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Incidence of acute coronary syndromes during the pandemic period of COVID-19 in a cardiology reference service in the city of Curitiba

Incidência de síndromes coronarianas agudas no período da pandemia da COVID-19 em serviço de referência em atendimento de cardiologia na cidade de Curitiba

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ABSTRACT – **Background:** Cardiovascular diseases are an important cause of death worldwide, and ischemic heart diseases account for a considerable number of these deaths. COVID-19, a disease caused by SARS-CoV-2, may pose important cardiovascular complications and implications, including acute coronary syndromes. This study aimed to compare prevalence data of acute coronary syndromes during the COVID-19 pandemic period (2020) to the previous year (2019). **Methods:** This is a retrospective, descriptive, analytical, and cross-sectional study, with variables acquired through the analysis of the medical records of all adult patients of both sexes admitted for acute myocardial infarction, unstable angina, and ischemic heart disease between the months of January to December 2019, and January to December 2020, to a cardiology reference hospital in Curitiba (PR). The variables obtained were about diagnosis of these diseases, clinical consultation, laboratory tests, and imaging tests. The data found were then correlated with each other to define possible causal relations. **Results**: There was a 40.38% reduction in the incidence of hospitalizations for the cited diagnoses in 2020 compared to 2019. There was no difference between days of onset of symptom between the compared years, days of hospitalization, or number of comorbidities presented by patients, although there was a higher number of diagnoses of unstable angina and presence of chest pain in individuals seen in 2020. **Conclusion:** The COVID-19 pandemic affected the lives of all people, including the search for care in health facilities and hospitals worldwide, resulting in a lower demand for health services, including for severe and acute diseases, which can lead to increased morbidity and mortality in the population.

Keywords: Acute coronary syndrome; COVID-19; Coronavirus infections

RESUMO – **Introdução:** As doenças cardiovasculares compõem importante causa de óbito pelo mundo, sendo as doenças isquêmicas do coração responsáveis por um número considerável dessas mortes. A COVID-19, doença causada pelo SARS-CoV-2, pode causar importantes complicações e implicações cardiovasculares, dentre elas as síndromes coronarianas agudas. Este estudo teve como objetivo relacionar dados de prevalência de síndromes coronarianas agudas durante o período de pandemia pela COVID-19 (2020) com os dados do ano anterior (2019). **Métodos:** Trata-se de estudo retrospectivo, descritivo, analítico e transversal, com obtenção de variáveis por meio da análise dos prontuários de todos os pacientes adultos, de ambos os sexos, internados por infarto agudo do miocárdio, angina instável e doença isquêmica do coração entre os meses de janeiro a dezembro de 2019 e de janeiro a dezembro de 2020, em um hospital de referência para cardiologia em Curitiba (PR). As variáveis obtidas foram sobre diagnóstico dessas doenças, consulta clínica, exames laboratoriais e exames de imagem. Os dados encontrados foram correlacionados entre si para definirmos possíveis relações de causalidade. **Resultados**: Houve redução de 40,38% na incidência de internamentos pelos diagnósticos citados em 2020 em comparação a 2019. Não houve diferença entre dias de início de sintomas entre os anos comparados, dias de internamento ou número de comorbidades apresentadas pelos pacientes, apesar de haver maior número de diagnósticos de angina instável e de presença

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de dor torácica nos indivíduos atendidos em 2020. **Conclusão:** A pandemia da COVID-19 impactou a vida de todas as pessoas, inclusive na busca por atendimento em unidades de saúde e hospitais em todo o mundo, resultando em menor procura aos serviços de saúde, inclusive para doenças graves e agudas, que podem levar ao aumento da morbimortalidade populacional.

