Cogitare Enfermagem

ORIGINAL ARTICLE

Analysis of the outcome of patients with acute myocardial infarction undergoing percutaneous coronary intervention

HIGHLIGHTS

1. High hospital mortality compared to international literature.
2. The role of the nurse is essential in cardiologic emergencies.
3. Heart rate, blood glucose, and cardiovascular history significantly influenced the outcome of death.

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ABSTRACT

Objective: To analyze the outcome of patients with acute myocardial infarction undergoing percutaneous coronary intervention. **Method:** Quantitative, documentary, and retrospective study conducted in a public teaching health institution, with data from June 2022 to May 2024. Participants were diagnosed with acute myocardial infarction with ST-segment elevation and were undergoing emergency percutaneous coronary intervention. Data were analyzed using descriptive and inferential statistics. **Results:** The sample consisted of 230 patients, predominantly male (71.7%), of white race (72.2%), married (58.7%), with a hospital mortality rate of 15.6%. Heart rate, admission blood glucose, and cardiovascular history were statistically significant predictors of death. **Conclusion:** Hospital mortality in the investigation sample was higher than the records in the literature. The relevance of the nurse's role in the care of cardiovascular emergencies is reaffirmed.

DESCRIPTORS: Cardiovascular Diseases; Myocardial Infarction; ST Elevation Myocardial Infarction; Myocardial Reperfusion; Hospital Mortality.

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INTRODUCTION

Cardiovascular diseases (CVD) are the leading cause of death worldwide. Chest pain is one of the most common reasons individuals seek care in emergency departments (ED) [1-3]. A significant portion of patients presenting with acute chest pain is diagnosed with acute coronary syndrome (ACS), which can be divided into angina, ST-segment elevation myocardial infarction (STEMI), or non-ST-segment elevation myocardial infarction (NSTEMI)[4].

Acute chest pain is the main clinical finding in patients with ACS. As a protocol, performing an electrocardiogram (ECG) within the first 10 minutes of admission to a healthcare facility is recommended, as it allows assessment of arterial occlusion, especially in STEMI, where arterial occlusion is generally total and requires immediate reperfusion to prevent myocardial ischemia. Acute myocardial infarction (AMI) is the leading cause of death worldwide, and in Brazil, it accounts for approximately 10.2% of hospital admissions[4].

STEMI cases can progress to death within the first hours of the disease. Therefore, this patient must receive immediate care. In this health condition, the use of percutaneous coronary intervention (PCI) remains the first-line treatment when available, according to the current guidelines organized by Piegas and collaborators[5]. Within the scope of the Unified Health System, PCI is available in reference centers for the treatment of STEMI.

Understanding the outcomes of patients who experienced STEMI is an essential health indicator, as it allows for the understanding of trends and associated factors, supporting planning, resource allocation, and implementation of actions aimed at improving the quality of care and patient safety. Therefore, the objective of this study was to analyze the outcomes of patients with acute myocardial infarction undergoing percutaneous coronary intervention.

METHOD

This is a quantitative, documentary, and retrospective study, conducted in accordance with the guideline *Strengthening the Reporting of Observational Studies in Epidemiology* (STROBE)[6].

The study took place in a public teaching health institution, a reference for an area that encompasses approximately 576,817 users of the health system[7], and, recently, the site for directing cardiological emergencies, due to the closure of the former cardiology reference in the region.

The hospital under study has 336 registered beds, of which 60 beds are designated for adult intensive care. Patient regulation is done by the Macro Health Region and by the Health Consortium of the Municipalities of Western Paraná (Consamu), and its intra-hospital referral is carried out by the medical team of the institution, according to clinical indication. The hemodynamic unit of the institution has an operating room where cardiac catheterizations, angioplasties, arteriographies, and the introduction of catheters, such as for hemodialysis, pacemakers, among others, are performed. Regarding angioplasty, such a procedure can occur in emergency, urgent, or outpatient settings.

The data under study involved the period from June 1, 2022, to May 31, 2024. The initial date refers to the opening of the hemodynamic unit, extending the study period to 24 months.

The study population consisted of adult patients (≥18 years) who were admitted to the emergency unit (EU) of the hospital in question and were referred to hemodynamics for emergency cardiac catheterization, with or without primary angioplasty. Those who underwent scheduled elective procedures on an outpatient basis were excluded, as well as those who were transferred to other health institutions due to the impossibility of follow-up on the outcome.

