Original

Impacts of COVID-19 on patients who underwent percutaneous transluminal coronary angioplasty

Impactos da COVID-19 em pacientes submetidos à angioplastia coronariana transluminal percutânea
Impactos del COVID-19 en pacientes sometidos a angioplastia coronaria transluminal percutánea

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Abstract

Objective: To assess the impact of COVID-19 on patients diagnosed with acute coronary syndromes who underwent percutaneous transluminal coronary angioplasty. **Methods:** This is a cross-sectional study conducted in accordance with the STROBE guidelines in the city of Recife, Pernambuco, Brazil. Data were collected on sociodemographic characteristics, personal history, symptoms, complications, length of hospital stay and chest pain duration, anatomical and physiological aspects, pharmacological therapy, and occurrence of death, involving two groups of patients who underwent percutaneous transluminal coronary angioplasty. Group 1 consisted of 75 patients treated between March and June 2020, while Group 2 included 51 patients treated between May and August 2023. Variables were compared between groups using statistical tests with a 95% confidence level and a p-value < 0.05. **Results:** The study population showed a predominance of elderly male patients (54.6%), with hypertension (70.6%), and diabetes (41.3%). Statistically significant differences were found in smoking status (p=0.00), presence of dyspnea (p=0.00), nausea (p=0.00), perioperative complications (p=0.03), length of hospital stay (p=0.00), and the presence of single vessel versus multivessel coronary artery disease (p=0.001). **Conclusion:** The study revealed that, during the pandemic period, patients with acute coronary syndromes who underwent percutaneous transluminal coronary angioplasty were predominantly smokers, exhibited more severe arterial lesions, experienced a higher rate of complications, and had longer hospital stays compared to those treated after the pandemic ended.

Descriptors: COVID-19; Cardiovascular Diseases; Angioplasty.

Whats is already known on this?
The increased demand for healthcare services during the pandemic period hindered the diagnosis and treatment of patients with acute coronary syndromes.

What this study adds?
During the COVID-19 pandemic, patients with acute coronary syndromes who underwent percutaneous transluminal coronary angioplasty exhibited more severe arterial lesions, greater complications, and longer hospital stays.

Resumo

Objetivo: *Analisar o impacto da COVID-19 em pacientes com síndromes coronarianas agudas (SCA) submetidos à angioplastia coronariana transluminal percutânea (ATPC).* ***Métodos:*** *Estudo transversal conforme STROBE, realizado na cidade do Recife/PE, com dados sociodemográficos, antecedentes pessoais, sintomas, complicações, tempo de internamento e de dor torácica, aspectos anatomofisiológicos, terapia medicamentosa e óbito, com dois grupos submetidos à ATPC. O grupo 1 formou-se com 75 pacientes atendidos entre março e junho de 2020, e o grupo 2 com 51 pacientes atendidos entre maio e agosto de 2023. As variáveis foram comparadas entre os grupos por meio de testes estatísticos com nível de significância de 95% e p-valor < 0,05.* ***Resultados:*** *Houve maior frequência de idosos, do sexo masculino (54,6%), hipertensos (70,6%) e diabéticos (41,3%). Houve diferença significativa nas variáveis tabagismo (p=0,00), dispneia (p=0,00), náusea (p=0,00), complicações relacionadas ao período perioperatório (p=0,03), dias de hospitalização (p=0,00) e à presença de lesão arterial única ou multiarterial (p=0,001).* ***Conclusão:*** *Demonstrou-se que no período da pandemia os pacientes com SCA submetidos à ATPC eram em sua maioria tabagistas, com lesões arteriais mais graves, apresentaram mais complicações e mais dias de internação, quando comparados com aqueles atendidos após o fim da pandemia.*