Descritores: Síndrome coronariana aguda; COVID-19; Infecções por coronavírus

INTRODUCTION

Cardiovascular diseases are the leading cause of mortality worldwide.[1] Among them, ischemic heart diseases are the most common cause of death, with acute myocardial infarction (MI) as the most frequent single cause of death among men and women.[2]

In Brazil, of the total acute coronary syndromes (ACS), 35% correspond to ST-segment elevation MI (STEMI), with a mortality rate of 8.1% in the country. In relation to non-ST-segment elevation MI (NSTEMI), the incidence is 20% of ACS in Brazil, with a mortality rate of 6.8%.[3]

Discovered in 2019 in China, the novel coronavirus, an RNA virus from the same family of severe acute respiratory syndrome coronavirus (SARS-CoV) and of Middle East respiratory syndrome coronavirus (MERS-CoV), in addition to causing severe acute respiratory syndrome, has been listed as a potential cause of significant cardiovascular complications and implications.[4-6] Following this, the World Health Organization (WHO) named the condition as coronavirus disease 2019 (COVID-19) and declared it a pandemic with a high potential for infection and transmission.[6]

Since SARS-CoV-2 infection occurs by binding the virus to the main portion of the angiotensin-converting enzyme 2 (ACE2), which is widely expressed in the cardiovascular system, it is possible to cause acute myocardial injury, leading to myocarditis, besides the possibility, by some mechanisms of local and systemic inflammatory activities, to present itself as arterial or venous thrombosis and promote ACS.[7,8]

This study aimed to compare prevalence data of acute coronary syndromes during the COVID-19 pandemic period to the previous year.

METHODS

A retrospective, analytical, cross-sectional study presenting data on hospitalization of patients due to ACS during the period from January to December 2019, and the same period, in 2020.

Data were collected through analysis of medical records of these patients, who were seen at a cardiology reference hospital in the city of Curitiba (PR). All patients hospitalized for MI, angina pectoris, and ischemic heart disease during the study period were included. We excluded patients younger than 18 years, with symptom onset time greater than 30 days, with no relevant information in medical records, or admitted for other cardiologic diseases.

The variables collected comprised information on diagnosis, risk factors for coronary artery disease (CAD), and electrocardiography and transthoracic echocardiography, in addition to the arteries compromised on cardiac catheterization (when available).

The Informed Consent Form (ICF) was waived because, during the study, it was not necessary to approach the selected patients personally and individually, since the data were collected only by analyzing the medical records. The waiver of the ICF was approved by the local Research Ethics Committee, under protocol 4,440,591.

For the quantitative response variables, the normality distribution was checked using the Shapiro-Wilk test; when the distribution was normal, the results were expressed using mean (± standard deviation); when it was not normal, median (minimum - maximum) was used. For the qualitative variables, the values for each group were expressed by the absolute number (percentage of the total).

To verify the statistical significance of these findings, different tests were applied, depending on the nature of the variable. To identify the statistical difference between a quantitative and a qualitative variable, the parametric analysis of variance (Anova) test was applied when the distribution was normal and the non-parametric Mann-Whitney test when it was not. The Chi-squared test was used to verify the association between two qualitative variables. For all the analysis, p-values <0.05 were considered sufficient to reject the null hypothesis and consider the result statistically significant.

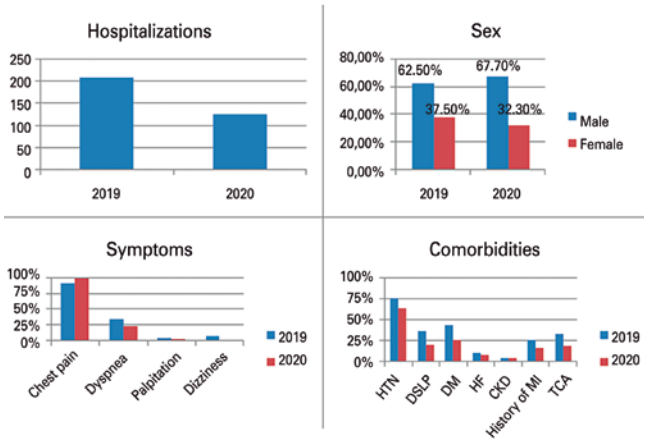
For statistical analyses, preparing graphs and tables, we used the statistical software JAMOVI version 1.6.7, which is based on the R language.

The sample comprises the total number of inpatients in the selected period, with the diagnoses of interest. To evaluate the power of the test that this sample number represents, we performed a posteriori sample calculation - capable of informing the power value of the test - using the GPower tool, version 3.1. To this end, the confidence level was set at 95%, the margin of error at 5%, and eventual effect sizes for each test.

