THE IMPACT OF THE COVID-19 PANDEMIC ON HOSPITALIZATIONS AND ADMISSION PROFILE OF PATIENTS WITH HEART FAILURE DECOMPENSATION AT THE ALBERT EINSTEIN ISRAELITA HOSPITAL

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Abstract: Introduction: The coronavirus disease 2019 (COVID-19) pandemic was officially declared by the WHO on March 11, 2020, and the first Brazilian case was registered on February 26, 2020. Since then, health systems have been adapted to receive the emerging flow of patients requiring hospitalization due to moderate to severe manifestations of COVID-19 infection. In this scenario, patients with chronic comorbidities were advised to stay at home, as a way to minimize the chances of infection. Thus, the current context determined that patients who presented decompensated Heart Failure (HF) had their medical-hospital care altered, a fact already evidenced by an English study from June 2020, which observed a reduction in the number of hospitalizations during the pandemic due to exacerbation of HF and a worse clinical profile at the time of hospital admission2. In this sense, a reduction in the number of hospitalizations due to HF decompensation was observed at Hospital Israelita Albert Einstein (HIAE) from March to August 2020. In this study, we will evaluate the impact of the COVID-19 pandemic on hospitalizations due to HF decompensation at HIAE, through data on the clinical profile at the time of admission and the evolution of these patients during hospitalization, comparing them with the period before the pandemic by the new coronavirus. Objective: The objectives of the present study aim to quantify the reduction in hospitalizations, evaluate the clinical profile at the time of admission and evaluate the morbidity and mortality of these patients, comparing the current pandemic data with previous data. We do not aim to analyze the relationship between COVID-19 infection and cardiovascular disease. Methods: Retrospective observational cohort study, carried out in a database of patients who were admitted to HIAE with

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decompensated Heart Failure, between the periods of October 2019 and August 2020. Inclusion criteria were patients with reduced left ventricular ejection fraction (LVEF ≤ 45%) and age ≥ 18 years. Patients were not tested for COVID-19 diagnosis. The sample was characterized based on the mean and standard deviation, minimum and maximum, median and quartiles, for quantitative variables, and by absolute and relative frequencies, for qualitative variables. Comparisons between periods were verified using Chi-square or Fisher's exact tests, and Student's t-tests or Mann-Whitney tests, according to the distribution characteristic. Data normality was verified using the Shapiro-Wilk test, bloxplot graphs, histograms and quantile comparison graphs. Results: During the pandemic period, we saw an increase in the number of hospitalizations due to decompensated heart failure, with these patients being more severe, with rising creatinine levels during hospitalization and higher mortality due to HF during the pandemic. However, these patients admitted to the service had a higher ejection fraction compared to the previous period. The use of vasoconstrictor and inotropic drugs remained the same. We had more female hospitalizations when compared to the pre-pandemic period. Conclusion: The number of hospitalizations due to acute HF did not decrease during the pandemic period, which differs from previous literature. However, we corroborate the idea that there is an increase in severity and morbidity of hospitalized patients. More female patients were hospitalized, and the hospitalized patients had a higher LVEF compared to the pre-pandemic period.

Keywords: Heart Failure; COVID-19; Coronavirus; Quarantine; Lockdown; Acute Heart Failure.

INTRODUCTION

March 11, 2020 was marked by the decree made official bythe World Health Organization (WHO) that classified the outbreak of the coronavirus disease2019 (COVID-19) as a pandemic. According to the WHO, in 80% of patients COVID-19 manifests itself with mild symptoms and no complications, in 15% requires hospitalizationand in 5% needs care in the intensive care unit (ICU). (WHO, 2020)

The first Brazilian case of the new coronavirus (SARS-CoV) was registered on February 26, 2020 in the municipality of São Paulo, at the Hospital Israelita Albert Einstein. With the advanceof the disease, the São Paulo government decreed a mandatory quarantine on March 22, following recommendations from international bodies, such as the WHO and the federal government. The measure was an attempt to slow the spread of COVID-19 and reduce contagion rates, as a way to gain enough timeto reorganize the health systemand build field hospitals, thus avoiding the overload of health services and the lack of hospital beds.

Due to the recommendations and changes established in the context of the pandemic, the medical and surgical treatment of hospitalized and outpatient patients was restricted to urgent cases, and all emergency and Intensive Care Unit (ICU) departments were prepared to receive patients infected by the new coronavirus. Telemedicine consultations were also recommended for patients who did not have suspected disease and who were not symptomatic, as a way to reduce exposure and the risk of contagion.

This new health contextdetermined that patients with chronic comorbidities, such as Heart Failure(HF), changed their behavior in the search for hospital services in the minimal presence of symptoms that indicated decompensation of their pathologies. Since these patients are considered a risk group for COVID-19, this measure alsoaimed to avoid hospitalization and, consequently, contamination by the disease. A June 2020 study analyzed the impact of the new coronaviruson hospitalizations and clinical characteristics of patients with HF decompensationduring the pandemic in England, comparing the results with hospital data from previous years. The conclusion obtained was that there was a reduction of approximately 50% inthe number of hospitalizations due to HF during the lockdown period, and the patients who were admitted to the English health service had a worse and more severe clinical profile. (BROMAGE et al, 2020)

Heart Failure (HF) is a complex clinical syndromethat occurs when abnormalities in the function and structure of the heartmake it unable to maintain an adequate heart ordecrease the filling of its vents, resulting in an imbalancebetween the supply and demand of oxygen body tissues

(BONOW et al, 2013). The term Chronic Heart Failure refers to permanent and progressive situations of the established pathology, while Acute HeartFailure refers to the newly established pathologyor that which presented worsening of the signs and symptoms of an already present HF. The main symptoms reported in acute HF are dyspnea, lower limb edema, fatigue, orthopnea, and paroxysmal nocturnal dyspnea, which may be accompanied by signs of jugular vengeal stasis, hepatojugular reflux, andpulmonary congestion (PONIKOWSKI, 2016). The onset and severity of symptoms experienced and reported by patients withacute heart failure varies according to the underlying cause ofheart failure.

