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Clinical Research

Two-year prognosis of acute coronary syndrome during the first wave of the coronavirus disease 2019 pandemic[☆]

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A B S T R A C T

Background: The first wave of the coronavirus disease 2019 pandemic significantly changed behaviour in terms of access to healthcare.
Aim: To assess the effects of the pandemic and initial lockdown on the incidence of acute coronary syndrome and its long-term prognosis.
Methods: Patients admitted for acute coronary syndrome from 17 March to 6 July 2020 and from 17 March to 6 July 2019 were included. The number of admissions for acute coronary syndrome, acute complication rates and 2-year rates of survival free from major adverse cardiovascular events or death from any cause were compared according to the period of hospitalization.
Results: In total, 289 patients were included. We observed a 30 ± 3% drop in acute coronary syndrome admissions during the first lockdown, which did not recover in the 2 months after it was lifted. At 2 years, there were no significant differences in the combined endpoint of major adverse cardiovascular events or death from any cause between the different periods ($P = 0.34$). Being hospitalized during lockdown was not predictive of adverse events during follow-up (hazard ratio 0.87, 95% confidence interval 0.45–1.66; $P = 0.67$).
Conclusions: We did not observe an increased risk of major cardiovascular events or death at 2 years from initial hospitalization for patients hospitalized during the first lockdown, adopted in March 2020 in response to the coronavirus disease 2019 pandemic, potentially as a result of the lack of power of the study.

1. Abbreviations

ACS	acute coronary syndrome
CI	confidence interval
COVID-19	coronavirus disease 2019
GRACE	Global Registry of Acute Coronary Events
HR	hazard ratio
LVEF	left ventricular ejection fraction
MACE	major adverse cardiovascular events
NSTEMI	non-ST-segment elevation myocardial infarction
OR	odds ratio
SAMU	Emergency Medical Assistance Service
STEMI	ST-segment elevation myocardial infarction

☆ Tweet: we did not observe an increased risk of major cardiovascular events or death at 2 years from initial hospitalization for patients hospitalized during the first lockdown adopted in March 2020 in response to the COVID-19 pandemic.

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2. Introduction

Hauts-de-France was particularly affected during the "first wave" of the coronavirus disease 2019 (COVID-19) pandemic, with up to 583 patients hospitalized in intensive care units for COVID-19 on 7th April 2020 in a region that usually has 452 critical care beds [1,2].

Amiens University Hospital is one of two percutaneous coronary intervention centres in the Somme, and handles most cases of acute coronary syndrome (ACS) in the department, which has 570,000 inhabitants.

Several studies showed a drop in ACS admissions of between 20% and 40% during the first weeks of the first lockdown [3–9]. In addition, several studies showed longer delays in ACS management, mainly as a result of an increase in the time before calling for help, resulting in a longer duration of myocardial ischaemia [3,10,11]. More mechanical or rhythmic complications were reported for certain patients [3,10,12], with higher mortality in the acute phase [9,10,13]. However, longer-term morbidity and mortality data are not available for the population hospitalized during this specific lockdown period.

We therefore aimed to analyse the 2-year prognoses of patients hospitalized at Amiens University Hospital for an acute myocardial infarction during the first national lockdown, by comparing them with those of patients hospitalized in the following 6 weeks and during the same periods of the previous year.

The secondary objectives were to establish and compare the rates of ACS, as well as the rates of in-hospital complications (major adverse cardiovascular events [MACE] or death).

3. Methods

3.1. Study design

This was a single-centre retrospective study that included all patients admitted to the cardiac intensive care unit or the intensive care unit of Amiens University Hospital for an ACS–ST-segment elevation myocardial infarction (STEMI) or non-ST-segment elevation myocardial infarction (NSTEMI) – who had coronary angiography during the following four periods: "Period 1" from 17 March to 11 May 2020 (first national lockdown); "Period 2" from 12 May to 06 July 2020 (post lockdown); "Period 3" from 17 March to 11 May 2019; and "Period 4" from 12 May to 06 July 2019.

The study protocol conformed to the ethical guidelines of the 1975 Declaration of Helsinki. In accordance with French legislation on studies of routine clinical practice, the study protocol was approved by a hospital committee with expertise in studies not requiring approval by an institutional review board. Furthermore, the study database was registered with the French National Data Protection Commission (Commission nationale de l'informatique et des libertés [Paris, France]; reference: PI2021_843_0099).

3.2. Study population

All consecutive patients hospitalized with ACS who had coronary angiography during Periods 1, 2, 3 or 4 were eligible.