RESULTS

From the analysis of the collected data, a reduction in the number of hospitalizations in the year 2020 was found when compared to the year 2019, with 124 *versus* 208 hospitalizations, representing a 40.38% decrease in the number of hospital admissions (Figure 1).

The clinical profile of patients, such as age, sex, length of hospital stay, and time from symptom onset to hospitalization, showed no statistically significant differences between the 2-year periods (Table 1).



Hospitalizations: number of patients admitted in 2 years. Sex: proportional distribution of inpatients by sex. Symptoms: percentage ratio of symptoms of clinical presentation in 2 years. Comorbidities: percentage ratio of comorbidities among inpatients in 2 years.
HTN: hypertension; DLSP: dyslipidemia; DM: diabetes mellitus; HF: heart failure; CKD: chronic kidney disease; MI: myocardial infarction; TCA: transluminal coronary angioplasty.
Figure 1. Distribution graphs of patients admitted due to acute coronary syndromes in 2019 and 2020.

As for the symptoms at onset of the disease in these patients, an increase in chest pain was identified in patients admitted in 2020, compared to the previous year. Dyspnea and dizziness, as symptoms at onset, showed a decrease in the comparison between the periods.

In 2020, there was an increased number of patients with unstable angina as shown by diagnosis in medical records when compared to 2019, even with an absolute reduction in the number of patients hospitalized by ACS.

Except for the decrease in the number of ischemia reports in 2020, when electrocardiography (ECG), echocardiography, and catheterization were evaluated, there were no differences in alterations in these tests among the patients during the 2-year periods studied.

No relations were identified between test changes (altered contractility or reduced ejection fraction on echocardiography or ischemia on ECG) and days of hospitalization (more or fewer days). The same occurred for changes in tests and time from symptom onset to hospitalization.

No relation was observed between the number of comorbidities and days of hospitalization, as well as between number of comorbidities and time to onset of symptoms.

Table 1. Characteristics comparing patients in 2019 and 2020

Characteristics	Total population	2019	2020	p-value
Total	332 (100)	208 (62.7)	124 (37.3)	
Age	64.1±12.2	64.3±11.7	63.7±13.1	0.685*
Male sex	214 (64.5)	130 (62.5)	84 (67.7)	0.334†
Length of stay (days)	4 (1-38)	3 (1-38)	4 (1-13)	0.916‡
Symptoms				
Chest pain	315 (94.9)	191 (91.8)	124(100)	0.001†
Dyspnea	100 (30.1)	71 (34.1)	29 (23.4)	0.039†
Palpitation	11 (3.3)	8 (3.8)	3 (2.4)	0.482†
Dizziness	18 (5.4)	16 (7.7)	2 (1.6)	0.018†
STEMI	94 (58.4)	57 (64.8)	37 (50.7)	0.071†
NSTEMI	132 (79.5)	89 (93.7)	43 (60.6)	<.001†
Unstable angina	33 (10.0)	1 (0.5)	32 (25.8)	<.001†
Onset of symptoms	0.5 (0.002-21)	0.6 (0.02-20)	0.5 (0.02-21)	0.714‡
Comorbidities				
HTN	236 (71.1)	157 (75.5)	79 (63.7)	0.022†
Dyslipidemia	101 (30.4)	76 (36.5)	25 (20.2)	0.002†
DM	123 (37.0)	90 (43.3)	33 (26.6)	<.001†
Heart failure	32 (9.6)	22 (10.6)	10 (8.1)	0.453†
Chronic kidney disease	15 (4.5)	9 (4.3)	6 (4.8)	0.828†
History of MI	74 (22.3)	54 (26)	20 (16.1)	0.037†
History of TCA	92 (27.7)	68 (32.7)	24 (19.4)	0.009†
Eco EF (+)				
Intermediate	45(20.5)	31 (21.7)	14 (18.4)	
Preserved	141 (64.4)	89 (62.2)	52 (68.4)	
Reduced	33 (15.1)	23 (16.1)	10 (13.2)	0.659†
High contractility	144 (64.3)	91 (63.6)	53 (65.4)	0.788†
ECG (+)				
Ischemia	176 (58.1)	125 (63.8)	51 (47.7)	0.007†
ST segment elevation	101 (32.0)	63 (32.3)	38 (31.4)	0.867†
Non-ST segment elevation	82 (26.1)	43 (22.2)	39 (32.5)	0.043†
CATH (+)				
RCA	123 (37.0)	81 (38.9)	42 (33.9)	0.355†
LAD	160 (48.2)	106 (51.0)	54 (43.5)	0.191†
LCx	84 (25.3)	61 (29.3)	23 (18.5)	0.029†
LCA	37 (11.1)	17 (8.2)	20 (16.1)	0.026†
Number of vessels	2 (1-4)	2 (1-4)	1 (1-4)	0.133‡

