sudirman, Kebumen with consecutive sampling techniques. The sample size in this study was 50 people.

Inclusion criteria were patients diagnosed with acute myocardial infarction with MACE. While the exclusion criteria were incomplete medical record data, patients with liver disorders, liver cirrhosis, and biliary obstruction.

Data analysis was carried out in the form of univariate and bivariate analysis. Univariate analysis was performed to describe the frequency distribution of the data. Bivariate analysis using the Pearson/Spearman correlation test was conducted to find the relationship between two variables. The research has obtained permission from the Research Ethics Committee of the Faculty of Medicine, Islamic University of Indonesia and Dr Sudirman Hospital, Kebumen.

## 3 Result and Discussion

There were 50 subjects included in this study. Table 1 showed the distribution of patients with acute myocardial infarction by age, gender, median of onset and median of SGOT. Patients who experienced AMI mostly occurred in patients aged > 50 years, as many as 46 (92%) patients, while in the group of patients aged < 50 years who experienced AMI were as many as 4 (8%) patients. Patients with AMI were more in the male sex with a total of 30 (60%) patients while the female sex found 20 (40%) patients. The average of the median onset of chest pain in patients is 4 h with a minimum value of 30 min and a maximum of 168 h (7 days).

As many as 40 (80%) patients experienced an increase in SGOT with varying levels. However, only 5 (10%) people had a significant increase of more than 3× the upper limit of the referral value. The median of SGOT level was 51 with a minimum level of 23 U/L and a maximum of 975 U/L.

Table 2 showed the distribution of type of MACE by sex and age of the patient. Some patients had more than one type of MACE. CHF and stroke were more common

**Table 1.** Subject Characteristics

Characteristic	Number	Percentage
Age		
<50 y.o	4	8%
>50 y.o	46	92%
Sex		
Male	30	60%
Female	20	40%
History of DM	7	14%
History of Hypertension	6	12%
Median of Onset (h)	4 (0.5–168)	
MedianSGOT (IU/L)	51 (23–975)	

**Table 2.** Distribution of Type of MACE

Characteristic	Type of MACE			
	CHF	Stroke	Arrhythmia	Cardiogenic Shock
Sex				
Male	14 (56%)	2 (100%)	7 (43,75%)	1 (6,7%)
Female	11 (44%)	0 (0%)	9 (56,25%)	14 (93,3%)
Age				
<50 y.o	0 (0%)	0 (0%)	0 (0%)	2 (13,3%)
>50 y.o	25 (100%)	2 (100%)	16 (100%)	13 (86,7%)

in men than in women, namely 14 (56%) CHF patients and 2 (100%) stroke patients. CHF occurred in 11 (44%) female patients and none had a stroke. On the other hand, arrhythmia was more common in female patients, 9 (56.25%) patients were female and 7 (43.75%) patients were male. Likewise for cardiogenic shock, 14 (93, 3%) patients were female and only 1 (44%) patients were male.

Based on age characteristics, all types of MACE are more common in the group of patients aged > 50 years with the most common types of MACE were CHF in 25 patients, followed by arrhythmia in 16 patients, cardiogenic shock in 13 patients, and stroke in 2 patients. In the age group < 50 years, there were only 2 patients with MACE in the form of cardiogenic shock.

Table 3 showed the number of patients and the profile of SGOT levels in each MACE group. Stroke had the highest median SGOT of 74.5 U/L (32–117 U/L), followed by arrhythmias with a median SGOT profile of 58 IU/L (23–975 U/L), CHF with a median SGOT of 54 IU/L (26–975 U/L) and cardiogenic shock with a median SGOT of 45 IU/L (23–251 U/L).

**Table 3.** SGOT Level Based on MACE Group

Type of MACE	N	SGOT(U/L) (Median (Min-Max))
CHF	25 (39%)	54 (26–975)
Stroke	2 (3,125%)	74,5 (32–117)
Arrhythmias	16 (34,375%)	58 (23–975)
Cardiogenic Shock	15 (%)	45 (23–251)

**Table 4.** Correlation of SGOT level with MACE

	SGOT	
Number of MACE	r = 0,113	p 0,434

Table 4 indicates that SGOT levels were not correlated with the number of MACE ( $r = 0,113, p = 0,434$ ).

#### 4 Discussion

Age and gender are risk factors associated with the occurrence of acute myocardial infarction. The results of this study were in accordance with previous study which showed that males were more affected by myocardial infarction than females. Men are more prone to atherosclerosis because of the influence of lifestyle. Women are at lower risk because of the effect of estrogen which has a protective effect against atherosclerosis in women. In this study, the largest age distribution was in the age group > 50 years. The coronary arteries will start changing from the age of 20 years and be followed by other arteries after the age of 40 years and continue to increase with age [5]. The risk of AMI incidence in postmenopausal women was increase 2–3× due to decrease in estrogen affecting its protective effect on atherosclerosis [5, 6].