Within the current pandemic scenariodue to the new coronavirus, it was observed that the patients most affected in seeking care in hospital services were those who suffered an exacerbation of the chronic formof the disease. (BROMAGE et al, 2020)

Acute HF is one of the main causes of hospitalizations in Brazil and in the world and, as it is apotentially fatal condition, there is a need forrapid and effective therapeutic intervention. In addition, acute HF is related to an increase in mortality and rehospitalizations in the short and long term (GHEORGHIADE et al, 2013). In Brazil, DATASUS data from 2019 point to approximately 1 millionand 700 thousand hospitalizations due to diseases of the circulatory system, and among these, 200 thousand hospitalizations were due to decompensation of Heart Failure (MINISTRY OF HEALTH, 2023).

The first study on acute HF in Brazil, the BREATHE, demonstrates that the main causes of chronic HF decompensationare, in descending order of incidence: medication adherence to drug treatment, infectionand inadequate controlof sodium and water intake. Other causes of decompensation involve arrhythmias, pulmonary embolism, andacute valvular disease. (ALBUQUERQUE et al, 2015)

Also according to the BREATHE study, the main etiologies of HF in patients who were hospitalized due to decompensationvary according to the Brazilian region studied: the South, Southeast and Northeast have a predominance of ischemic causes (33.6%, 32.6%, 31.9%, respectively); and the North region has 37.2% of patients with hypertensive etiology and 42.4% with chagasic etiology.

A wide variety of classifications for Acute Heart Failure have been proposed, based on different criteria (PONIKOWSKI et al, 2015). The classificationby Stevenson (1989) divides HF decompensation according to its clinical-hemodinic profile, basedon physical examination findings of pulmonary congestion (wetor dry, if present or absent, respectively) and periphery hypoperfusion (cold or hot, if present or absent, respectively). The combinationof these profiles identifies 4 groups, which include acute HF presentations:

Profile A: patients without signs of hypoperfusionand without pulmonary congestion (hot and dry);

Profile B: patient with no signs of hypoperfusionand pulmonary congestion(hot and humid);

Profile C: patient with signs of hypoperfusionand no pulmonary congestion (cold and dry);

Profile D: patient with signs of hypoperfusionand pulmonary congestion(cold and wet).

The epidemiology of acute HF presentations in Brazil, according to the BREATHE study, states that 67.4% of patients present to the hospital with a hot and humid profile; 17.8% with a cold and humid profile; 9.6% with a hot and dry profile and 5.2% with a cold and dry profile.

The diagnosis of decompensation must be made immediately upon hospital admission, in order to establish the correct therapy and initiate management in a timely manner, aiming to reduce in-hospital mortality, hospitalization period and symptoms (MAISEL et al, 2008). It is recommended that the diagnosis be made based on clinical findings, personal cardiovascular history and potential cardiac and non-cardiac precipitants, in addition to performing a complete physical examination looking for signs of congestion and peripheral hypoperfusion. Additional tests should be requested upon admission to complement the clinical evaluation of the patient, in order to establish the triggering factor for the exacerbation and the possible differential diagnoses, thus being able to detect potential aggravating factors of acute HF and assess the presence of pulmonary and systemic congestion. These additional tests include chest X-ray, electrocardiogram, laboratory tests and echocardiogram

(PONIKOWSKI et al, 2016). Subsequent to this evaluation, the findings should be analyzed according to the Framingham criteria (appendix 01) or Boston criteria (appendix 02) for the effective diagnosis of HF.

After the diagnosis of HF decompensation, the patient's risk of in-hospital mortality at admission should be determined by the patient's clinical presentation (COLLINS et al, 2015) and by risk scores, the best validated being the ADHERE registry risk scale, which takes into account the variables creatinine, systolic blood pressure and blood urea nitrogen (BUN). According to the BREATHE study, in Brazil, 12.6% of hospital admissions due to HF decompensation result in death. (YANCY et al, 2005)

The recommended treatment for acute chronic HF involves an approach that encompasses the etiological management and its trigger and has a specific conduct for each admission profile, taking into account systemic blood pressure (SBP) and the clinical-hemodynamic profile based on Stevenson's classification (1989). According to the Brazilian Guideline for Chronic and Acute Heart Failure, the management of acute HF includes the use of Angiotensin Receptor Blockers (ARBs) or Angiotensin Converting Enzyme Inhibitors (ACEIs), Beta-blockers (BBs), diuretics, vasodilators, vasoconstrictors, inotropes and volume replacement. Therefore, it is possible to consider specific treatment as follows:

SBP > 110 mmHg and hot and dry hemodinic profile: ACE inhibitor or ARB + BB + suspensionof diuric use;

SBP > 110 mmHg and hot and humid hemodinic profile: vasodilator + diuretic+ BB + ACE/ ARB;

SBP between 85 and 110 mmHg and hot and humid hemodinic profile: vasodilator + diuretic+ BB + ACE/ARB;

SBP between 85 and 110 mmHg and cold and humid hemodemic profile: vasodilator + inotropic+ diuric+ reductionof BB dose + ACE/ARB;

SBP < 85 mmHg and cold and humid hemodermal profile: inotropics+ vasoconstrictors + ethical diure+ suspend use of BB + suspend use of ACE/ARB;

SBP < 85 mmHg and cold and dry hemodermal profile:volume replacement + suspend use of BB + suspend use of ACE/ARB.