Results expressed as n (%), mean±standard deviation, or median (minimum-maximum).

*Analysis of variance; ‡ Mann-Whitney; † Chi-squared.

STEMI: ST-segment elevation myocardial infarction; NSTEMI: non-ST-segment elevation myocardial infarction; HTN: hypertension; DM: diabetes mellitus; MI: myocardial infarction; TCA: transluminal coronary angioplasty; EF: ejection fraction; ECG: electrocardiogram; CATH: catheterization; RCA: right coronary artery; LAD: left anterior descending artery; LCx: left circumflex artery; LCA: left coronary artery.

DISCUSSION

The mechanism of viral invasion in COVID-19 is explained by the binding of the virus to ACE2, which has functions in several organs, such as heart, lungs, kidneys, and others. Since most of its production occurs in type-2 pneumocytes, the respiratory symptoms are explained in part, along with the cardiotoxicity caused by the virus, since more than 7.5% of the cardiac cells express the enzyme. Another factor, which seems to collaborate with the process of myocardial injury, is the tumor necrosis factor alpha

(TNF-α).[5,6,9] The European Society of Cardiology (ESC) has identified patients with cardiovascular risk factors, such as male sex, advanced age, diabetes, hypertension, obesity, established cardiovascular or cerebrovascular disease, as particularly vulnerable populations at increased risk of morbidity and mortality when admitted with COVID-19.[7]

The main cardiovascular manifestations caused by the virus include cardiac arrhythmia, elevation of cardiac biomarkers of ischemic and non-ischemic etiology, arterial or venous thromboembolism, cardiogenic shock, myocarditis and *cor pulmonale*.[4,5] The symptoms evident in COVID-19 include chest tightness, hypotension, tachycardia, angina pectoris, and other manifestations, such as ventricular tachycardia and ventricular fibrillation, worsening the patient's condition as well as their prognosis.[8,10]

As to the study data, for the ICD I20, I21, and I25, with time of onset less than 30 days, there was a decrease by 40.38% in admissions at the hospital studied. On the other hand, in Paraná, there was an increase of approximately 19% in out-of-hospital deaths from cardiac causes in 2020, with 4,030 deaths, compared to 3,395, in 2019.[11] Alves et al. showed that in the state of Minas Gerais, during the period from January 1 to June 6, 2019 and 2020, there was a 15.56% increase in the number of MI deaths at home during the pandemic year. Given this scenario, the possible causes were listed as changes in the health system, such as the interruption of non-essential and elective care, the policies of social isolation associated with the fear of contamination by the virus, and the isolation for milder cases of COVID-19, allowing the worsening of the coronary condition and favoring a more guarded prognosis.[12]

Several studies conducted during the COVID-19 pandemic also had very similar results, such as the work conducted by Lantelme et al., which showed a 10% reduction in the incidence of MI in early 2020 when compared to the same period in 2019. Nevertheless, this percentage reached about 31% in the lockdown periods in France, where the data was collected.[13] In Brazil, analysis of the registry of patients included in a common chest pain protocol from 16 hospitals, in six different states, over the period from May 2019 to May 2020 showed a drop in demand for care of more than 40%.[14]