The identification of these patients was carried out through the procedure report of the institution's health management system, using procedure filters: cardiac catheterization, coronary angioplasty, coronary angioplasty with the implantation of a stent, and coronary angioplasty with the implantation of two stents, which constitute the procedures performed and registered in the unit and institution. During the period, 2672 patient records were evaluated, of which 2440 were not included as they were elective procedures, and two were excluded due to having an inter-hospital transfer as the outcome. As a result, 230 patients met the inclusion criteria and formed the study sample.

Data collection occurred from June to September 2024. A form was used for the study in *Microsoft Excel* software, based on data from the literature on the subject, containing information distributed in columns, including admission date, clinical characteristics at admission, health history, medications administered in pre-hospital care and at patient admission, vital signs, and glycemic analysis at admission and outcome.

After collection, the data tabulated in *Microsoft Excel* spreadsheets, version 2010, were exported to *Statistical Package for the Social Sciences (SPSS),* version 26. The t-tests of *Student* and Fisher's test were performed. Descriptive analyses were performed for all studied variables, using percentage proportion measures for categorical variables and measures of central tendency and dispersion for continuous variables.

The outcome (hospital discharge or death) of the patient diagnosed with STEMI who underwent PCI was considered the response variable. To test the association with explanatory variables, in an attempt to explain the patients' outcomes, the Student's t-test was used for independent variables and Fisher's exact test, according to the behavior of each variable. Statistically significant results were considered those with a p-value < 0.05.

This study respected the ethical principles of research with human beings, according to Resolution 466/2012 of the National Health Council[8] and is part of a matrix study entitled "Door-to-guide time and care protocol for patients with coronary syndrome," approved by the Institutional Ethics and Research Committee, according to opinion number 6.546.326.

RESULTS

The sample consisted of 230 patients, with a predominance of men (n=165; 71.7%); white race (n=166; 72.2%); married (n=135; 58.7%), with an average age of 63 and 68 years, slightly higher for those who progressed to death ($p>0.05$), as shown in Table 1. Mortality during this period was 15.6% for the studied sample, totaling 36 deaths.

Clinically, STEMI was the main initial diagnostic hypothesis for both studied groups and was considered statistically significant (Table 1).

Among the monitored vital signs, heart rate (HR) and temperature showed statistically significant associations between the studied groups (p = 0.036 and p = 0.01, respectively). The variation in temperature between the groups was minimal, while the heart rate was higher in the group of patients who progressed to death, although still within the range considered normocardia (50 to 99 bpm)[9]. Blood glucose also showed a statistically significant difference between the groups, with higher averages in patients who progressed to death (p = 0.001) (Table 1).

Table 1. Association of sociodemographic and clinical variables of study participants according to the outcome of discharge and death. Cascavel, PR, Brazil, 2024 (n=230)

	Outcome		
	Discharge (n=194)	**Death (n=36)**	
	n (%)	**n (%)**	**p***
Sex			
Male	142 (61.7)	23 (10)	0.3
Female	52 (22.6)	13 (5.7)	
Race			
White	141 (61.3)	25 (10.9)	
Black	6 (2.6)	0 (0.0)	0.130
Yellow	46 (20)	9 (3.9)	
Brown	1 (0.4)	2 (0.9)	
Marital status			
Married	118 (51.3)	17 (7.4)	
Single	23 (10)	4 (1.7)	
Divorced	20 (8.7)	2 (0.9)	**0.008**
Widower	18 (7.8)	12 (5.2)	
Not informed	15 (6.5)	1 (0.4)	
Initial diagnostic hypothesis			
STEMI	177 (77)	29 (12.6)	
NSTEMI	9 (3.9)	2 (0.9)	
ACS	6 (2.6)	0 (0)	**0.05**
IAM	2 (0.9)	3 (1.3)	
BAVT	0 (0)	1 (0.4)	
AVEh	0 (0)	1 (0.4)	
	Discharge (n=194)	**Death (n=36)**	
	Mean ± S.D.	**Mean ± S.D.**	**p****
Age	63.7 ± 11.5	68.4 ± 12.1	0.8
Temperature	35.8 ± 0.7	35.3 ± 1.02	**0.036**
Respiratory rate	21.8 ± 36.3	21.5 ± 5.1	0.59
Heart rate	81.2 ± 18.5	91.2 ± 23.6	**0.01**
Systolic blood pressure	138.3 ± 28.8	116.2 ± 35.8	0.12
Diastolic blood pressure	86.4 ± 19.6	77.1 ± 20.1	0.44
Blood glucose	151.9 ± 57.0	265.77 ± 130.77	**<0.001**
Oxygen saturation	95.2 ± 7.4	92.1 ± 5.5	0.18

Legend: p* = p-value obtained by the Student's t test for independent samples; p** = p-value obtained by Fisher's test; AMI: Acute Myocardial Infarction; STEMI: Acute Myocardial Infarction With ST Segment Elevation; NSTEMI: Acute Myocardial Infarction Without ST Segment Elevation; ACS: Acute Coronary Syndrome; BAVT: Total Atrioventricular Block; AVEh: Hemorrhagic Cerebrovascular Accident.