According to the BREATHE study, the main medications used in the intra-hospital environment in Brazil were: loop diuretics (89.8%), beta blockers (57.1%), vasodilators (6.6%) and inotropes (13.6%).

Brazilian records indicate an intra-hospital mortality rate between 4 and 12% (YANCY et al, 2005) for patients with acute decompensated HF. The ADHERE registry indicates that patients remain hospitalized for an average of 4.4 days. After hospital discharge, patients with HF still have a risk of being readmitted within 90 days and a 30% chance of death within 1 year. (PONIKOWSKI et al, 2016) In addition, increases in serum creatinine levels associated with long hospitalization in patients hospitalized for acute decompensated HF are observed and are related to a worse short- and long-term prognosis for these patients.

Thus, given the above and the current Brazilian and global scenario, a reduction in hospital admissions due to decompensation of chronic heart failure was observed at Hospital Israelita Albert Einstein (HIAE) during the novel coronavirus pandemic (March-August/2020).

Therefore, the objective of this study is to evaluate the incidence of exacerbations of chronic heart failure during the months of the pandemic and to evaluate the hemodynamic profile at the time of hospital admission of these patients, comparing the results with data from HIAE prior to the pandemic. In addition, we will also evaluate in-hospital morbidity and compare the creatinine value at admission and the highest value reached during hospitalization.

Study Objectives

To comparatively evaluate the incidenceof acute HF exacerbations during the months beforeand during the pandemic, in patients not tested for COVID-19;

To analyze thediagnoses at hospital admissionand the use of vasoactive and inotropic drugsbetween periods;

To compare in-hospital morbidity and mortality;

To evaluate the evolutionof creatinine with values at admissionand significant changesduring hospitalization;

Relevance of the Study

The new coronavirus disease and the side effects caused by the lockdown have not yet been fully explained in the medical literature regarding their harmful effects on population health.

Previous studies have already suggested a decrease in hospitalizations and a decrease in the care of chronic patients, which may worsen long-term care. Therefore, it is intriguing to assess the severity of the immediate effects of the pandemic on the care of these patients, especially those with Acute Heart Failure, the leading cause of death in the world according to the WHO (WHO, 2023).

Therefore, it is a challenge to cover a topic that still has little scientific basis to corroborate or diverge from our data, so it is important to know the momentary impact on treatment so that future studies can estimate the long-term effects.

To advance the study, patient data was collected and stored in a spreadsheet and analyzed anonymously, making the data protected and, consequently, safe for patients.

Given the above, we propose as a hypothesis that during the first wave of the pandemic (March 2020 to August 2020) we had a decrease in hospital admissions for HF, but those admitted were in greater severity, causing greater mortality and morbidity due to Acute Heart Failure.

METHODS

Patients

This retrospective observational study included 327 patients diagnosed with Acute Heart Failure upon admission to Hospital Israelita Albert Einstein between October 2019 and August 2020. None of these patients were tested for COVID-19.

All patients were over 18 years of age and were also included based on documentation of systolic ventricular dysfunction (LVEF ≤ 45% or description of moderate to severe systolic dysfunction in the medical record).

No patients were tested for COVID-19.

Experimental design

The database was divided into two groups according to the time of admission hospital: group A patients admitted between October 2019 and February 2020, with a total of 89 patients; and, group B, patients admitted between March 2020 and August 2020, totaling n = 119.

The objective of the groups was an an comparative analysis contemplating the achievement of the study objectives Throughyou are from the HIAE database.

We used a database from the Hospital Israelita Albert Einstein, in the city of São Paulo, for analysis.

In the database, the main quantitative variables that will be analyzed are:

- Number of patients admitted to the service;
- Creatinine at the time of hospital admission and after 24 hours, 48 hours, 72 hours and at the time of hospital discharge;
- In-hospital mortality.

In addition, the main qualitative variablesanalysed will be:

- Reason for CI decompensation;
- Systemic blood pressureclassified as hypotension, normotens,or hypertension;
- Need for inotropic medications;
- Need for vasopressor medications.

The database was subdivided according to the time of hospital admission of these patients, with group A being considered patients admitted between October 2019 and February 2020; and group B being patients admitted between March 2020 and August 2020.

The sample was characterized based on the mean and standard deviation, minimum and maximum, median and quartiles, for quantitative variables, and by absolute and relative frequencies, for qualitative variables.

Comparisons between periods were verified using Chi-square or Fisher's exact tests, and Student's t-tests or Mann-Whitney tests, according to the distribution characteristic. Data normality was verified using the Shapiro-Wilk test, bloxplot graphs, histograms and quantile comparison graphs.

The analyses were performed using the Statistical Package for the Social Sciences – SPSS, v.26.0 (2), considering a significance level of 5%.