Descritores: *COVID-19; Doenças Cardiovasculares; Angioplastia.*

Resumén

Objetivo: *Analizar el impacto del COVID-19 en pacientes con síndromes coronarios agudos (SCA) sometidos a angioplastia coronaria transluminal percutánea (ACTP).* ***Métodos:*** *estudio transversal según STROBE, realizado en la ciudad de Recife/PE, con datos sociodemográficos, antecedentes personales, síntomas, complicaciones, duración de la internación y dolor torácico, aspectos anatomofisiológicos, tratamiento farmacológico y fallecimiento, con dos grupos sometidos a ACTP. El grupo 1 se hallaba constituido por 75 pacientes tratados entre marzo y junio de 2020, y el grupo 2 por 51 pacientes tratados entre mayo y agosto de 2023. Las variables se compararon entre los grupos mediante pruebas estadísticas con un nivel de significación del 95% y un valor p < 0,05.* ***Resultados:*** *Hubo una mayor frecuencia de pacientes de edad avanzada, del sexo masculino (54,6%), hipertensos (70,6%) y diabéticos (41,3%). Hubo diferencia significativa en las variables tabaquismo (p=0,00), disnea (p=0,00), náuseas (p=0,00), complicaciones relacionadas con el periodo perioperatorio (p=0,03), días de hospitalización (p=0,00) y presencia de lesión única o multiarterial (p=0,001).* ***Conclusión:*** *Se demostró que, durante la pandemia, los pacientes con SCA sometidos a ACTP eran en su mayoría fumadores, presentaban lesiones arteriales más graves, más complicaciones y más días de hospitalización en comparación con los atendidos tras el final de la pandemia.*

Descriptores: *COVID-19; Enfermedades Cardiovasculares; Angioplastia.*

INTRODUCTION

Cardiovascular diseases (CVD) are among the most prevalent Chronic Non-Communicable Diseases (NCDs) in the country, representing the leading causes of morbidity and mortality within the Brazilian population. The prevalence of CVD is estimated at 6.1%, with Coronary Artery Disease (CAD) being the primary cause of death among CVDs. It is important to highlight that CAD is classified into stable angina and Acute Coronary Syndrome (ACS).[1-2]

Acute coronary syndrome (ACS) is triggered by any process that disrupts the balance between oxygen supply and demand in the cardiac muscle, most commonly due to the instability of an atheromatous plaque or the formation of a thrombus in the coronary arteries. Chest pain, characteristically retrosternal and constrictive, potentially radiating to the upper limbs, neck, and jaw is one of the main clinical manifestations. Additionally, symptoms such as dyspnea, syncope, excessive sweating, diaphoresis and abdominal pain are common. ACS is categorized into Unstable Angina (UA), Acute Myocardial Infarction (AMI) with ST-segment elevation or without ST-segment elevation.[3]

According to the Hospital Information System of the Brazilian Unified Health System (Portuguese Acronym: SIASUS), in 2023 there were 170,846 hospitalizations due to acute myocardial infarction (AMI), of which 13,992 resulted in death. Regarding other regions of the country, the Northeast recorded 33,284 cases, ranking third in the number of hospitalizations.[4]

As a cardiovascular emergency, timely medical attention must be sought, as the severity of the condition is directly related to the duration of ischemia. Studies suggest that delayed diagnosis of ACS during the COVID-19 pandemic may lead to long-term adverse outcomes, exacerbating morbidity and mortality rates.[5-6]

Cardiovascular complications in patients with COVID-19 result from direct viral injury, combined with the inflammatory and thrombotic responses triggered by the infection. Individuals presenting with both ACS and COVID-19 face a sixfold higher risk of mortality within 30 days.[7-8]

The COVID-19 pandemic had a significant impact across all areas of healthcare, including interventional cardiology, particularly among patients who underwent percutaneous transluminal coronary angioplasty (PTCA). The convergence of COVID-19 and cardiovascular disease, alongside the restructuring of healthcare systems, has presented numerous challenges as well as new perspectives. Studies have shown that COVID-19 impacted patients undergoing PTCA in multiple ways, both directly

(through the pathophysiological effects of the active infection), and indirectly (due to the restructuring of healthcare systems). In addition, there was a decline in the number of PTCA procedures, particularly elective ones, accompanied by longer intervals from symptom onset to first medical contact and increased door-to-balloon times.[9-11] Reluctance to seek hospital care, systemic healthcare overload, and the allocation of beds to critically ill COVID-19 patients collectively contributed to an incomplete understanding of the pandemic's impact on this patient population.

Given the increased demand for healthcare services during the pandemic, challenges in diagnosing and treating patients with acute coronary syndromes (ACS) became widespread. Therefore, this study aimed to analyze the impact of COVID-19 on patients with ACS who underwent percutaneous transluminal coronary angioplasty (PTCA).

METHODS

This is a cross-sectional, observational, retrospective study with comparison groups and a quantitative approach, conducted in accordance with the STROBE guidelines. The study used secondary data from the hemodynamics department and included patients initially admitted through the emergency department of a large tertiary hospital specializing in cardiology located in the city of Recife, Pernambuco, Brazil. The hospital has 425 beds and provides care to over 480 high-complexity cardiology patients per month. The data were retrospectively analyzed to allow for a comparison between patient groups during and after the COVID-19 pandemic.

