Original Research Article

Prevalence and Risk Factors of In-Hospital Mortality of ST Elevation Myocardial Infarction (STEMI) Patients during January - December 2021 at Bekasi Regency General Hospital

ABSTRACT

Aims: To determine the prevalence of Acute Coronary Syndrome (ACS) patients and the risk factors of in-hospital mortality of ST-Elevation Myocardial Infarction (STEMI) patients at Bekasi Regency General Hospital in 2021.
Study design: This research was a descriptive cross-sectional study using secondary data from medical records. The data were presented in diagrams and tables.
Place and Duration of Study: Cardiology department and Emergency Room Unit Bekasi Regency General Hospital, December 2021 to March 2022
Methodology: This study is a descriptive cross-sectional study using secondary data (medical record) which included all the patients over 35 years old that admitted through ER during January to December 2021 with complaints including chest pain or shortness of breath which later hospitalized. The final sample used in this study is 117 subjects.
Results: There were 117 cases of ACS in 2021. They were 14% STEMI, 15% Non-ST Elevation Myocardial Infarction (NSTEMI), and 71% Unstable Angina Pectoris (UAP). Most patients were male (54%), and aged <65 years old (85%). The in-hospital mortality was 19% STEMI, 17% NSTEMI, and 12% UAP. Among 16 STEMI patients, 81% were male and 94% were aged <65 years old. There were 69% who came to the emergency room <12 hours and only 50% underwent fibrinolytic.
Conclusion: The risk factors of in-hospital mortality of STEMI patients were 40% late onset, 23% anterior STEMI, 20% hypertension, 60% diabetes mellitus, 50% chronic kidney disease, 33% tachycardia, and 100% Killip III.

Keywords: acute coronary syndrome, st-elevation myocardial infarction, in-hospital mortality, prevalence, risk factors

1. INTRODUCTION

Coronary heart disease is a disease caused by plaque accumulation in the coronary arteries that supply oxygen to the heart muscles[1].The acute coronary syndrome is also caused by increased oxygen demand, reduced blood oxygen transport, and is often caused by reduced coronary flow as a result of narrowing or obstruction of the arteries due to atherosclerosis[2]. The acute coronary syndrome consists of Unstable Angina Pectoris (UAP), non-ST elevation myocardial infarction (NSTEMI), and ST elevation myocardial infarction (STEMI) [3,1].Angina pectoris is a clinical syndrome caused by an imbalance between demand and supply of coronary artery flow[3]. Non-ST ElevationMyocardial Infarction (NSTEMI) is an acute coronary syndrome with clinical symptoms of chest pain typical of infarction, electrocardiogram (ECG) without ST segment elevation, and elevated cardiac enzymes (CKMB, troponin T). NSTEMI can cause various complications, such as acute pulmonaryedema, cardiac arrest, and even death[4].

Acute ST Elevation Myocardial Infarction (STEMI) is a clinical syndrome defined by myocardial ischemia symptoms related to persistent ST elevation and release of myocardial necrosis biomarkers[5].Acute myocardial infarction is diagnosed based on the typical clinical symptoms of chest pain, increased cardiac biomarkers, and changes in electrocardiogram patterns [6].Increased cardiac-specific markers found in acute myocardial infarction are MB isoenzyme of creatinine kinase (CKMB), troponin T, and troponin I.CKMB isoenzymes are plentiful in cardiac muscle cells. Increased levels of CKMB indicate the extent and severity of infarction in the heart muscle[6].On the electrocardiogram, an assessment of ST elevation is performed at the J point and is found in two opposite leads.The ST segment elevation threshold value in the diagnosis of STEMI for males and females in most leads is 0.1 mV[7].ST segment elevation without Left Ventricular Hypertrophy (LVH) or Left Bundle Branch Block (LBBB) is a new ST segment elevation at the J point >2mm (0.2 mV) in males or >1.5 mm (1.5 mV) in females in leads V2-V3 and/or >1 mm (0.1 mV) in another precordial lead or limb lead, in at least 2 contiguous leads[5,7].