Data Anonymization and Ethics

The data was anonymized by Marina Barros de Melo, a nurse in the Cardiology program at Hospital Israelita Albert Einstein, holder of ID number 42.947.457-x and CPF number 369.983.938-90. The professional has no connection with the project and declared responsibility and commitment to the use of the data, in order to guarantee the privacy of the individuals whose information will be accessed.

The anonymization process occurred, first of all, through an ordering of the medical records

in an Excel spreadsheet according to the medical record number and the date of admission of the patient to the service. In this way, patients who were readmitted will have subsequent rows in the organization of the spreadsheet.

After this step, a conditional equation {=IF(D4=D3;C3;C3+1)} will be applied using the cells in the spreadsheet as a basis. The purpose of the equation was to create an increasing number of patients per admission, so that each patient would receive a unique admission number that corresponds to that hospitalization. This process used a high-level Python programming language, at no cost to the research or the researcher.

Finally, the medical record, travel, name and date of birth fields were excluded from the spreadsheet. It was also certified that the deleted data was not stored on any device in the "cloud".

The already anonymized spreadsheet was delivered to the researcher in charge via a Pen Drive.

Budget

Any expense related to the project was the sole responsibility of the project team and will not incur costs for SBIBAE.

RESULTS

Incidence Profile of Heart Failure Exacerbations

For the analysis of the desired objectives, 208 patients were included, 89 (42.8%) admitted before the pandemic and 119 (57.2%) after the beginning of the pandemic (Table 01).

Regarding gender, we found a significant difference between the periods compared, with a higher prevalence of male hospitalizations in the pre-pandemic period (74.2% vs. 55.5%; p-value = 0.006) (Table 1A). We did not observe any difference in age between the periods (p-value = 0.311),

with the mean age being 78 years in the pre-pandemic period and 80 years in the post-pandemic period (Table 1B).

We did not observe any significant difference between the periods for the characteristics of the patients: weight (p-value = 0.310) (Table 1D); height (p-value = 0.672) (Table 1E); and, body mass index (p-value = 0.286) (Table 1F).

Table 1: Comparison between patient profiles and periods (n = 208).

	Admission period				
	Pre-pandemic (n=89)		Post-pandemic (n=119)		p-value
	n	%	n	%	
A. Sex					0.006A
Male	66	74,2%	66	55,5%	
Female	23	25,8%	53	44,5%	
B. Age					0.311B
Mean and Standard Deviation	78	15	80	13	
Minimum and Maximum	26	98	39	98	
Median and Quartiles	81	73 - 88	82	72 - 91	
C. Stature					0.672B
Mean and Standard Deviation	1,69	0,10	1,69	0,10	
Minimum and Maximum	1,48	1,88	1,45	1,90	
Median and Quartiles	1,70	1,63 - 1,75	1,67	1,63 - 1,76	
D. Body mass index					0.286B
Mean and Standard Deviation	27,23	5,28	26,48	4,39	
Minimum and Maximum	18,50	42,01	18,67	40,90	

Median and Quartiles	25,71	23,34 - 31,21	25,94	23,23 - 28,58

[The] Chi-square test

[c] Student's t-test

Diagnoses at admission, use of vasoactive and inotropic drugs

Regarding the diagnosis at admission, we found significant evidence (p = 0.003) of a higher prevalence of chronic HF cases in the pre-pandemic period (89.9% vs. 73.9%) and a higher prevalence of acute HF in the post-pandemic period (16.8% vs. 3.4%) (Table 2B) (Figure 01).