A non-probabilistic convenience sample consisted of two groups of patients who underwent percutaneous transluminal coronary angioplasty (PTCA): Group 1 included patients treated between March and June 2020, comprising 75 individuals out of 113 initially assessed; Group 2 consisted of patients treated between May and August 2023, comprising 51 individuals out of 127 initially included. The time frame for Group 2 was defined based on the post-pandemic period, following the World Health Organization's official declaration of the end of the COVID-19 pandemic on May 5, 2023. Patients in both groups were classified not by the presence or absence of a COVID-19 diagnosis, but by the need for PTCA during or after the COVID-19 pandemic period.

The following inclusion criteria were used to select participants: age over 18 years, non–ST-segment elevation myocardial infarction (NSTEMI), ST-segment elevation myocardial infarction (STEMI), new-onset bundle branch block (right or left), and the presence of severe coronary artery stenosis requiring emergency PTCA. Exclusion criteria included prior surgical or percutaneous revascularization, prior fibrinolytic therapy, cardiopulmonary resuscitation, severe liver disease, blood dyscrasias, metastasis, and terminal illness.

Initially, patients who underwent the procedure were identified through the hemodynamics laboratory admission logbook. Thereafter, data were systematically extracted from electronic medical records. Using a structured data collection instrument, the following information was obtained: sociodemographic data (age, gender, place of origin); personal history (systemic arterial hypertension, diabetes mellitus, smoking status, dyslipidemia, and cerebral vascular accident); initial symptoms (chest pain, syncope, nausea, excessive sweating, and dyspnea); PTCA-related data (single-vessel lesion, multivessel lesion, use of tirofiban, and duration of pain); post-PTCA complications (in-stent thrombosis, unstable angina, complete atrioventricular block, ventricular fibrillation, and cardiopulmonary arrest); length of hospital stay (in days); and occurrence of death.

Subsequently, data were compiled into a spreadsheet using Microsoft Excel®, and statistical analyses were conducted by an independent statistician. Both descriptive and inferential statistical analyses were performed using GraphPad Prism (version 6) and SPSS 20.0 software. The Kolmogorov-Smirnov test was applied to assess data normality. Continuous variables were reported as means or medians, based on the coefficient of variation, whereas categorical variables were expressed as percentages. Comparisons between the two groups were performed using Fisher's exact test, Chi-square test, Mann-Whitney U test, or Student's t-test, depending on the type and normality of the data. A p-value threshold of < 0.05 was adopted for all statistical tests, corresponding to a 95% confidence interval.

Considering the retrospective approach and the temporal separation between the periods compared (March-June 2020 and May-August 2023), rigorous methods were applied to reduce biases characteristic of this study design. Clearly defined and standardized eligibility criteria were applied to both groups, ensuring that clinical characteristics relevant to PTCA indication were comparable. Time frames

were established based on key milestones, such as the pandemic peak and the World Health Organization's declaration marking the end of the pandemic in order to capture distinct contextual periods.

Although the hospital is a large tertiary care center, the initial pandemic period (March-June 2020) may have been marked by limited bed availability or heightened pressure on emergency services, potentially influencing the patient profile and timeliness of care delivery. Nonetheless, comparing this with a more normalized post-pandemic timeframe (May-August 2023) allows for a clearer contrast between these scenarios.

To ensure data quality and comparability over time, data were collected using a standardized, purpose-designed instrument, with consistent methodology applied to both groups. This encompassed objective and clinically well-defined variables such as sociodemographic data, personal history, PTCA specifics, complications, length of hospital stay, and occurrence of death, which are customarily documented with consistency.

The study adhered to the ethical guidelines established by Resolution No. 466/2012 of the National Health Council, which governs research involving human subjects, and was approved under protocol No. 5.512.337.

RESULTS

Sociodemographic characteristics highlight a predominance of elderly male individuals in both groups, with mean ages of 66.39±12.45 years in Group 1 and 60.44±13.29 years in Group 2, primarily from the metropolitan area of Recife, Pernambuco. Regarding personal history, systemic arterial hypertension was the most frequent comorbidity in both groups (70.6% in Group 1 and 82.3% in Group 2), followed by diabetes mellitus (41.3% in both groups). Significant differences between groups were observed for smoking status and age, as shown in Table 1.