Typical chest pain in STEMI located in the substernal, with >20 minutes duration, accompanied by cold sweat, chest pain that is described as feeling like crushed and can spread to the left arm, back, jaw, or epigastrium.Risk factors for STEMI include diabetes, cholesterol, high blood pressure, chronic kidney disease, and heredity[3]. STEMI is an indicator of total coronary artery occlusion. This condition requires revascularization to restore blood flow and myocardial reperfusion as soon as possible, either medically using fibrinolytic agents or mechanically through primary percutaneous coronary intervention[7].Several factors must be considered when choosing reperfusion therapy. Initiation of reperfusion management does not need to wait for the results of increased cardiac biomarkers[5,7].

Percutaneous coronary intervention (PCI) is a non-surgical intervention procedure using a catheter to dilate or open narrowed coronary arteries due to atherosclerosis or thrombosis with ballooning or deploying a stent.For STEMI patients who come to a hospital with PCI facilities, primary PCI must be performed within 90 minutes with the onset of complaints <12 hours.For patients who come to a hospital without PCI facilities, fibrinolytic therapy should be initiated at <12 hours of onset and if primary PCI cannot be performed within 120 minutes of first medical contact[5,3].Early reperfusion therapy can reduce in-hospital mortality rates and show better outcomes in patients with acute myocardial infarction. However, STEMI still causes various complications, including myocardial dysfunction, heart failure, cardiogenic shock, arrhythmias, mechanical complications, and pericarditis[8].

Based on the background explanation above, the problem that can be concluded is how the distribution of acute coronary syndrome patients who were admitted through the emergency room and an overview of what risk factors can cause mortality of acute coronary syndrome patients during hospitalization in Bekasi Regency General Hospital during January to December 2021.

2. MATERIAL AND METHODS

This study is a descriptive cross-sectional study using secondary data. The study subjects included all the patients over the age of 35 that admitted through the ER in Bekasi Regency General Hospital from January to December 2021 with chest pain or shortness of breath and later hospitalized. The research was conducted from December 28th, 2021 to March 28th, 2022. This study used secondary data from the medical records of Bekasi Regency General Hospital.

3. RESULTS AND DISCUSSION

3.1 Data Selection and Collection

The initial study was carried out by collecting register data for all patients with acute coronary syndrome who were admitted through the ER from January to December 2021. From the data register, there were 149 patients with acute coronary syndrome in the past year. Consequently, a search for medical record status was conducted to collect the necessary data. Out of the 149 statuses, 12 statuses could not be found and 20 statuses were not included in the inclusion criteria. Therefore, the final sample in this study is 117 statuses (Fig. 1).