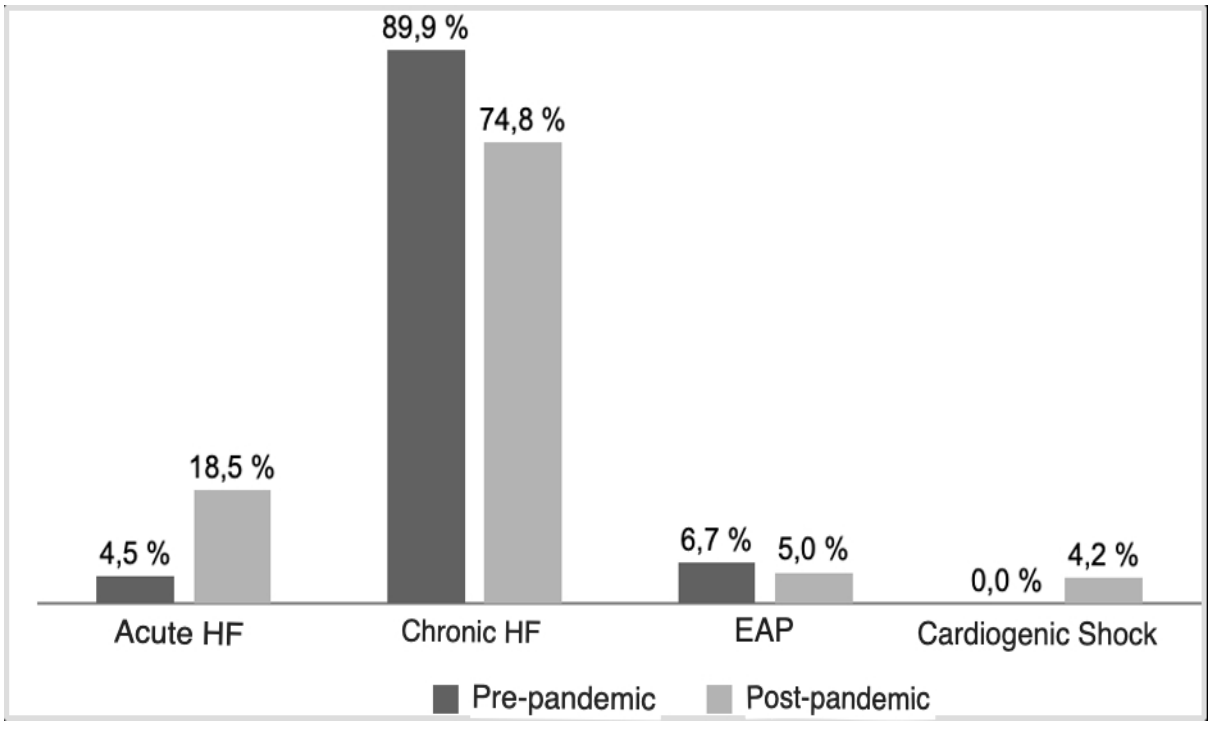

Figure 1: Comparison of diagnoses between periods (p-value = 0.006).

Table 2: Comparison between diagnoses at admission between periods (n = 208).

	Admission period				
	Pre-pandemic (n=89)		Post-pandemic (n=119)		p-value
	n	%	n	%	
A. Etiology of the disease					0.207A
Ischemic	62	78,5%	73	70,2%	
Non-ischemic	17	21,5%	31	29,8%	
Non-ischemic etiologies					-
Hypertensive	1	5,9%	6	18,2%	
Valvular	3	17,6%	4	12,1%	
Family member (if described in the patient's chart)	1	5,9%	0	0,0%	
Peripartum	1	5,9%	0	0,0%	
Myocarditis / Inflammatory	2	11,8%	2	6,1%	
Infiltrative	0	0,0%	3	9,1%	
Stress/Takotsubo	1	5,9%	1	3,0%	
Chagas Diseases	0	0,0%	0	0,0%	
Idiopathic/Other	4	23,5%	11	33,3%	
Ischemic + Idiopathic/Other	0	0,0%	2	6,1%	
Valvular + Idiopathic/Other	4	23,5%	4	12,1%	

B. Hospitalization diagnosis (n=207) *					0.003B
Acute CI	3	3,4%	20	16,8%	
Chronic CI	80	89,9%	88	73,9%	
EAP	5	5,6%	5	4,2%	
Cardiogenic Shock	0	0,0%	3	2,5%	
Acute CI + EAP	1	1,1%	0	0,0%	
Acute HF + Cardiogenic Shock	0	0,0%	2	1,7%	
Chronic CI + EAP	0	0,0%	1	0,8%	
C. Used inotropic drugs during hospitalization					0.079B
Yes	39	43,8%	38	31,9%	
No	50	56,2%	81	68,1%	
D. Which Inotropic Drug					0.793A
Dobutamine	28	31,5%	28	23,5%	
Sindax	4	4,5%	5	4,2%	
Milrinone	0	0,0%	0	0,0%	
Dobutamine + Sindax	6	6,7%	3	2,5%	
Dobutamine + Milrinone	1	1,1%	2	1,7%	
E. Used vasoconstrictor drugs during hospitalization					0.994A

No	77	86,5%	103	86,6%
Yes	12	13,5%	16	13,4%
F. Which vasoconstrictor drug:				
Dopamine	2	16,7%	1	6,3%
Norepinephrine	11	91,7%	15	93,8%
Adrenaline	3	25,0%	3	18,8%
Vasopressin	1	8,3%	1	6,3%

[The] Chi-square test

[B] Fisher's exact test

* Test not considering cases with more than one response (etiology/diagnosis)

Some patients had more than one diagnosis: one with acute HF + APE, two with acute HF + Cardiogenic Shock, and one with chronic HF + APE, but these were not statistically significant (p = 0.310) (Table 2B).

Regarding the etiology, we also did not find a significant difference between the periods (p value = 0.207), with ischemic diseases being the most frequent (pre-pandemic = 78.5% and post-pandemic = 70.2%). Some patients had more than one etiology: two patients in the post-pandemic period had Ischemic + Idiopathic etiology; four patients in each period had Valvular + Idiopathic etiology (Table 2A).

Regarding the use of inotropic drugs during hospitalization, the prevalence was higher in the pre-pandemic period (43.8% vs. 31.9%), but this difference was not significant (p value = 0.079) (Table 2C). Among the patients who used it, in both periods the most used was Dobutamine (31.5% in the pre-pandemic period and 23.5% in the post-pandemic period) and again we did not observe a significant difference regarding the type of drug used between the periods (p-value = 0.793) (Table

2D). In addition, some patients used more than one inotropic drug during hospitalization: six in the pre-pandemic period and three in the post-pandemic period used Dobutamine + Levosimendan (Sindax); one in the pre-pandemic period and two in the post-pandemic period used Dobutamine + Milrinone (Table 2D).

Regarding the use of vasoconstrictor drugs during hospitalization, the prevalence was similar in both periods (pre = 13.5% and post = 13.4%), with no significant difference (p-value = 0.994) (Table 1E). Patients could use more than one drug at the same time, with norepinephrine being the most commonly used drug in both periods (Table 2F).

In-hospital morbidity and mortality profile

The type of hospital discharge did not show a significant difference between the periods (p-value = 0.420), with discharge to home being the most prevalent (pre-pandemic = 83.1% and post-pandemic = 84.9%) (Table 3A). The incidence of death was higher in the post-pandemic period (7.6% vs. 4.5%) (Table 3A).