Table 1. Sociodemographic profile and personal history of individuals with ACS who underwent PTCA Recife, PE, Brazil, 2020-2023.

Variables	Group 1 N=75 (%)	Group 2 N=51 (%)	p-value
Age	66.39±12.45¥	60.44±13.29¥	**0.01**
Gender			
Male	41 (54.6)	30 (58.8)	0.71
Female	34 (35.4)	21 (41.2)	
Place of origin			
Metropolitan region of Recife	41 (54.6)	31 (60.8)	0.58
Interior region of Pernambuco	34 (35.4)	20 (39.2)	
Personal History			
Systemic Arterial Hypertension	53 (70.6)	42 (82.3)	0.14
Smoking Status	47 62.6)	15 (29.4)	**0.00**
Diabetes Mellitus	31 (41.3)	22 (43.1)	0.85
Cerebrovascular Accident	5 (6.6)	2 (3.9)	0.69
Dyslipidemia	4 (5.3)	6 (11.7)	0.31

Caption: Group 1: Percentage corresponding to March-June 2020 (n:75); Group 2: Percentage corresponding to May-August 2023 (n:51); N: Absolute number; %: Frequency; ¥Mean±standard deviation. Student's t-test, Chi-square test, and Fisher's exact test were used.
Source: Research data, 2024.

Table 2 presents the distribution of clinical characteristics at the time of admission. Regarding precordial pain, Group 1 showed a higher prevalence (90.6%) compared to Group 2 (86.3%). Significant differences were observed between groups for the presence of dyspnea, nausea, post-PTCA complications (including in-stent thrombosis, unstable angina, complete atrioventricular block, ventricular fibrillation, and cardiopulmonary arrest), and length of hospital stay. Regarding length of hospitalization, Group 1 exhibited a significantly longer median stay of 14 days (5-24) compared to 6.5 days (5-9.7) in Group 2.

Table 2. Main symptoms observed during the initial hours of ACS evaluation, post-PTCA complications, length of hospital stay, and occurrence of death Recife, PE, Brazil, 2020-2023.

Variables	Group 1 N=75 (%)	Group 2 N=51 (%)	p-value
Symptoms			
Precordial pain	68 (90.6)	44 (86.3)	0.57
Dyspnea	37 (49.3)	12 (23.5)	**0.00**
Excessive sweating	23 (30.6)	12 (23.5)	0.42
Nausea	16 (21.3)	8 (15.7)	**0.00**
Syncope	9 (12)	0 (0)	-
Post-PTCA complications	15 (20)	3 (5.9)	**0.03**
Length of hospital stay (in days)	14 (5-24)*	6.5 (5-9.7)*	**0.00**
Occurrence of death	7 (9.3)	3 (5.9)	0.73

Caption: Group 1: Percentage corresponding to March-June 2020 (n:75); Group 2: Percentage corresponding to May-August 2023 (n:51); N: Absolute number; %: Frequency; *median (P25-P75). Mann-Whitney test, Chi-square test, and Fisher's exact test were used.
Source: Research data, 2024

Regarding the assessment of anatomical and physiological conditions, a significant difference was observed between the groups in terms of the presence of arterial lesions, whether single-vessel or multivessel (p=0.01). As for medications used to prevent ischemic cardiac events, tirofiban was the most frequently prescribed agent (8%). With respect to the time from pain onset to first medical contact, Group 1 had a median duration of 11 hours (2-25.5), whereas Group 2 presented a longer median of approximately 24 hours (7-48); nonetheless, this difference was not statistically significant (p=0.32) (Table 3).

Table 3. Anatomical and physiological aspects, pharmacological therapy, and chest pain duration. Recife, PE, Brazil, 2020-2023.

Variables	Group 1 N=75 (%)	Group 2 N=51 (%)	p-value
Single-vessel lesion	44 (58.7)	41 (80.4)	**0.01**
Use of Tirofiban	6 (8)	0 (0)	-
Time from pain onset to first medical contact	11 (2-25.5)*	24 (7-48)*	0.32

Caption: Group 1: Percentage corresponding to March-June 2020 (n:75); Group 2: Percentage corresponding to May-August 2023 (n:51); N: Absolute number; %: Frequency; *median (P25-P75). Mann-Whitney test, Chi-square test, and Fisher's exact test were used.
Source: Research data, 2024.