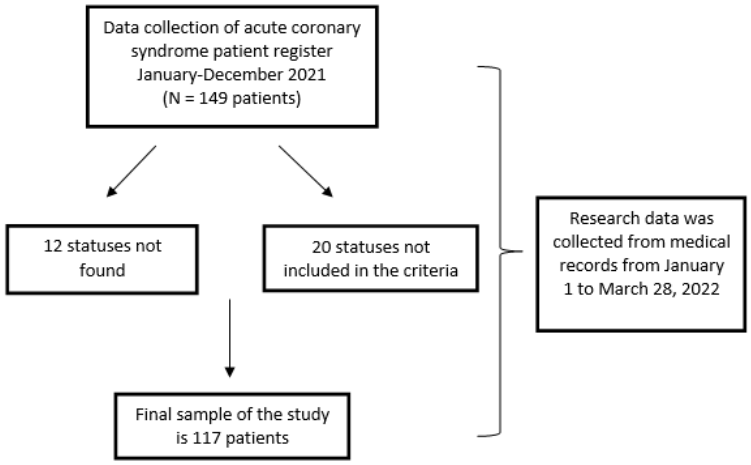

Fig. 1. Sampling process

3.2 Acute Coronary Syndrome Characteristics

This study shows that the number of acute coronary syndrome cases admitted through the ER in the medical record data of Bekasi Regency General Hospital during the period January 1 to December 31, 2021, was 149 cases. Later, out of these 149 cases, 12 cases had no medical records, and 20 cases were not included in the inclusion criteria. Thus, the final sample of this study was 117 cases. Out of the 117 cases, there were 16 cases of STEMI (14%), 18 cases of NSTEMI (15%), and 83 cases of UAP (71%). The distribution of Acute Coronary Syndrome (ACS) patients in Bekasi District Hospital in 2021 can be seen in Fig. 2.

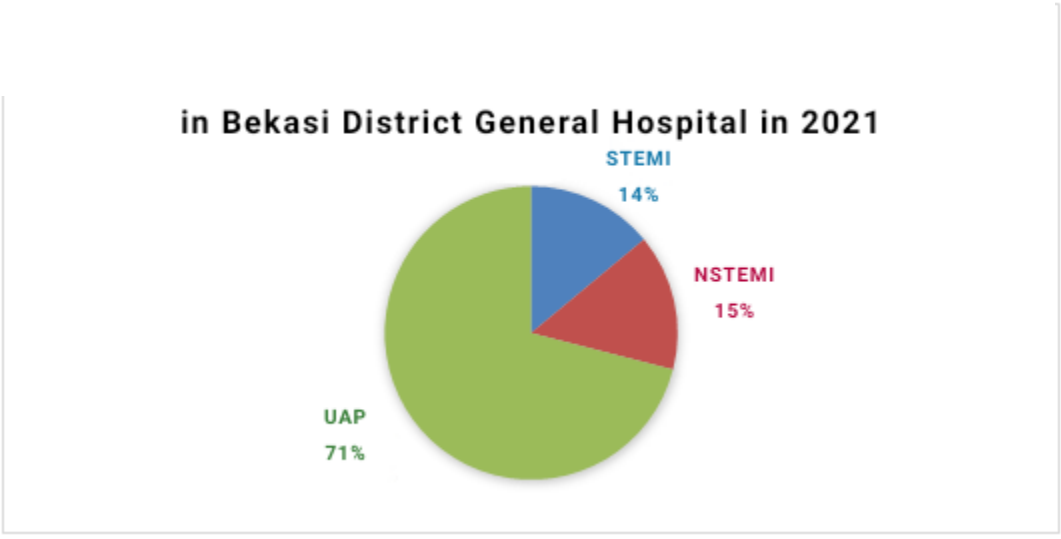

Fig. 2. Distribution of Acute Coronary Syndrome (ACS) patients in Bekasi Regency General Hospital in 2021

This study found that more than half of acute coronary syndrome patients are male patients (54%), while the rests are female patients (46%). Age is a part of the risk factor for acute coronary syndrome. This study classified the patients' age into the under 65 years old age group and the over 65 years old age group. Out of 117 patients, 99 patients are under 65 years old (85%), and 18 patients are over 65 years old (15%).

Patients' comorbidities were dominated by hypertension (85%) with 99 patients, 46 patients suffering from diabetes mellitus (39%), and 36 patients suffering from chronic kidney disease (31%). Out of 117 acute coronary syndrome cases in Bekasi Regency General Hospital during the period of 1 January to December 31, 2021, 16 of these cases died during in-hospital treatment at the hospital. The dead cases were 3 STEMI cases (19%), 3 NSTEMI cases (17%), and 10 UAP cases (12%). Among the 16 acute coronary syndrome patients who died, 7 of them were male (11%) and 9 of them were female (17%). Based on the age group, the majority of acute coronary syndrome patients that were died from the under 65 years old age group (15%), while there was only 1 patient over 65 years old that died (6%). Comorbidities among the patients that died included hypertension; 11 patients (11%), diabetes mellitus; 9 patients (20%), and chronic kidney disease; 9 patients (25%) (Table 1).

