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Consequences of COVID-19 pandemic on myocardial infarction reperfusion therapy and prognosis

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ABSTRACT

***Background**: The coronavirus disease (COVID-19) pandemic affected the prompt diagnosis and treatment of Acute myocardial infarction (AMI). **Aim**: To characterize the clinical profile of patients with AMI during the COVID-19 pandemic, comparing them with a historical cohort. **Material and Methods:** A case-control study of 96 patients with AMI transferred to a high-volume percutaneous coronary intervention (PCI) hospital between March and July 2020, and a historical cohort of 269 patients transferred during the same period in 2019. **Results**: When comparing patients transferred during the pandemic with those of the historical cohort, the former were younger (63 ± 12 vs 68 ± 12 years, $p < 0.01$), had a higher frequency of hypertension (66 vs 45%, $p < 0.01$) and of smoking (40% vs 25%, $p < 0.01$). Also, during COVID-19 outbreak a higher proportion of patients had ST-elevation AMI consulting > 12 hours from the onset of symptoms (44 vs 0%, $p < 0.01$), a higher median door-to-device time (4 vs 3 hours, $p < 0.01$), a higher use of primary percutaneous coronary intervention (97 vs 71%, $p < 0.01$), and higher frequencies of cardiogenic shock (20 vs 4%, $p < 0.01$) and mechanical complications (10% vs 2%, $p < 0.01$). Patients during COVID pandemic had a higher thirty-day overall (20 vs 1.4%, $p < 0.01$) and cardiovascular mortality (13 vs 1%, $p < 0.01$). During the outbreak, 40% of patients had positive COVID-19 status, which was a predictor for thirty-day overall mortality (Risk ratio 2.90; 95% confidence intervals 1.14-7.36). **Conclusions**: During the pandemic patients with AMI exhibited delays in consultations and treatment, higher morbidity, and increased mortality. COVID-19 positivity was associated to worse thirty-day overall survival.*

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***Key words:** Cardiac Catheterization; COVID-19; Myocardial Infarction; Percutaneous Coronary Intervention.*

Consecuencias de la pandemia COVID-19 en la reperfusión y pronóstico del infarto de miocardio

***Antecedentes**: La pandemia COVID-19 afectó el tratamiento oportuno del infarto agudo de miocardio (IAM). **Objetivo:** Caracterizar el perfil clínico de pacientes con IAM durante la pandemia COVID-19 y compararlos con una*

cohorte histórica. ***Pacientes y Métodos****: Estudio caso-control de 96 pacientes con IAM transferidos a un hospital de alto volumen de intervención coronaria percutánea (ICP) entre marzo julio de 2020 y una cohorte histórica de 269 pacientes transferidos en el mismo período de 2019 (n = 269).* ***Resultados****: Al comparar los pacientes transferidos durante pandemia y la cohorte histórica, los primeros eran más jóvenes (63 ± 12 y 68 ± 12 años respectivamente, p < 0,01), tenían una mayor frecuencia de hipertensión (65.6 y 45.1% respectivamente, p < 0,01) y tabaquismo (39,6 y 25,1% respectivamente, p < 0,01). También tuvieron una consulta > 12 h desde iniciados síntomas de IAM con elevación ST (44,4 y 0% respectivamente, p < 0,01), una mediana de tiempo puerta-guía mayor (4 y 3 horas respectivamente, p < 0,01), un mayor uso de ICP primaria (97 y 71% respectivamente, p < 0,01), mayor frecuencia de shock cardiogénico (19,8 y 4,1% respectivamente, p < 0.01) y complicaciones mecánicas (10,4 y 1,7% respectivamente, p < 0,01). A treinta días, los primeros tuvieron mayor mortalidad general (19,8 y 1,4% respectivamente p < 0.01) y cardiovascular (12,5 y 1,4% respectivamente, p < 0,01). Durante la pandemia, 40% de los pacientes presentó positividad para COVID-19, siendo un factor predictivo de mortalidad general (razón de riesgo 2,90; intervalos de confianza 95% 1,14-7,36).* ***Conclusiones****: Durante la pandemia, hubo retrasos en tiempos de consulta y tratamiento y mayor morbimortalidad del IAM. La positividad de COVID-19 se asoció a peor sobrevida general a treinta días.*

Palabras clave: *Cateterismo Cardíaco; Infecciones por Coronavirus;Infarto del Miocardio; Intervención Coronaria Percutánea.*

Acute myocardial infarction (AMI) constitutes a major cause of morbidity-mortality in Chile; being responsible for 7.5% of deaths in 20181. During the past decades, morbidity-mortality have considerably declined due to timely reperfusion therapy[2,3]. Martinez et al. described a 30-day mortality rate of 8.1% for AMI patients undergoing percutaneous coronary intervention (PCI) in Chile[3].