DISCUSSION

This study revealed that, during the initial period of the COVID-19 pandemic, patients with acute coronary syndrome (ACS) who underwent percutaneous transluminal coronary angioplasty (PTCA) were predominantly smokers, exhibited more severe arterial lesions, and experienced a higher incidence of complications and longer hospital stays compared to patients with similar profiles treated after the pandemic ended. Notably, patients in Group 1 were not diagnosed with COVID-19. Consequently, the increased severity observed in this group is likely due to the considerable strain on healthcare services, which may have led to delays in diagnosing and effectively managing ACS cases requiring PTCA.

Regarding sociodemographic characteristics, there was a higher frequency of elderly male participants who were residents of the metropolitan region where the hospital is located. These findings align with those of a study that reported a predominance of male participants (77%) and a predominant age range of 50 to 60 years (43%).[12]

These results may reflect a combination of non-modifiable risk factors and behavioral patterns commonly observed among men, including excessive work hours, poor dietary habits, physical inactivity, harmful alcohol consumption, hypertension, diabetes mellitus, and dyslipidemia. The lower prevalence among women may be partially explained by the protective role of estradiol, which contributes to vasodilation of vascular smooth muscle and modulates lipoprotein levels, ultimately leading to a reduced risk of cardiovascular events. Additionally, women tend to seek healthcare services more frequently and are generally more aware of the importance of disease prevention and health promotion.[13-15]

Regarding comorbidities, the findings align with previous research identifying hypertension, dyslipidemia, diabetes mellitus, and smoking as key risk factors associated with ACS. A retrospective

study involving 264 patients diagnosed with ST-segment elevation myocardial infarction (STEMI) at a hospital in Juiz de Fora, Minas Gerais, reported a smoking prevalence of 39.3%, which was higher than that observed in the general population.[16-17]

As for the clinical conditions caused by smoking, cardiovascular diseases account for approximately 25% of all preventable deaths among smokers. Smoking cessation plays a crucial role in preventing recurrent ischemic cardiovascular events and has demonstrated greater effectiveness than other secondary prevention strategies, including pharmacological therapies.[18]

The hemodynamic repercussions of myocardial infarction (MI) can be exacerbated by the presence of diabetes mellitus. In addition to increasing the risk of infarction by up to four times, autonomic neuropathy may lead to nonspecific symptoms or even mask the clinical presentation of the infarction.[19-20]

Considering the pathophysiology of COVID-19, cardiovascular manifestations of the disease also include chest pain, electrocardiogram (ECG) alterations, and signs of myocardial ischemia, which would explain the increased mechanical complications observed in ST-segment elevation myocardial infarction (STEMI). The prolonged delay between the onset of chest pain and first medical contact has been associated with patients' fear of leaving home due to the perceived risk of COVID-19 infection. Additionally, this delay is attributed to inefficiencies within healthcare systems, insufficiently trained professionals, and the frequent subtlety or absence of clinical symptoms.[21-22]

Typical chest pain was reported in 90.6% of patients in the COVID-19 group and 86.3% in the non-COVID-19 group. Chest pain may be accompanied by nonspecific symptoms such as dyspnea, which is frequently mistaken for other conditions. A review study found that chest pain was the predominant symptom of myocardial infarction (MI) (59.5%), whereas dyspnea was observed in 67.6% of patients in the COVID-19 group. However, dyspnea can occur in both MI and COVID-19. Given this overlap, the authors emphasized the importance of complementary diagnostic tests, including imaging scans and echocardiography to support an accurate diagnosis. Furthermore, although chest pain is a common complaint in MI, it can easily go unnoticed in sedated patients. Therefore, the inclusion of electrocardiograms (ECG) and the assessment of myocardial necrosis markers is of paramount importance for this patient group.[23-24]

An international multicenter registry revealed that in-hospital mortality due to myocardial infarction (MI) was significantly higher among the COVID-19 groups (25%) compared to non–COVID-19 groups (3.8%). In general, COVID-19–positive patients exhibited atypical symptoms of myocardial infarction, most notably those resembling respiratory infections, which may contribute to delays in both diagnosis and treatment.[25]

A prospective study conducted in Turkey compared data from a cohort during the pandemic with pre–COVID-19 cohorts and found that each 10-minute delay in total ischemic time was associated with a 10% increase in mortality risk. In addition, the study also reported that the length of hospital stay was longer in the COVID-19 group (6.9 days) compared to the non–COVID-19 group (5 days).[26]