Table 1. Acute Coronary Syndrome Patient Characteristic

Variable	Amount (n=117)	Death (n=16)
STEMI	16 (14%)	3 (19%)
NSTEMI	18 (15%)	3 (17%)
UAP	83 (71%)	10 (12%)
Sex		
Male	63 (54%)	7 (11%)
Female	54 (46%)	9 (17%)
Age		
<65 years old	99 (85%)	15 (15%)
>65 years old	18 (15%)	1 (6%)
Hypertension	99 (85%)	11 (11%)
Diabetes Mellitus	46 (39%)	9 (20%)
Chronic Kidney Disease	36 (31%)	9 (25%)

Acute coronary syndrome is classified into three types, acute ST elevation myocardial infarction with (STEMI), acute non-ST elevation myocardial infarction (NSTEMI), and unstable angina pectoris (UAP). Unstable angina pectoris and NSTEMI can be distinguished from cardiac biomarkers. If a significant increase is found, the diagnosis is NSTEMI and if there is no significant increase, the diagnosis is UAP [7]. The result in (Fig. 2) is in line with the data register from the Jakarta Acute Coronary Syndrome (JAC) in 2008-2009 where there were more UAP patients than STEMI and NSTEMI patients[9].

The result is also in line with the study finding in 2014 which stated that the 41-60 age group is the most affected age group [10]. The risk of developing acute coronary syndrome is increasing in men who are over 45 years old and women who are over 55 years old [10].Patients' comorbidities can also be a risk factor for acute coronary syndrome. This is explained by the result in Fig. 2 which was in line with a study finding in 2018 that found that hypertension is the most common risk factor for acute coronary syndrome patients [11]. Increased systemic blood pressure in hypertension causes resistance to the blood pump from the left ventricle and causes ventricular hypertrophy. Ventricular hypertrophy causes an increase in myocardial oxygen demand thus increasing the workload of the heart. Ultimately, this can trigger angina and myocardial infarction. The incidence of acute coronary syndrome in patients with hypertension is five times greater than in normotensive patients. This shows that hypertension is a major risk factor for acute coronary syndrome [11].

The second most common risk factor is diabetes mellitus. Patients with diabetes mellitus have a 200% greater risk of experiencing acute coronary syndrome than patients without diabetes mellitus. Another study states that male patients

with diabetes mellitus have a 50% greater risk of experiencing acute coronary syndrome, while female patients with diabetes mellitus have twice the risk compared to patients without diabetes mellitus [11].

According to the 2018 Handbook of Management of Acute Coronary Syndrome—*Buku Pedoman Tata Laksana Sindrom Koroner Akut*, the prevalence of NSTEMI and UAP is greater than STEMI. NSTEMI patients' initial mortality is lower than STEMI patients, however, after 6 months, the mortality of both is comparable. In the long term, NSTEMI patients' mortality will be greater subsequently [7].Gender, age, and comorbid risk factors for acute coronary syndrome patients affect mortality. The result in Table 1 is in line with a study in 2017 which found that the causes of cardiogenic shock after acute coronary syndrome can be exacerbated by old age, diabetes mellitus, previous myocardial infarction, chronic occlusion of the ascending left coronary artery, and decreased ejection fraction which led to death [12].

3.3 STEMI Patients' Clinical Characteristics

Clinical and demographic data of STEMI patients in Bekasi Regency General Hospital in 2021 is summarized in Table 2. Out of 16 STEMI patients, the majority of them are under 65 years old, which were 15 patients (94%) and 13 male patients (81%). Out of these 16 STEMI patients, three of them died (20%) during in-hospital treatment and three of them were under 65 years old. The majority of the patients that died were male, which were 2 patients (15%).