Due to the coronavirus disease 2019 (COVID-19) pandemic, healthcare systems have undergone significant strains, including expansion of intensive care units, cancellation of outpatient visits and procedures[4]. Furthermore, in attempts to reduce viral transmission, stay-at-home campaigns and lockdowns have been established. A deferral in elective procedures was recommended by several cardiovascular societies[4,5]. In Chile, a reduction of around 65% of interventional cardiology procedures has been reported during the COVID-19 outbreak[6].

Patients with cardiovascular diseases have been recognized at increased risk of severe illness when infected with SARS-CoV-2. Unfortunately, factors like the restructuring of healthcare systems may cause "collateral damage" to patients with cardiovascular diseases. Despite uncertainties regarding the optimal reperfusion strategy for ST-elevation myocardial infarction (STEMI) during COVID-19 outbreak, international societies have reaffirmed the recommendation for PCI as standard of care for STEMI when provided in a timely fashion.[5] Nonetheless, international groups report a decline in hospital admissions due to acute cardiovascular diseases[7-13].

The aim of this study was to characterize the clinical profile, treatment, and outcome of patients with AMI during the coronavirus disease (COVID-19) pandemic, and to compare these variables with a historical cohort at a tertiary cardiac center in Chile.

Patients and Methods

We performed a case-control study, between March 3rd and July 15th 2020, including all patients with STEMI and non-ST elevation myocardial infarction (NSTEMI) transferred to the cardiac catheterization laboratory of Instituto Nacional del Torax, a high-volume PCI center (700 PCI

per year). Our center does not have an emergency department, patients undergoing AMI are transferred from two nearby hospitals and 20 primary care emergency services. Our center was not dedicated exclusively to COVID-19 attention during the outbreak. The target beneficiary population remained unchanged. Referrals for AMI during the same period of 2019 were reviewed as historical control. We considered March 3rd, 2020 as the starting point of COVID-19 outbreak in Chile. The study protocol was approved by the Servicio de Salud Metropolitano Oriente Ethics Committee.

Clinical registries from the cardiac catheterization laboratory were reviewed for assessment of demographics, comorbidities, clinical presentation, and troponin results. STEMI, NSTEMI and AMI with non-obstructive coronary artery disease (MINOCA) were defined according to the fourth definition of myocardial infarction[14]. Symptom onset-to-first medical contact (S-to-FMC) time is defined as the time interval from patient-reported chest discomfort onset to the time of first medical attention in patients with STEMI. Late presentation was defined as S-to-FMC ≥ 12 hours in patients with STEMI. Door-to-device (D-to-D) time was defined by the interval between initial medical attention and successful wire crossing during primary PCI (excluding patients undergoing systemic fibrinolysis).

COVID-19 positive (C19(P)) status was defined by positive throat swab for SARS-COV-2 by reverse transcription-polymerase chain reaction (RT-PCR), in patients undergoing cardiac catheterization during the COVID-19 outbreak. COVID-19 negative (C19(N)) status was defined by negative RT-PCR during the index hospitalization.

Conventional angiography was performed with a minimum of three views for the left coronary artery and two for the right coronary artery. Intracoronary thrombi were defined by the presence of a filling defect with either a total occlusion with irregular distal margins and post injection contrast retention, or a partial occlusion circumferentially outlined by contrast medium at angiography[15]. Multi-vessel coronary artery disease (CAD) was defined by at least two epicardial coronary arteries with atherosclerotic stenoses of significant severity. PCI indication followed current international guidelines and recommendations[4].

Cardiovascular deaths, non-cardiovascular deaths, and no-reflow at coronary angiography were defined according to academic research consortium-2-consensus[16]. Ventricular septal rupture, acute mitral regurgitation, and left ventricular free wall rupture are part of the spectrum of mechanical complications after AMI. Left ventricular ejection fraction (LVEF) was addressed through ventriculography when available or transthoracic echocardiography performed during the index hospitalization. Significant systolic dysfunction was defined by LVEF ≤ 40%.