Patients were admitted to the cardiac intensive care unit or intensive care unit via the SAMU (Emergency Medical Assistance Service), or came from other departments of Amiens University Hospital, as well as from hospitals in the Somme Littoral Sud Hospital Group that did not have the technical platform for angiography and coronary angioplasty.

The exclusion criteria were angiography invalidating the diagnosis (stress cardiomyopathy, myocardial infarction with no obstructive coronary arteries), the absence of troponin elevation (unstable angina), periprocedural myocardial infarction during elective percutaneous coronary intervention, < 18 years of age and refusal to participate in the study.

All patients in Periods 1 and 2 were screened for COVID-19 infection.

ACS met the fourth universal definition of myocardial infarction [14]. STEMI [15] and NSTEMI [16] were classified according to European Society of Cardiology recommendations.

3.3. Endpoints and data collected

The primary endpoint was a composite of the occurrence of MACE (recurrent ACS, urgent revascularization, hospitalization for heart failure, stroke) or death from any cause during follow-up. Heart failure was defined as a clinical syndrome characterized by typical symptoms (e.g. breathlessness or fatigue) and/or signs (e.g. ankle swelling, elevated jugular venous pressure, pulmonary crackles and peripheral oedema) [17]. Stroke was defined as an episode of neurological dysfunction caused by focal cerebral, spinal or retinal infarction [18].

The secondary endpoints were the number of weekly admissions for STEMI or NSTEMI, the occurrence of a mechanical and/or rhythmic complication in the acute phase (acute pulmonary oedema, sustained ventricular tachycardia, ventricular fibrillation, cardiorespiratory arrest, high-grade atrioventricular block, atrial fibrillation, acute ischaemic mitral regurgitation, tamponade, ventricular septal defect, right ventricular infarction, cardiogenic shock, stent thrombosis, left ventricular thrombus or stroke) and in-hospital death.

Other data collected were the nature of the first medical contact, the time from first symptoms to first medical contact, the time from first symptoms to revascularization, the mode of revascularization, patient severity at admission and during hospitalization (Killip class, SAPS II score [Simplified Acute Physiology Score] and GRACE 2.0 score [Global Registry of Acute Coronary Events]), haemodynamic and/or respiratory support, biological variables (low-density lipoprotein cholesterol, glycated haemoglobin, creatinine and troponin), left ventricular ejection fraction and length of hospital stay.

Troponin values are expressed relative to the upper laboratory standard rather than as an absolute value because of a change in the assay between 2019 and 2020 and differences in standards between centres.

3.4. Follow-up

All patients were scheduled to have a consultation at Amiens University Hospital at 3 months and 1 year; they were then followed by their treating cardiologist, if they requested this, or they continued to be followed at Amiens University Hospital every 6 months. The treating cardiologists were contacted by telephone and interviewed to collect data about their patients' follow-up. Patients were systematically examined clinically and had an electrocardiogram. The vital status of each patient was checked in August 2022 in the French Public Database of Deaths.

3.5. Statistical analysis

Continuous variables are expressed as means ± standard deviations or medians [interquartile ranges] for normally and non-normally distributed data, respectively, and were compared using Student's *t* test, analysis of variance (ANOVA), the Kruskal-Wallis H test or the Mann-Whitney-Wilcoxon test, as appropriate. Normality was checked using the Shapiro-Wilk test. Categorical variables are expressed as frequencies (percentages) and were compared using the χ^2 test or Fisher's exact test. We performed interperiod comparisons using Bonferroni's correction for variables