In Italy, a study of 54 hospitals recorded a 48.4% reduction in MI cases during one week in 2020, as compared to the same week in 2019. On the other hand, the case fatality for STEMI events increased significantly, from 4.1% in 2019 to 13.7% in 2020. Another interesting finding is that in 2020, in patients positive for SARS-CoV-2, case fatality was higher when compared to patients negative for the virus. This study also identified the time from symptoms to coronary angiography increased by 39.2% compared to the same period in 2019, due to patient and system-related delays. Consequently, the time to coronary revascularization had an increase of 31.5%. As for NSTEMI cases, the rate of hospitalizations fell by 65.4% from 2019 to 2020. The case fatality increased during the pandemic, from 1.7% in 2019 to 3.3% in 2020.[15]

The fear of contamination by the virus turned out to be one of the hypotheses for the reduction in number of admissions of patients with ACS. Thus, Gorini et al., tried to quantify this fear in patients regarding the coronavirus. About 25% of Chinese students had anxiety about the virus, and 35% of the Chinese population suffered from psychological stress in face of the virus, which may lead patients to underestimate the symptoms of MI.[16] Another factor attributed to the drop in the incidence of these patients would be the lifestyle caused by social isolation, which contributed to physical inactivity, less exposure to pollution, and less exposure to factors that generate myocardial stress.[13,15-17]

In view of these results, several countries around the world have begun to adopt policies to encourage citizens to seek medical attention when there are symptoms suggestive of ACS. In Sweden, a national campaign coordinated by the Swedish Society of Medicine (SSM), the Swedish Society of Cardiology, the Swedish Heart and Lung Foundation and by SWEDEHEART, launched in all the primary newspapers, TV channels, on the WEB, and on social media, sought to increase awareness of MI and its symptoms and to encourage patients to seek medical care. With this measure, one month after its beginning, the flow of patients was reestablished to that of before the pandemic.[18]

Also at the international level, in June 2020, the European Atherosclerosis Society (EAS), World Heart Federation (WHF), World Stroke Organization (WSO), and the European Society of Cardiology (ESC) joined together to share the important message: ignoring cardiac symptoms or delaying treatment brings risk of severe life-threatening complications and life-threatening consequences.[19]

In Brazil, similar measures were implemented to improve the care of patients with ACS symptoms, such as the LATIN program, which connected 13 tertiary care hospitals to 86 emergency care units (UPA, acronym in Portuguese). In this program, patients were attended to early via telemedicine, through routes that led them directly to the cath lab. Another example was the Alert Heart campaign, sponsored by the Brazilian Society of Hemodynamics and Interventional Cardiology (SBHCI).[20]

The Regional Council of Medicine of Paraná (CRM-PR) launched, in June 2020, in partnership with the state's specialty societies, the campaign Only Leave Home for Your Health, with the aim of raising awareness among physicians and the population about the importance of continuing treatment and monitoring of chronic diseases, as well as of seeking care in case of emergency. Government, social, and community actions, and spaces for this purpose in the lay media and medical literature, can save lives as never before.[20,21]

CONCLUSION

There was a significant reduction in the number of hospitalizations for acute coronary syndrome in a cardiology reference hospital in Curitiba during the COVID-19 (2020) pandemic period compared to the year before the pandemic (2019). The decreased demand for care in 2020 may have been driven by public policies, which, aiming to warn about the reduction of transmission of COVID-19, ended up discouraging the population to seek care for important acute diseases, such as acute coronary syndromes.

Regarding the possibility of assessing the severity of the case regarding the presence of comorbidities and changes in tests, there was no statistically significant relation between these data and time from onset of symptoms to hospitalization and length of stay. It is believed that these data were also impacted by the lower number of consultations and of acute coronary syndrome recorded in the hospital in 2020.

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None.

CONFLICTS OF INTEREST

The authors declare there are no conflicts of interest.

CONTRIBUTION OF AUTHORS

Conception and design of the study: LB and VBS; data collection: LRW and LCFA; data interpretation: EFC and JDSFF; text writing: EFC, JDSFF, LRW, LB, LCFA and VBS; approval of the final version to be published: FRF, MR and VBS.

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