Source: The authors (2024).

The average length of stay for these patients was statistically significant between the groups, with patients who progressed to death having the outcome, on average, in the first two/three days. As a complication, orotracheal intubation (OTI) was considered, which was also statistically significant for the patients' outcome (Table 2).

Table 2. Characterization of the association between length of stay and the need and timing of orotracheal intubation of study participants, according to the outcome of discharge and death. Cascavel, PR, Brazil, 2024 (n=230)

	Outcome		
	Discharge (n=194)	Death (n=36)	
	Mean ± S.D.	Mean ± S.D.	p*
Length of stay	7.67 ± 4.9	2.94 ± 3.6	**<0.001**
	n (%)	n (%)	p**
Orotracheal intubation			
Yes	42 (53.8)	36 (46.2)	**<0.001**
No	180 (100)	0 (0)	
Timing of intubation			
Health institution	7 (21.2)	26 (78.8)	0,187
Pre-hospital care	7 (41.2)	10 (58.8)	

Legend: p*= p-value obtained by the Student's t test; p** = p-value obtained by Fisher's test.
Source: The authors (2024).

The morbidities listed in the electronic medical record were organized by systems, according to the International Classification of Diseases (ICD-10). In patients who had hospital discharge as the outcome, diseases of the circulatory system were highlighted (n=153; 36%), with systemic arterial hypertension (SAH) predominating (n=121; 28.5%); endocrine, nutritional, and metabolic diseases (n=115; 27%) were composed of type 2 diabetes *mellitus* (DM2) (n=56; 13.2%); and mental or behavioral disorders (n=108; 25.5%) included, mainly, active smoking, smoking in abstinence, and alcoholism. Regarding patients who presented the outcome of death, diseases of the circulatory system also stood out (n=28; 34.6%), endocrine, nutritional, and metabolic diseases (n=23; 28.4%), and mental or behavioral disorders (n=18; 22.2%) (Table 3).

Table 3. Clinical characterization of study participants according to the outcome, based on morbidity records. Cascavel, PR, Brazil, 2024 (n=425)

Morbidity	Discharge (n=194)	Death (n=36)
	n (%)	n (%)
Circulatory system	153 (36)	28 (34.6)
Endocrine, nutritional, or metabolic	115 (27)	23 (28.4)
Mental or behavioral disorders	108 (25.5)	18 (22.2)
Renal system	12 (2.8)	3 (3.7)
Respiratory system	10 (2.3)	2 (2.5)
Nervous system	7 (1.6)	2 (2.5)
Visual system	3 (0.7)	2 (2.5)
Digestive system	0 (0)	3 (3.7)
Others	17 (4)	0 (0)

Source: The authors (2024).

The continuous use of medications (CUM) identified in patients with the outcome of discharge showed the use of angiotensin receptor blockers (n=55), beta-blockers (n=31), lipid-modifying agents (n=45), hypoglycemic biguanide (n=36), thiazide diuretic (n=27), angiotensin-converting enzyme inhibitors (n=26), among others. Among the patients included in the outcome of death, angiotensin receptor blockers (n=10), lipid-modifying agents (n=09), hypoglycemic biguanide (n=09), thiazide diuretic (n=07), beta-blockers (n=05), and angiotensin-converting enzyme inhibitors (n=4) were highlighted.

Another investigated data was the medications administered in pre-hospital care. In this case, among the participants who were discharged from the hospital, AAS (n=150), clopidogrel (n=143), isosorbide (n=26), morphine (n=18), enoxaparin (n=14), heparin (n=11), among others, were highlighted. Among the medications administered in the institution at admission for this same group, clopidogrel (n=90), AAS (n=28), simvastatin (n=14), and enoxaparin (n=14), among others, were included.

Regarding the participants who progressed to death, the medications administered in pre-hospital care included AAS (n=20), clopidogrel (n=19), isosorbide (n=3), morphine (n=4), enoxaparin (n=1), and heparin (n=4), among others. In the institution, the medications administered at admission included clopidogrel (n=17), AAS (n=10), simvastatin (n=4), and enoxaparin (n=3), among others. When testing the association of the use (or not) of these medications in an attempt to explain the outcome of these participants (discharge or death), statistical significance was obtained in the use of AAS (p=0.012) and clopidogrel (p=0.016).