The Civil Registry Database was reviewed to obtain survival status, in September 2020.

Statistical analysis

Continuous data are expressed as mean ± standard deviation or median and interquartile range, while categorical data as absolute number and percentage. Categorical data were compared using Pearson χ^2 test. Comparison of continuous data between groups at baseline was assessed through unpaired T-test or Mann-Whitney U according to normality. Non-parametric median analyses were performed. Thirty-day survival was addressed through Kaplan-Meier curves and log-rank analysis. Cox logistic regressions were performed to establish relative risk of overall and cardiovascular mortality associated to COVID-19 status. Statistical significance was assumed at a value of $P < 0.05$. Analyses were performed with IBM SPSS Statistics 20.0 (IBM Corp, USA).

Results

Baseline characteristics are shown in Table 1. Compared to the same period of 2019, during the COVID-19 pandemic there was a 67.5% reduction in referrals for AMI, 60.5% for STEMI and 71.8% for NSTEMI. Demographic characteristics were similar between groups. Regarding cardiovascular risk factors, a higher burden of hypertension and smoking was observed in 2020 ($p < 0.01$). Among the studied population during the outbreak, 39 patients had positive RT-PCR for SARS-CoV-2 (40.6%).

We observed a similar distribution in referrals for STEMI-NSTEMI ($p = 0.09$). In patients with STEMI, there was an increase in average S-to-FMC between both periods ($p < 0.01$), and 20 patients had a late presentation during 2020

Table 1. Baseline clinical and periprocedural characteristics of patients with AMI according to year

	Control group (n = 295)	Pandemic group (n = 96)	P
Demographics			
Age – years	68 ± 12	63 ± 12	< 0.01
Male – number (%)	191 (64.7)	69 (71.9)	0.20
Hypertension – number (%)	133 (45.1)	63 (65.6)	< 0.01
Diabetes – number (%)	112 (38.0)	38 (39.6)	0.78
Smoker – number (%)	74 (25.1)	38 (39.6)	< 0.01
Index event			
STEMI – number (%)	114 (38.6)	45 (46.9)	0.15
S-to-FMC – hours*	3.6 ± 2.0	22.3 ± 31.7	< 0.01
Median S-to-FMC time (IQR) – hours*	3.0 (2.0–5.0)	6.0 (2.0–24.0)	0.15
STEMI late presentation – number (%) *	0 (0)	20 (44.4)	< 0.01
Systemic thrombolysis – number (%) *	14 (12.3)	5 (11.1)	1.00
MINOCA – number (%)	1 (0.3)	29 (30.2)	< 0.01
Multivessel disease – number (%)	73 (24.7)	33 (34.4)	0.07
Left main coronary disease – number (%)	11 (3.7)	8 (8.3)	0.07
Intracoronary thrombi – number (%)	35 (11.9)	33 (34.4)	< 0.01
Thrombus aspiration – number (%)	4 (3.5)	4 (8.9)	0.11
Primary PCI – number (%) *	111 (97.3)	32 (71.1)	< 0.01
Median D-to-D time (IQR) – hours†	3.0 (2.0–4.0)	4.0 (3.0–7.8)	< 0.01
No-reflow – number (%) *	1 (0.9)	8 (17.8)	< 0.01
Cardiogenic shock presentation – number (%)	12 (4.1)	19 (19.8)	< 0.01
Intra-aortic balloon pump – number (%) *	1 (0.9)	5 (11.1)	< 0.01
LVEF – %	48 ± 12	46 ± 13	0.07
LVEF ≤ 40% - number (%)	77 (26.1)	36 (37.5)	0.03
Maximal hs-cTnI – pg/ml	4990 ± 5007	8250 ± 7755	< 0.01

* In patients with STEMI. † In patients with STEMI, excluding thrombolysis.

($p < 0.01$). 48% of patients with NSTEMI had S-to-FMC > 24 hours in 2020, compared to 4.4% during 2019 ($p < 0.01$). No significant differences regarding performance of systemic thrombolysis prior to coronary angiography for STEMI were detected. Reperfusion criteria were observed in 79% of cases undergoing systemic thrombolysis, with no significant differences between years. With reference to diagnostic coronary angiography findings, patients had no major differences regarding finding of CAD or left main coronary artery disease. There was a higher prevalence of MINOCA, coronary thrombosis (CT) burden and cardiogenic shock (CS) during the COVID-19 outbreak ($p < 0.01$).