Table 3: Comparison of morbidity and mortality between periods (n = 208).

	Admission period				
	Pre-pandemic (n=89)		Post-pandemic (n=119)		p-value
	n	%	n	%	
A. Type of hospital discharge					0.420A
Residence	74	83,1%	101	84,9%	
Home care	8	9,0%	8	6,7%	

Transferred to another service	3	3,4%	1	0,8%	
Death	4	4,5%	9	7,6%	
B. Length of Stay					0.578C
Mean and Standard Deviation	18	42	13	17	
Minimum and Maximum	1	344	1	106	
Median and Quartiles	8	4 - 16	7	4 - 15	
C. Systolic blood pressure					0.250B
Mean and Standard Deviation	124	27	128	29	
Minimum and Maximum	52	211	57	212	
Median and Quartiles	119	103 - 143	125	107 - 148	
D. Diastolic blood pressure					0.870B
Mean and Standard Deviation	75	16	74	18	
Minimum and Maximum	47	125	20	120	
Median and Quartiles	72	64 - 83	74	61 - 85	
E. Urea on admission					0.663C
Mean and Standard Deviation	77	40	77	35	
Minimum and Maximum	25	190	22	201	
Median and Quartiles	64	48 - 98	76	51 - 97	
F. Creatinine at admission					0.996C
Mean and Standard Deviation	1,69	0,87	1,74	0,94	
Minimum and Maximum	0,61	4,37	0,50	5,56	

Median and Quartiles	1,48	1,16 - 1,85	1,49	1,01 - 2,13	
G. Creatinine higher hospitalization value (mg/dL)					0.514C
Mean and Standard Deviation	1,95	1,16	2,07	1,15	
Minimum and Maximum	0,67	6,51	0,77	6,55	
Median and Quartiles	1,57	1,28 - 2,02	1,68	1,23 - 2,6	
H. Left Ventricular Ejection Fraction					0.023C
Mean and Standard Deviation	31,91	7,45	34,63	8,73	
Minimum and Maximum	15	47	17	50	
Median and Quartiles	30	27 - 36	35	27 - 42	

[The] Chi-square test

[B] Student's t-test

[C] Mann-Whitney test

The length of stay also did not show a significant difference, with a median of eight days in the pre-pandemic period and seven days in the post-pandemic period (p-value = 0.578) (Table 3B).

The left ventricular ejection fraction showed a significant difference between the periods, being higher in the post-pandemic period (median = 35 vs. median = 30; p-value = 0.023) (Figure 2) (Table 3H).

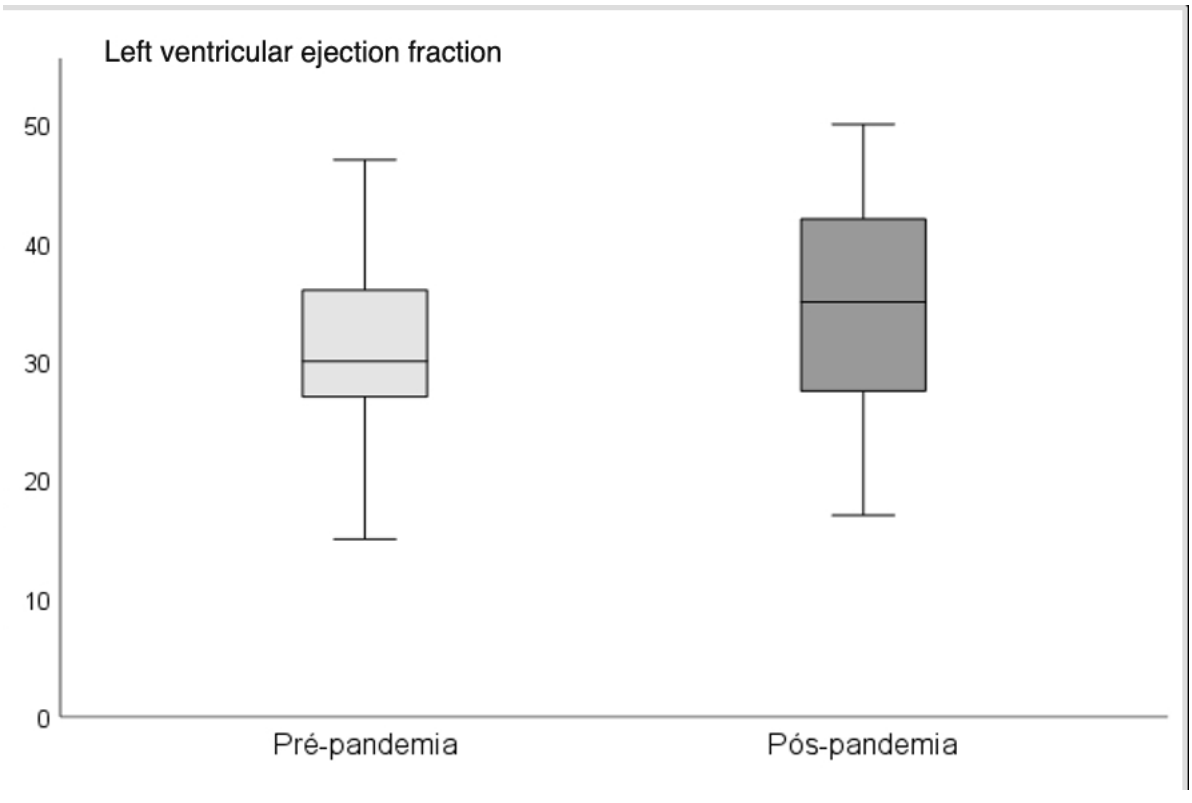

Figure 2: Comparison of LVEF between periods (p-value = 0.023).