Type of MACE included in this study were CHF, stroke, arrhythmia and cardiogenic shock. The highest number of MACE experienced by patients was CHF, followed by cardiogenic shock, arrhythmia and stroke. The incidence of MACE is influenced by several factors such as gender and age. A previous study by Jeffrey (2009) showed that the incidence of MACE was 9.6% higher in women compared to 5.3% for men. Wahyuni’s (2014) research results show different things. Gender could not be used as a predictor of MACE during hospitalization, but the age factor showed a significant relationship [5, 7].

In line with another study, it was found that more than 40% of elderly patients with acute coronary syndrome (ACS) while being hospitalized experienced heart failure and cardiogenic shock [8]. This is due to changes in vascular endothelial function and thrombogenesis in the elderly, which is characterized by an increase in circulating fibrinogen and factor VII, as well as impaired fibrinolytic activity and coronary vasodilation response [9].

Previous studies stated that arrhythmia was experienced by 65% of STEMI patients. It was caused by changes in the frequency and rhythm of the heart, as well as disturbances in the location of origin or conduction of electrical impulses of the heart [10]. This study shows the number of patients who experience arrhythmias more women. In contrast, the results of previous studies showed that arrhythmias occur more in men than women [11, 12]. The incidence of arrhythmias increases with age and has been reported to be a factor in sudden cardiac death. Previous research showed that the distribution of arrhythmia cases by age mostly occurred at the age of 51–60 years, which was 35%. Another study found that most cases of arrhythmias occurred at the age of > 45 years and also above 66 years [12–14].

Another complication in this case of MACE taken in this study is cardiogenic shock. As many as 80% of cases of cardiogenic shock are caused by AMI [15]. STEMI cases increase the risk factor for cardiogenic shock 2 times compared to NSTEMI [16].

Stroke was the lowest incidence of MACE in this study. The stroke complications can be ischaemic or haemorrhagic. Previous study in England showed that the incidence of ischemic stroke complications was 3-fold greater than that of haemorrhagic stroke following PCI procedure. Ischaemic stroke complications have increased in incidence over time, whilst haemorrhagic stroke complications have decreased, driven through temporal changes in clinical, procedural, drug-treatment and demographic factors. Both type of stroke increase mortality up to 3 times for ischaemic stroke and 13, 5 times for hemorrhagic stroke [17, 18].

In this study it was found that as many as 80% of subjects had levels of SGOT above normal. Increased levels of SGOT in AMI patients are caused by damage to myocardial cells, causing tissue death in the myocardium. In acute myocardial infarction, AST starts rising 6 to 8 h after the symptom onset, reaches the peak level at 24 to 36 h and returns to normal in 3 to 7 days [4]. An increase in SGOT appears as a marker of damage to liver function and an increase in this enzyme is also associated with the incidence of cardiac death, especially in STEMI patients [19].

In this study, there was no relationship between an increase in SGOT and the number of MACE events. SGOT has high activity in the myocardium, so myocardial necrosis causes an increase in SGOT in serum. Elevated levels of SGOT in AMI patients can indicate the extent of the infarct area in the heart that has the potential to progress to MACE. In AMI patients, peak of SGOT correlates closely with creatine kinase myocardial band (CK-MB), congestive heart failure as assessed by the Killip classification and acute hypoxic liver injury [4].

A previous study used SGOT as a biomarker of hypotoxic liver injury to predict the incidence of MACE in NSTEMI patients. SGOT level > 101 U/L was chosen as cut off to predict the occurrence of MACE in patients. But in multivariate analysis, there was no significant relationship between hypotoxic liver injury and MACE [20].

The Atherosclerosis Risk in Community (ARIC) study showed that higher SGOT levels, even within the normal range, were significantly and independently associated with high-sensitivity cardiac troponin T concentrations. SGOT is also elevated in patients with congestive heart failure, possibly because of liver injury caused by reduction of blood flow to the liver or passive backward congestion that occurs in the setting of decreased cardiac output. However, nonhemodynamic factors may also have a role. The

very high SGOT activity found in patients with congestive heart failure or cardiogenic shock may be due to acute central hepatic necrosis secondary to decreased cardiac output and decreased hepatic blood flow. Thus, the cardiovascular risk associated with elevated SGOT in this condition reflects the underlying structural CVD [4].

This study has limitations. This study uses secondary data from medical records so there is still a risk of selection bias and information on data collection. Further research is needed to analyze the influence of other factors such as onset, role of therapy and intervention that may influence the occurrence of MACE during hospitalization.

## 5 Conclusion

Highest median of SGOT levels was found in the stroke group. There was no relationship between increased levels of SGOT with the number of major adverse cardiovascular events (MACE) in patients with acute myocardial infarction.

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