A decrease in primary PCI procedures was detected in patients with STEMI ($p < 0.01$). Delays in median D-to-D time were observed in 2020 ($p < 0.01$), as well as higher rates of no-reflow phenomena ($p < 0.01$). Significant systolic dysfunction was more prevalent in patients with AMI during 2020 ($p = 0.032$). Patients with AMI during 2020 exhibited greater maximal high-sensitivity troponin values ($p = 0.001$). Of note, incidence of mechanical complications increased in patients with AMI during COVID-19 outbreak ($p < 0.01$), mainly ischemic mitral regurgitation (Table 2). Concordantly, a higher use of intra-aortic balloon pump was also seen in STEMI patients ($p<0.01$).

Significant differences in 30-day overall survival and cardiovascular survival were observed at 30 days of follow-up in patients with AMI between these time periods ($p < 0.01$) (Figure 1A-B). During COVID-19 outbreak, the 30-day cardiovascular survival rate for STEMI and NSTEMI was 75.6% and 97.9%, respectively.

Table 2. Outcomes of patients with acute myocardial infarction

	Control group (n = 295)	Pandemic group (n = 96)	P
Overall deaths within 30 days – number (%)	4 (1.4)	19 (19.8)	< 0.01
Cardiovascular deaths within 30 days – number (%)	4 (1.4)	12 (12.5)	< 0.01
Mechanical complications – number (%)	5 (1.7)	10 (10.4)	< 0.01
Acute ischemic mitral regurgitation – number (%)	3 (1.0)	9 (9.4)	< 0.01

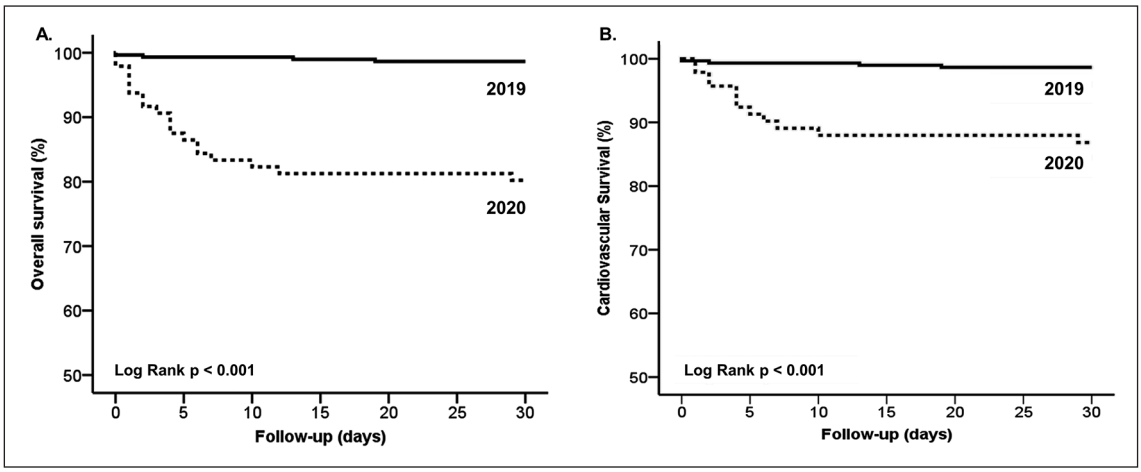

Figure 1.

Differences during the pandemic according to COVID-19 status

There was no difference regarding demographics and comorbidities according to COVID status (Table 3). NSTEMI was the most prevalent AMI type in C19(P) patients ($p < 0.01$).

At coronary angiography, C19(P) patients exhibited intracoronary thrombi more frequently ($p < 0.01$), and less CAD ($p = 0.005$). After PCI, TIMI-3 flow was less common in C19(P) patients ($p < 0.01$). C19(P) patients had lower mean LVEF ($p < 0.01$), more prevalent significant systolic dysfunction ($p < 0.01$), and higher mean high-sensitivity troponin measurements ($p < 0.01$). Patients with C19(N) status had a greater incidence of CS ($p = 0.03$), while there were no major differences in the incidence of mechanical complications between groups ($p = 0.16$).