The previous cardiovascular history included AMI, cardiac catheterization, angioplasty, and cardiac surgery. Statistical significance was identified through the Fisher test, as indicated by the data in Table 4.

Table 4. Association of the cardiovascular history and cardiovascular interventions of the study participants, according to the outcome of discharge and death. Cascavel, PR, Brazil, 2024

	Outcome		
	Discharge (n=194)	Death (n=36)	p*
Variables	n (%)	n (%)	
Previous acute myocardial infarction	25 (80.5)	6 (19.4)	**0.002**
Previous cardiac catheterization	16 (72.7)	6 (27.3)	**0.009**
Previous angioplasty	23 (95.8)	1 (4.2)	**<0.0001**
Previous cardiac surgery	4 (80)	1 (20)	**<0.0001**

Legend: n = 230; p* = p-value obtained from the Fisher test.

Source: The authors (2024).

DISCUSSION

The present study aimed to analyze the outcome of patients diagnosed with STEMI who underwent PCI, seeking to identify factors associated with the outcome in this sample. In this sense, 194 (84.4%) of the patients had improved discharge as the outcome, while the hospital mortality in this study was 15.6% (n=36), which is higher than that identified in a systematic review of studies conducted in Latin America and the Caribbean that included 29 articles related to STEMI, which shows mortality during hospitalization ranging from 9.1% to 10.7%. In comparison, a study conducted in South Korea[11] reported a female mortality rate of 12.2% and a male rate of 5.5%, obtained from a study conducted in South Korea. In a study conducted in Portugal[12], a mortality

rate of 8.5% was identified in women and 4.1% in men affected by STEMI, in a study conducted in Portugal.

The study pointed to a sample predominantly composed of men, of white race, married, with an average age between 63 and 68 years, slightly higher in the sample that had death as the outcome. The findings obtained are similar to those found in a study also conducted in the south[13] and midwest[14] of Brazil. However, these findings differ from the international literature, which often shows a higher incidence of women affected by AMI, in the age group under 60 years, with this group being more susceptible to complications, for unexplained reasons[11-12,15].

Regarding the SSVV of patients at admission, statistical significance was identified related to temperature and heart rate when comparing the two studied groups. The imbalances in sympathetic and parasympathetic activity caused in the pathophysiology of AMI can lead to a reduction in vagal effect, which in turn will contribute to changes in heart rate, reducing the protective action against possible ventricular arrhythmias, increasing oxygen consumption by the myocardium[5]. In this study, the group that progressed to death presented elevated heart rate values, highlighting the relevance of this finding in the sample, although still within the values of normocardia[9]. Regarding temperature, no authors were identified who addressed this relationship, which may indicate that the significance indicated in this study may not have clinical relevance in daily practice and needs to be investigated in future studies.

At the time of admission, the analysis of blood glucose showed statistical relevance in the comparison between higher levels of results in patients who progressed to the outcome of death, as well as the prevalence of type 2 diabetes *mellitus* in this group. This finding may relate both to the pathophysiology of atherosclerotic diseases, where metabolic disorders favor the development of this pathology and its main complications, as well as the impact of stress-induced hyperglycemia, which consists of moments of hyperglycemia caused by physiological stress, promoted by AMI, often related to worse prognoses[16-17].

The initial diagnosis of the critically ill patient is made based on the patient's clinical condition and the information collected by the pre-hospital care team, which plays a crucial role in the care of the cardiac patient, as it has time-dependent treatment, and an accurate diagnosis allows access to care and effective referral[18]. The prevalence of the initial diagnosis of ST-segment elevation myocardial infarction (STEMI) enables targeted care to the clinical picture, ensuring the use of appropriate pharmacological treatment, as well as percutaneous coronary intervention (PCI) in less time, ensuring that the myocardium is preserved, contributing to better prognosis[19].

Despite the evolution of studies and strategies for reperfusion, the complications of AMI require attention. The early identification of signs of complications, including cardiogenic shock, is essential for the proper management of the clinical conditions of patients[20]. In cases of clinical signs suggestive of complications, it may sometimes be necessary to provide ventilatory support, obtain an advanced airway, and initiate mechanical ventilation.