STEMI patients who came to the ER of Bekasi Regency General Hospital complained about chest pain with onset of attack <12 hours, which were 11 patients (69%). Only five patients (31%) come to the ER with the onset of attack >12 hours. Out of 11 patients with initial onset <12 hours, only 8 of them received fibrinolytic therapy, 2 patients did not receive it due to fibrinolytic contraindications, while the other one rejected the fibrinolytic therapy. Most of the acute myocardial infarctions were located in the anterior part of the heart, with 13 patients (81%), while three patients (19%) were in the non-anterior part of the heart. All three patients who died had a myocardial infarction in the anterior part of the heart.

Risk factors of STEMI patients are hypertension (94%), diabetes mellitus (31%), and chronic kidney disease (13%). Symptoms and clinical signs, of the patients, when they arrived were low systolic blood pressure (31%), high pulse rate (19%), and no arrhythmia (0%). Killip classifications when the patient arrives are Killip I (13%), Killip II (44%), Killip (13%), and Killip IV (31%) (Table 2).

Table 2. STEMI Patient Characteristic

Variable	Amount (n=16)	Death (n=3)
Age		
<65 years old	15 (94%)	3 (20%)
>65 years old	1 (6%)	0 (0%)
Sex		
Male	13 (81%)	2 (15%)
Female	3 (19%)	1 (33%)
Onset		
<12 hours	11 (69%)	1 (9%)
>12 hours	5 (31%)	2 (40%)
Reperfusion		
Fibrinolytic	8 (50%)	1 (13%)
Non-Fibrinolytic	8 (50%)	2 (25%)
STEMI location		
Anterior	13 (81%)	3 (23%)
Non-Anterior	3 (19%)	0 (0%)
Hypertension	15 (94%)	3 (20%)
Diabetes Mellitus	5 (31%)	3 (60%)
Chronic Kidney Disease	2 (13%)	1 (50%)
Hypotension	5 (31%)	0 (0%)

Tachycardia	3 (19%)	1 (33%)
Killip		
I	2 (13%)	0 (0%)
II	7 (44%)	0 (0%)
III	2 (13%)	2 (100%)
IV	5 (31%)	1 (20%)
Arrhythmia	0 (0%)	0 (0%)

According to a research finding in 2017, the number of mortalities in acute coronary syndrome patients that were not treated properly is 40% and the majority of the death occurred in the first two hours since the initial onset (Table 2). The mortality and morbidity that occur in STEMI patients increase with age. Besides, STEMI has a high mortality number, oftentimes due to complications. The predictors of STEMI patient mortality include Killip III and IV, arrhythmia, anterior STEMI, non-reperfusion, chronic kidney disease, tachycardia, STEMI onset >12 hours, and diabetes mellitus [12].

The cause of death in myocardial infarction is multifactorial and depends on the elapsed time duration since the initial attack. Sudden death is commonly caused by ischemia precipitating ventricular arrhythmias during the acute phase of myocardial infarction. Other complications that commonly occur are ventricular tachycardia/ventricular fibrillation (13%), left ventricular dysfunction (11.9%), cardiogenic shock (10.7%), atrial tachycardia/atrial fibrillation (7.1%), and right ventricular infarction (7.1%). Mortality in patients who did not receive reperfusion therapy was 13.2%. The purpose of reperfusion is not only for restoration of arterial patency but also for restoration of coronary flow which has been shown to be associated with reduced heart wall motion abnormalities and improved clinical outcomes [12].

Patients with a previous acute myocardial infarction had the same hospital outcomes as patients without a previous acute myocardial infarction but had a higher recurrence rate at 6 months. Refractory ischemia or recurrent ischemia is symptomatic ischemia within 10 minutes with ST segment deviation or definitive T-wave inversion, and/or hypotension, pulmonary edema, or a heart murmur representing myocardial ischemia (despite the use of nitrates and beta-blockers or calcium channel blockers), occurs in up to 20% of ischemic patients. Refractory ischemia has mortality within 30 days two times greater than patients with ST segment elevation and even greater mortality risk than patients without ST segment elevation [12].