Another observational study conducted in Turkey emphasized that COVID-19–positive patients had a longer total ischemic time (390 minutes) compared to those who tested negative (270 minutes). Consequently, regarding in-hospital outcomes, they showed higher rates of stent thrombosis (7.1% vs. 1.7%, p=0.002), longer hospital stays (4 days vs. 3 days, p=0.018), increased incidence of cardiogenic shock (14.2% vs. 5.5%, p=0.023), and higher overall and cardiac in-hospital mortality (p<0.001 and p=0.032, respectively). However, in terms of coronary angiography data, the rate of PCI (percutaneous coronary intervention) in multivessel lesions was similar between the two groups, contrasting with the findings of the present investigation, in which a higher prevalence of multivessel disease was identified during the pandemic period. It is important to note that no COVID-19–positive patients were included in the present study.[27]

A review of patient admissions at a cardiology referral center revealed a 45% decrease in cardiovascular-related emergency department visits during the pandemic. According to the Brazilian Society of Cardiology, primary coronary reperfusion should be performed within a timely window (<2h), as this is associated with reduced mortality. However, the results of this study show that the average time to PTCA ranged from a minimum of 11 hours to a maximum of 24 hours, leading to significant in-hospital outcomes. Even when symptom onset and PTCA occur between 12 and 48 hours, percutaneous intervention remains beneficial in up to 13% of cases compared to conservative treatment, which may help explain the delayed approach to care.[28-29]

Based on the findings of a study conducted in Indonesia, it is evident that the COVID-19 pandemic had a significant impact on the management of patients with acute coronary syndrome (ACS), especially those with ST-segment elevation myocardial infarction (STEMI). The proportion of STEMI patients who experienced delays from symptom onset to first medical contact increased significantly (47.7% vs. 32.0%, OR=1.84, 95% CI 1.18, 2.85). Therefore, these findings indicate that the COVID-19 pandemic significantly disrupted treatment timelines for ACS patients by increasing delays in seeking medical attention, prolonging ischemic time, and potentially raising mortality rates. This highlights the critical need for healthcare systems to be properly equipped in order to deliver timely care, even in the face of global crises.[30]

The study has certain limitations, including a reduced sample size caused by missing information in the electronic medical records, which led to the exclusion of some participants. Conducted at a cardiology referral hospital in the Metropolitan Region of Recife, Pernambuco, this study analyzed patient data from two distinct time periods. However, its retrospective design, single-center nature, and narrowly defined inclusion and exclusion criteria limit the generalizability of its findings. While the results may reflect the profile of similar patients in other high-complexity settings with comparable resources, their application to different regions should be approached with caution due to structural, epidemiological, and healthcare delivery differences.

This article offers valuable insights into the sociodemographic and clinical profiles of patients with acute coronary syndrome (ACS) during the COVID-19 pandemic. It also describes the symptoms presented in the early hours of the acute event, complications following medical care, length of hospital stay, and specific features related to coronary artery lesions. These findings offer a clearer understanding of the patient profile during the pandemic and facilitate comparisons with the post-pandemic context, thereby informing improvements in care delivery strategies, health education, and rehabilitation for these conditions.

CONCLUSION

The findings of this study highlighted the impact of COVID-19 on patients treated at a public hospital. Amid the pandemic, there was a notable prevalence of smokers among patients with acute coronary syndrome (ACS), along with a patient profile marked by more severe cases, including multivessel lesions, extended hospital stays, and increased cardiovascular complications.

Based on these findings, it is recommended to enhance clinical practice by prioritizing early intervention aimed at minimizing the time between symptom onset and initial contact with healthcare services. Additionally, implementing more proactive monitoring and management strategies for common comorbidities such as hypertension and diabetes may contribute to reducing both the length of hospital stay and the incidence of post-PTCA complications.

To validate these findings and expand their applicability, conducting multicenter prospective studies is recommended to more thoroughly assess the factors associated with clinical stages and to develop specific protocols that optimize the management of patients with acute coronary syndrome across varied healthcare settings.

CONTRIBUITIONS

Study conception or design: Silva EJS, Silveira MMBM. Data collection: Silva EJS, Galvão PCC. Data analysis and interpretation: Sousa MM, Cabral JVB, Figueiredo TR, Silveira MMBM. Article drafting or critical review: Vasconcelos WTF, Sousa MM, Cabral JVB. Final approval of the version to be published: Figueiredo TR, Silveira MMBM.

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