An increase in 30-day mortality was observed in patients with C19(P) ($p = 0.018$) (Figure-1A). Of note, 30-day cardiovascular mortality showed no differences according to COVID-19 status ($p = 0.715$) (Figure-1B). Seven patients died of non-cardiovascular causes, due to COVID-19-related acute respiratory distress syndrome. C19(P) was associated to an increase in the relative risk of overall death at 30-days of follow up (RR 2.9, 95% CI 1.14-7.36; $p = 0.03$) (Table 4). When adjusted by AMI type, C19(P) status remained associated to an increased risk of overall mortality at 30-days (RR 3.7; 95% CI 1.4-9.8, $p < 0.01$). C19(P) status was not associated to an increase in 30-day cardiovascular mortality ($p = 0.72$). STEMI, CT, significant systolic dysfunction, and CS were predictors of cardiovascular deaths at univariate analyses (Table 4).

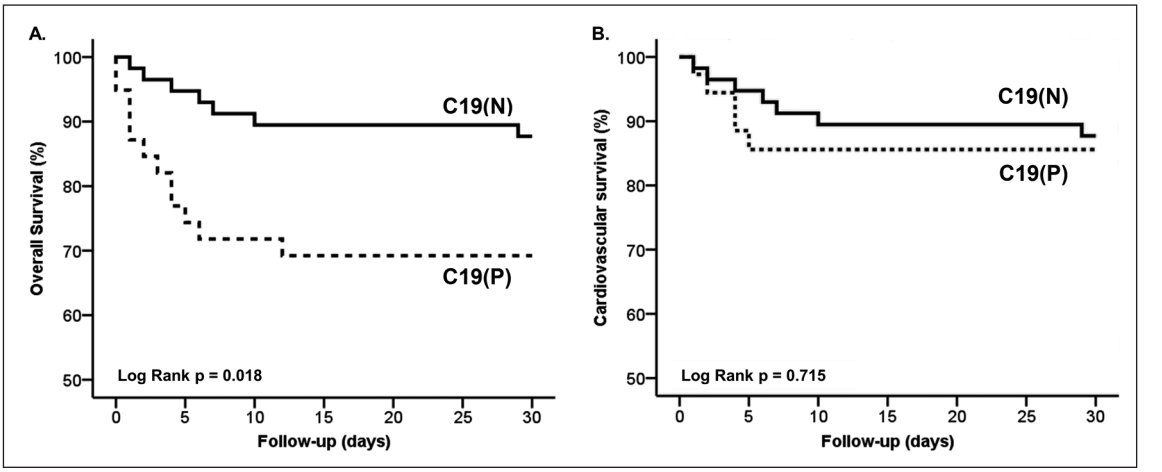

Figure 2.

Table 3. Baseline clinical and periprocedural characteristics and outcomes of patients with AMI according to COVID-19 status during the COVID-19 pandemic

	COVID-19 (-) (n = 57)	COVID-19 (+) (n = 39)	P
Age – years	61.3±10.8	64.9±12.9	0.14
Male – number (%)	44 (77.2)	25 (64.1)	0.16
Hypertension – number (%)	40 (70.1)	23 (59.0)	0.26
Diabetes – number (%)	23 (40.3)	15 (38.4)	0.85
Dyslipidemia – number (%)	13 (22.8)	7 (17.9)	0.57
Smoker – number (%)	25 (43.9)	13 (33.3)	0.30
Index event			
STEMI – number (%)	34 (59.6)	11 (28.2)	< 0.01
Median S-to-FMC time (IQR) – hours*	6.0 (2.0-24.0)	3.0 (2.0-10.0)	0.54
STEMI late presentation – number (%)	17 (50.0)	3 (27.3)	0.19
Systemic thrombolysis – number (%)	3 (8.8)	2 (18.1)	0.98
Multivessel disease - number (%)	26 (45.6)	7 (17.9)	< 0.01
Left main coronary disease - number (%)	5 (8.8)	3 (7.7)	0.85
MINOCA	4 (7.0)	25 (64.1)	< 0.01
Intracoronary thrombi – number (%)	11 (19.3)	21 (53.8)	< 0.01
Median D-to-D time (IQR) – hours†	4.0 (3.0 – 11.0)	3.0 (1.5 – 5.0)	0.49
TIMI 3 flow after PCI – number (%)	44 (77.2)	7 (17.9)	< 0.01
No-reflow – number (%)	6 (10.5)	8 (20.5)	0.17
Cardiogenic shock presentation – number (%)	16 (28.1)	3 (7.7)	0.03
LVEF – %	48 ± 12	43 ± 14	< 0.01
LVEF ≤ 40% – number (%)	14 (24.6)	22 (56.4)	< 0.01
Maximal hs-cTnI – pg/ml	4992 ± 3467	13012 ± 9667	< 0.01
Complications			
Overall deaths within 30 days – number (%)	7 (12.3)	12 (30.8)	0.02
CV deaths within 30 days – number (%)	7 (12.3)	5 (12.8)	0.72
Mechanical complications – number (%)	8 (14.0)	2 (5.1)	0.16