4. CONCLUSION

Based on the study and discussions, it can be concluded that:

1. The number of acute coronary syndrome patients admitted through the ER of Bekasi Regency General Hospital in 2021 is 149 cases. There are 12 cases without medical records and 20 cases excluded from the inclusion criteria. Thus, the final sample in this study is 117 cases.

2. Acute coronary syndrome patients are classified into 16 STEMI patients (14%), 18 NSTEMI patients (15%), and 83 UAP patients (71%).

3. Most patients of acute coronary syndrome were male, with a total of 63 patients (54%) while the others were female, with a total of 54 patients (46%).

4. Most patients with acute coronary syndrome were under 65 years old, with a total of 99 patients (85%), and the rest were under the age of 65, with a total of 18 patients (15%).

5. The risk factors for acute coronary syndrome patients were 99 hypertension patients (85%), 46 diabetes mellitus patients (39%), and 36 chronic kidney disease patients (31%).

6. The number of acute coronary syndrome patients who died during in-hospital treatment was 16 patients, including three STEMI patients (19%), three NSTEMI patients (17%), and ten UAP patients (12%). There were 7 male patients (11%) and nine female patients (17%). The number of patients under the age of 65 is 15 patients (15%), while the other patient over the age of 65 is only one patient (6%). The risk factors included 11 hypertension patients (11%), nine diabetes mellitus patients (20%), and nine chronic kidney disease patients (25%).

7. Out of 117 cases, the number of STEMI patients is 16, and three of them have died during in-hospital treatment.

8. Most STEMI patients are under the age of 65 years, with a total of 15 patients (94%), while there was only one patient over the age of 65 (6%).

9. Most STEMI patients were male patients, with a total of 13 patients (81%) and the other were female patients with a total of three patients (19%).

10. STEMI patients that come through the ER with clinical symptoms of chest pain with <12 hours onset are 11 patients (69%), while patients with >12 hours onset are five patients (31%).

11. STEMI patients that received fibrinolytic therapy are eight patients (50%) and only patients with initial onset <12 hours received the therapy. There were two patients who did not receive the fibrinolytic due to contraindications and there was one patient that rejected the fibrinolytic therapy.

12. Most of the acute myocardial infarctions were located in the anterior part of the heart with a total of 13 patients (81%), while the rest were located in the non-anterior part of the heart with a total of three patients (19%).

13. STEMI risk factors were 15 hypertension patients (94%), five diabetes mellitus patients (31%), and two chronic kidney disease patients (13%).

14. Symptoms and clinical signs when STEMI patients arrived including 5 low systolic blood pressure (31%), high pulse rate (19%), and no arrhythmia (0%).

15. Killip classifications when STEMI patients arrived were2 Killip I patients (13%), seven Killip II patients (44%), two Killip III patients (13%), and five Killip IV patients (31%).

Suggestions for further studies:

1. Using analytical research methods to study the correlation between the risk factors with acute coronary syndrome condition.

2. Using patient data that received PCI procedure.

3. Using this study as a basis for further research with a wider period of acute coronary syndrome patient registers.

CONSENT (WHEREEVER APPLICABLE)

This manuscript used secondary data from the medical records of Bekasi Regency General Hospital. The consent form is not applicable for this study.

ETHICAL APPROVAL (WHEREEVER APPLICABLE)

This manuscript used secondary data from the medical records of Bekasi Regency General Hospital. Approval of the Ethics Committee is not required for this study.

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ABBREVIATIONS

Abbreviation	Definition
ACS	Acute coronary syndrome
WHO	World Health Organization
STEMI	ST-Elevation Myocardial Infarction
PCI	Percutaneous Coronary Intervention
NSTEMI	Non-ST Elevation Myocardial Infarction
UAP	Unstable Angina Pectoris
ECG	Electrocardiogram
CKMB	Creatine kinase-MB
LVH	Left Ventricular Hypertrophy
LBBB	Left Bundle Branch Block
ER	Emergency Room
JAC	Jakarta Acute Coronary Syndrome