Orotracheal intubation (OTI) was considered statistically significant in the sample, as all patients who progressed to death presented this need related to some complication. According to the current guidelines of the Brazilian Society of Cardiology, OTI should be recommended in situations where bag-mask ventilation becomes ineffective, such as in cases of unconsciousness, comatose patients, or in cardiac arrest[5]. The complications of AMI maintain significant levels and mortality, particularly in low- and middle-income countries, emphasizing the association with factors such as a diet high in lipids, sodium,

and sugars, sedentary lifestyle, and smoking, as highlighted by the Pan American Health Organization, since in the presentation of the condition, mortality from this pathology is related to the individual's access to health services that meet their clinical needs[20].

Often, complications are related to comorbidities associated with the ischemic cardiac condition. The present study found no association of these comorbidities that could explain the outcome of discharge or death among the studied sample. Thus, the data on comorbidities related to the participants, according to their outcome, were presented descriptively, related to their frequency.

The comorbidities presented by the patients were related to the widely disseminated risk factors for AMI, as extensively pointed out by the data from national and international literature, including systemic arterial hypertension (SAH), type 2 diabetes *mellitus* (T2DM), hypertriglyceridemia, and smoking, corresponding to the comorbidities experienced by the patients. The prevalence of SAH and T2DM in the sample was also identified in a study conducted in databases in the United States, and in a systematic review developed in Brazil[21], as well as SAH, T2DM, hypertriglyceridemia, and smoking in a multicenter study conducted in Portugal, where there was also a prevalence of diabetes in the sample. Regarding the control of comorbidities after AMI, specific medication therapies stand out, aiming to reduce possible complications and recurrence of cardiovascular events[5,17,21-22].

In the face of cardiac emergencies, the appropriate management of the patient according to the current guidelines will contribute to better prognoses. The medications used in pre-hospital care and upon patient admission were in accordance with the recommended ones, highlighting AAS, clopidogrel, statins, enoxaparin, and heparin, in addition to medications possibly used for symptomatology, such as isosorbide and morphine[5]. The use of guidelines that direct the treatment and referral of the patient allows for standardization and follow-up in care, utilizing valuable tools that contribute to the better prognosis of the patient[23].

The previous cardiovascular history of the patients, in the association between the studied groups, showed statistical significance regarding the outcome of death, highlighting previous AMI, previous cardiac catheterization, angioplasty, and previous cardiac surgery. In a literature review conducted in Nigeria[24], the authors highlight that patients who experienced STEMI tend to have an increased risk for the development of new cardiovascular events, thus necessitating the adoption of risk factor control and maintenance of follow-up for these patients in specialized outpatient care.

Effective control of risk factors, although widely disseminated, depends not only on the availability and access to resources but also on the patient's ability to understand the guidance and its application. In this sense, health literacy acts as a central element to assess the individual's understanding of the relevant factors for disease control. For better results, the health team should expand communication methods, using strategies accessible to the individual's understanding and promoting integration among the different levels of the health care network[25].

Within the health system, the patient with STEMI may go through various points of care, which must be aligned for adequate and quality service. In light of this, the role of the nurse becomes fundamental, from identifying the suggestive picture of acute coronary syndrome to the initial management of symptoms, planning the care to be provided, applying prognostic risk scales, managing hemodynamic support, and transitioning care, presenting a potential contribution to the treatment of STEMI, as the incorporation of organizational strategies and training for nurses is mentioned in the literature as tools for reducing response time[26-27].

The mortality rate (15.6%; n=36) is higher than the data available in the literature, highlighting the need for the application of new strategies for the management and care of patients experiencing STEMI to reduce mortality.

As limitations, research in secondary databases restricts researchers due to the lack of some records, including variables that may be relevant, as well as the limitation of short-term outcome analysis, that is, during the hospitalization period, making it impossible to assess long-term mortality.

CONCLUSION

Patients diagnosed with STEMI who underwent PCI had a hospital mortality of 15.6%. The sample was predominantly composed of men, with an average age of 63 to 68 years, slightly elevated in patients who experienced death. Heart rate, temperature, and blood glucose were highlighted as factors to be considered upon patient admission, in addition to the clinical history, especially in patients with a previous cardiovascular history before the event, highlighting cardiac catheterization, AMI, and surgical myocardial revascularization.

The study reinforces the need to establish new forms of management and assistance for patients experiencing STEMI, aiming to reduce the time until the artery is reopened, ensuring the survival of cardiac muscle, in addition to emphasizing the significant contribution that nurse improvement has, as a potential to reduce patient treatment time and consequently improve their prognosis.

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Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work - **Ampessan J, Carvalho ARS, Leite CN, Polezer CN.** Drafting the work or revising it critically for important intellectual content - **Ampessan J, Carvalho ARS, Martins LK.** Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved - **Ampessan J, Carvalho ARS.** All authors approved the final version of the text.

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