We compared other patient characteristics between the periods, but they also did not show statistical differences. They are: systolic blood pressure (pre-mean = 124 vs. post-mean = 128; p-value = 0.250) (Table 3C); diastolic blood pressure (pre-mean = 75 vs. post-mean = 74; p-value = 0.870) (Table 3D); urea on admission (pre-median = 64 vs. post-median = 76; p-value = 0.663) (Table 3E); creatinine on admission (pre-median = 1.48 vs. post-median = 1.49; p-value = 0.996) (Table 3F).

Changes in creatinine value

We compared creatinine values on admission with the highest value observed during hospitalization. Although we found no evidence of differences in creatinine values between the periods, as seen in Tables 3F and 3G, in both periods we observed an increase in creatinine values

compared to admission values, and this difference was significant (p-values < 0.001). In the pre-pandemic period, the median increased from 1.48 mg/dL to 1.57 mg/dL. In the post-pandemic period, the median increased from 1.49 mg/dL to 1.68 mg/dL. The results are presented in Table 2 and Figure 6.

Table 4: Comparison of creatinine (mg/dL) values at admission with the highest value at admission, by period (n=150).

	Creatinine on admission		Creatinine higher hospitalization value		p-value #
Pre-pandemic (n=31)					<0.001
Median and Quartiles	1,48	1,16 - 1,85	1,57	1,28 - 2,02	
Minimum and Maximum	0,61	4,37	0,67	6,51	
Post-pandemic (n=119)					<0.001
Median and Quartiles	1,49	1,01 - 2,13	1,68	1,23 - 2,6	
Minimum and Maximum	0,50	5,56	0,77	6,55	

Wilcoxon test.

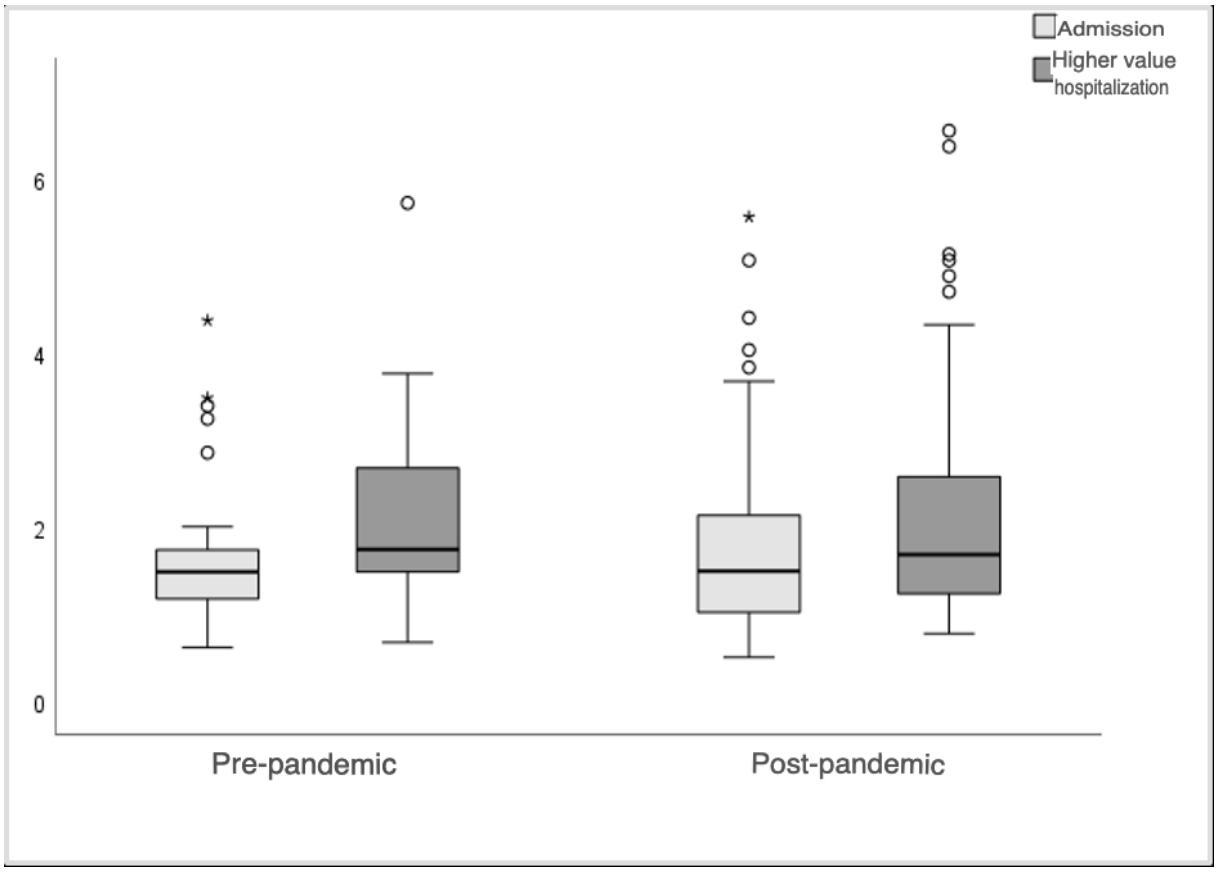

Figure 3: Comparison of Creatinine at admission with the highest hospitalization value between the periods (p-value < 0.001).