*In patients with STEMI. †In patients with STEMI, excluding thrombolysis.

Table 4. Univariate analyses for predictors of 30-day overall and cardiovascular mortality in patients with AMI during the COVID-19 pandemic

Variable	Overall mortality Risk ratio (95% CI)	CV mortality Risk ratio (95% CI)
STEMI	1.56 (0.63 – 3.87)	12.42 (1.60 – 96.25)
STEMI late presentation	2.33 (0.68-7.95)	2.33 (0.68-7.95)
MINOCA	2.36 (0.96-5.80)	1.91 (0.61-6.02)
Multivessel disease	1.60 (0.58 – 4.44)	1.16 (0.35 – 3.85)
Coronary thrombosis	3.19 (1.28 – 7.93)	3.32 (1.05 – 10.47)
COVID-19 positive status	2.90 (1.14 – 7.36)	1.24 (0.39 – 3.90)
LVEF ≤ 40%	11.18 (3.3 – 38.5)	6.52 (1.76 – 24.14)
Cardiogenic shock	15.7 (5.6 – 44.2)	66.2 (8.5 – 518.4)

Discussion

We observed a 67.5% reduction in AMI referrals to our cardiac catheterization laboratory. Prior reports described reductions in admissions for AMI and/or cardiac catheterization laboratory activations for STEMI, ranging between 31 and 53[7-13]. The Latin American Society of Interventional Cardiology (SOLACI), compared two week periods before and after quarantine within 2020, reporting a decrease in coronary angiography and PCI for STEMI of 55.7% and 51.2%, respectively[6]. Data from Chilean centers showed reductions of coronary angiography for STEMI of 45.3%[6]. Toro et al. revealed no drops in AMI cases seen at emergency departments during the first two months of the COVID-19 pandemic compared to previous years[17]. Our study considers a longer period of the first pandemic wave in Chile, during which the number of COVID-19 cases increased, large-scale lockdowns were implemented and healthcare system strains ensued[18].

The decrease in admissions for AMI constitutes a matter of concern. The limited access to early reperfusion and medical treatment will likely result in an increase of cardiovascular mortality. The decrease in AMI consultations could be partially responsible for the rise of out-of-hospital cardiac arrests during the COVID-19 outbreak[19-21].

In regard to patients transferred for cardiac catheterization for AMI, during the pandemic period we noticed an increase in S-to-FMC and late presentations for STEMI. We also observed a 10-fold increase in the proportion of patients with S-to-FMC > 24 hours for NSTEMI. Most studies concerning S-to-FMC suggest an increase in S-to-FMC for STEMI. Tam et al, described a significant increase in S-to-FMC for STEMI patients in Hong Kong, with median values of 318 minutes during the pandemic (n = 7) versus 82 minutes prior to the pandemic (n = 108)[22]. Wilson et al (n = 388), described a 3-fold increase in late presentation for STEMI in London (34.1% during COVID-19 vs 10.4% before COVID-19).[23] Trabattoni et al, reported 41% of STEMI patients consulting after 24 hours of symptoms-onset compared to 20% during the prior year[24]. Braiteh et al, described 36.4% of NSTEMI patients had > 24 hours of S-to-FMC during the outbreak compared to 27.1% in 2019 at a single center study in New York (p = 0.03)[25]. Primessnig et al, in a single-center study from Germany, described > 20% increase in STEMI late presentation and NSTEMI S-to-FMC > 24 hours during the early COVID-19 outbreak[26].

Fear of infection, delays in medical attention and misled altruism, have been suggested as possible explanations to reduced admissions for AMI, increase in S-to-FMC and late AMI presentations[7,27-29].

During the COVID-19 outbreak, we observed a significant increase in D-to-D times. No relevant differences regarding D-to-D times have been reported in European and Chinese healthcare centers[7,22,30-32]. In a survey by SOLACI, 58.2% Latin-American centers signaled delays to reperfusion in STEMI patients[6]. Regional

differences could be explained by availability of systemic thrombolysis or cardiac catheterization laboratories, and transportation limitations. There were no changes in cardiac catheterization availability for STEMI patients at our center, neither increases in systemic thrombolysis performance in our population during the pandemic period. Delays in D-to-D time in our center were probably secondary to deficiencies in transportation. Preliminary information on ambulance transfers from our Health Service, showed a 4.4% reduction in overall transfers and 12.8% reduction in interfacility transfers during COVID-19 outbreak[33]. Possible reasons for transfer decline include limited number of ambulances, personnel shortages and disinfection protocols. No official data regarding ambulance response times was available.

Patients had more severe presentations of AMI during the COVID-19 outbreak, shown by the higher troponin values and greater incidence of significant left ventricular systolic dysfunction. These markers had been previously described by other groups and associated mainly to delays in reperfusion[26,29,34]. Primessnig et al, suggested that an increase in the prevalence of CS was mostly associated to delayed reperfusion therapy for AMI[26]. In our study, CS was more prevalent in the C19(N) patients, probably due to the higher prevalence of STEMI with delayed reperfusion therapy in this subgroup.

C19(P) patients exhibited a greater incidence of intracoronary thrombi, reduced TIMI flow and a tendency towards no reflow phenomena, probably related to the prothrombotic state induced as part of the inflammatory response to COVID-19. Higher thrombus burden, reduced TIMI flow at procedural ending and increase use of thrombus aspiration devices use have been previously associated to COVID-19 positivity in STEMI patients[31,35].

We observed an increase in 30-day overall and cardiovascular mortality for AMI during COVID-19 pandemic, similar to AMI mortality rates documented in Chile in the early 1980s[37]. Trabattoni et al, described an in-hospital mortality for AMI of 38% during the COVID-19 outbreak versus 10% during the same time period in 2019 in Italy[24]. An Italian multicenter study of STEMI patients with C19(P) status exhibited greater mortality among STEMI patients (28.6% vs 11.9%, $p < 0.05$)[10]. A retrospective study in STEMI patients from pan-London heart attack group, showed C19(P) patients had higher mortality compared to COVID-19 negative patients undergoing primary PCI (21.7% vs 9.3%, OR 2.72; 95% CI 1.25-5.82)[31]. In our study COVID-19 positivity was an independent predictor of 30-day overall mortality in AMI patients, albeit not of cardiovascular mortality, as half of patients from COVID-19 group experienced deaths related to the development of acute respiratory distress syndrome. Multicentric data from the National Health Service, showed no evident differences of in-hospital mortality of patients admitted for AMI between January and May of 2020 and the same period of 2019[38]. Unfortunately, the British studies do not report 30-day overall or cardiovascular mortality rates, and comprise a period with proportionally less new C19(P) cases and perhaps less strain towards the healthcare system[31,38]. In the United States, marked increases in cardiovascular mortality due to ischemic heart disease were reported in C19(N) patients in states that experienced the early surges of COVID-19. This was not observed in states with later surges in COVID-19 cases[39].

Limitations

Considering that this is a single-center observational experience, our results may not be generalized to other regions. Following discharge after the procedures performed at the cardiac catheterization laboratory, most patients returned to their referral hospitals to continue monitorization and care. Symptom onset could have been imprecisely reported by patients, and was registered as approximate hours in our registries. Patients with AMI with non-obstructive coronary artery disease underwent intravascular imaging according to operator criteria, and cardiac magnetic resonance was not performed to address COVID-19 associated myocarditis or stress-induced cardiomyopathy as differential diagnosis. Analyses for independent predictors of adverse outcomes could be better addressed through multicentric registries.

Conclusions

COVID-19 pandemic had detrimental consequences over AMI treatment access and prognosis. During the COVID-19 pandemic we observed a

reduction in AMI referrals for cardiac catheterization, delays in presentation to medical attention and access to treatment, higher incidence of CS and mechanical complications, and worse survival at 30 days compared to the previous year. C19(P) patients had a greater incidence of NSTEMI, and higher overall and non-cardiovascular mortality associated to the infection. C19(N) patients had a greater incidence of STEMI and CS.

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