DISCUSSION

Exacerbations of Heart Failure

The benefits of physical exercise and diet to compensate for HF and health are already well documented in the literature (ROGERS et al, 2017). However, the change in life dynamics imposed by quarantine created barriers to the practice of physical activities and the maintenance of a balanced diet.

In an English study, there were records that 82% of patients showed an increase in sedentary lifestyle, smoking and intake of ultra-processed foods (ROBINSON et al, 20221) during the lockdown,

which can cause harm to health even in the short term (PRESSLER et al, 2013). In this study, an increase in anginal symptoms was reported (CRANSAC-MIET et al, 2021). Such evidence mentioned above may support our finding of greater hospitalizations for Acute Heart Failure during the period of analysis.

Furthermore, during the analysis period during the pandemic, we found that patients had higher left ventricular ejection fraction (LVEF) (30 vs. 35). Although the values are different, they are still considered as HF with reduced ejection fraction (HFrEF) according to the current literature (JESUS et al, 2024). According to GOMEZ-SOTO et al (2024), physical exercise is an important predictor for the prognosis of patients with HFrEF, preventing decompensation and reducing mortality. As mentioned above, data indicate that during the lockdown there was a decrease in the practice of physical activities (ROBINSON et al, 2021).

However, there were no active questions in our study about eating habits, physical activity and weight change during the period. Furthermore, as we started our analysis at an early stage of the pandemic, when we did not have sufficient resources for abundant testing, we do not know how many of these cases are correlated with COVID-19 infection. Therefore, further studies are needed to verify the suggested correlations.

In both groups analyzed, pre- and post-pandemic, the BMI of admitted patients was overweight, although the comparison between groups did not show statistical relevance.

Our finding of an increase in hospitalizations due to exacerbation of heart failure is inconsistent with the literature already recorded. This fact can be explained by regional differences in the penetrance and temporal severity of the pandemic (BOOTH et al, 2020).

In addition, we also recorded data on more hospitalizations of female patients. Previous data indicate that women with HF are more likely to present psychological changes such as anxiety and depression when compared to male patients (STEVENSON et al, 1989). Psychological exhaustion is reported as a determining factor in self-care (CLELAND et al, 2006). In addition, they have lower adherence to non-pharmacological treatment (YANCY et al, 2024). Quarantine has been described

as a high-stress and anxiety-inducing factor, which may increase the reduction in self-care. However, it is dangerous to generalize and assume psychiatric symptoms as the only factors for the worsening of HF, therefore, more studies are needed to support our finding. Furthermore, the worsening of HF in females may be correlated with the difference in treatment (CAMPBELL et al, 2024) provided in outpatient care for symptomatic patients, being a catalyzing factor for decompensation during the reduction in medical care during the lockdown. Still, more studies are needed to verify these findings.

Morbidity and mortality

Considering the periods analyzed and the number of hospitalizations due to HF, we affirm that there was an increase in hospitalizations during the pandemic (89 vs. 119). This data is discordant with most of the literature already described, therefore more studies are needed for greater scientific validation.

However, we can consider that the increase in this number may be correlated with patients who presented with symptoms due to acute HF, acute pulmonary edema or cardiogenic shock. The total number of patients with these diagnoses at admission during the pandemic results in n=30 (25%) and, in the pre-pandemic period, we had a record of n=9 (10%), even though such findings are not statistically relevant. That said, we can

Even with the greater severity of patients at admission, we noted stability in relative numbers in the use of vasoactive and inotropic drugs to stabilize these patients, corroborating previous studies (TIWARI et al, 2022).

In contrast, we observed that post-pandemic patients presented a more severe condition, associated with higher mortality (4.5% vs. 7.6%). The contrast between the periods can be explained, for example, by the longer delay that patients may have taken to seek medical care when they presented symptoms (SHARMA et al, 2020).

Thus, due to the higher mortality, we can note the increase in creatinine values during

hospitalization. In the pre-pandemic period, the median creatinine values increased from 1.48 mg/dL to 1.57 mg/dL. During the pandemic period, the median increased from 1.49 mg/dL to 1.60 mg/dL.

Study Limitations

Our study has limitations, since it was limited in time to the first wave of coronavirus, which had lower health service occupancy compared to subsequent ones; at this time, we still did not have abundant testing for COVID-19, making it difficult to correlate the findings with SARS-CoV-2 infection. Thus, it is difficult to validate such data for other time periods. In addition, we present a low sample size and it is only representative of a single care service.

However, our study adds to the medical literature. We present data on a greater number of hospitalizations due to acute HF and among women, which has not yet been presented in the medical literature. We corroborate data on the amount of vasoconstrictor and inotropic drugs. There is inconclusive data on morbidity and mortality due to HF during the period. Therefore, further studies are needed to evaluate and provide more data for science and medical care.

CONCLUSIONS

The number of hospitalizations for acute HF did not decrease during the pandemic period, which differs from previous literature. However, we corroborate the idea that there is an increase in severity and morbidity of hospitalized patients.

More female patients were hospitalized, and hospitalized patients had higher LVEF compared to the pre-pandemic period.

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