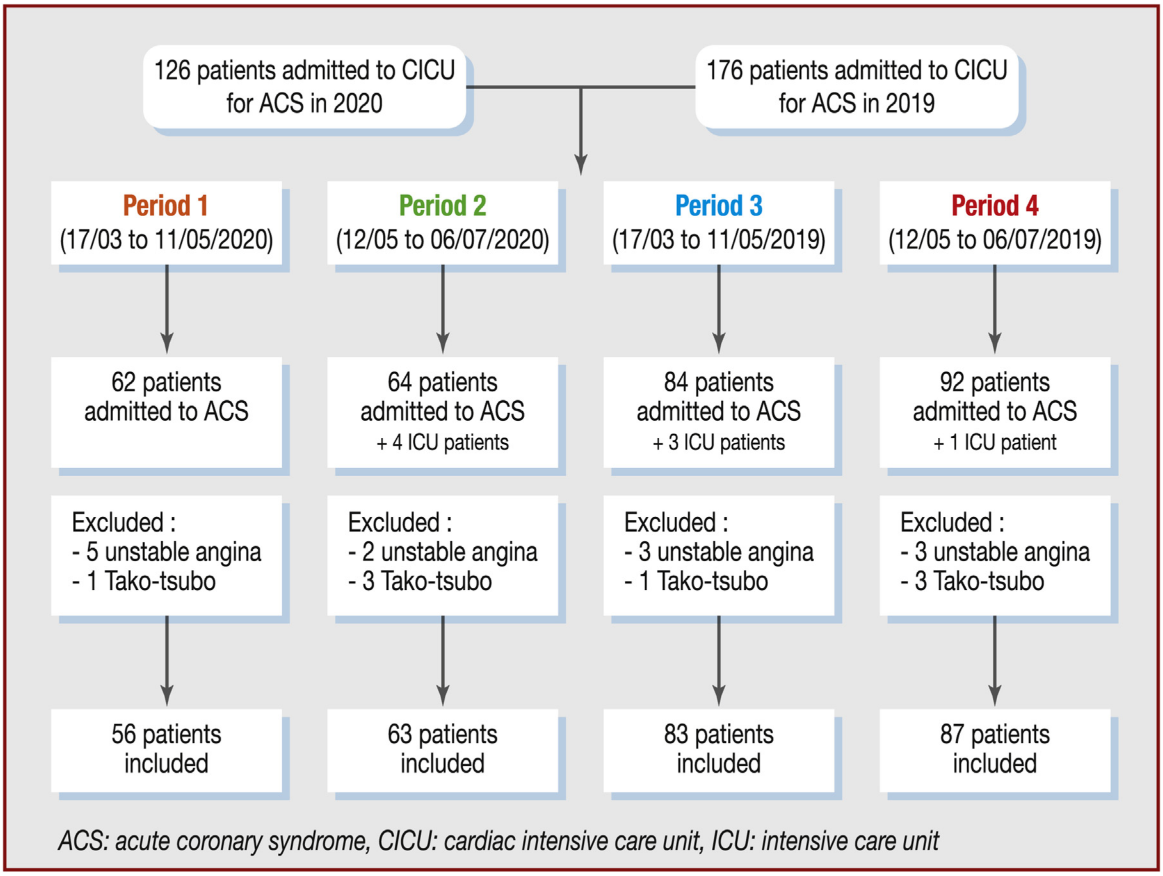


Fig. 1. Flow chart (ACS: acute coronary syndrome; CICU: cardiac intensive care unit; ICU: intensive care unit).

with $P < 0.10$. We added a footnote “a” when the interperiod comparison with Period 1 had a P value < 0.05.

Comparisons were made between patients from Period 1 and Period 3.

Logistic regression was applied to identify factors predictive of in-hospital complications. The cumulative probability of event survival was estimated using the Kaplan-Meier method. Survival curves were compared using the log-rank test.

Cox proportional hazard models were used to identify factors associated with the occurrence of combined criteria, with an estimation of the hazard ratio (HR) and its 95% confidence interval (CI). All patients were included in this analysis, except those who died during the initial hospitalization.

All tests were two-tailed, and the threshold for statistical significance was set at $P < 0.05$. All statistical analyses were performed using SPSS for Windows software, version 22.0 (SPSS Inc., Chicago, IL, USA).

The only missing data concerned low-density lipoprotein cholesterol (10%), glycated haemoglobin (12%) and troponin (5.5%) concentrations.

If we had conducted this study prospectively, 191 events would have been needed to show an augmentation in MACE/death rates of 50% (HR 1.50) between patients hospitalized during lockdown (Period 1) versus the same period in 2019 (Period 3).

4. Results

4.1. Study population

In total, 310 patients were eligible (302 cardiac intensive care unit patients, eight intensive care unit patients). Thirteen patients were excluded for unstable angina, and eight for stress cardiomyopathy. Finally, 289 patients were included: 119 (41%) for 2020 and 170 (59%) for 2019. The distribution between the four periods was 56 patients in Period 1, 63 patients in Period 2, 83 patients in Period 3 and 87 patients in Period 4 (Fig. 1). There were no significant differences between the four study populations in terms of age, sex or history (Table 1). Only 4% of hospitalized patients were positive for COVID-19 during Period 1, and none during Period 2.

4.2. ACS admission rate

A 30 ± 3% drop in ACS hospitalizations was recorded in 2020 versus 2019. Weekly admissions for myocardial infarction decreased significantly in 2020 relative to 2019 (7.4 ± 1.9 vs 10.6 ± 2.4; $P < 0.001$) (Fig. 2), and there was a higher proportion of STEMI than NSTEMI during Period 1 (lockdown) (Table 1 and Fig. 3).

4.3. Time to treatment

The first medical contact was mostly made by the SAMU, then by the emergency department and the general practitioner, with no significant differences between the periods (Table 2). The time between first symptoms and first medical contact was > 24 hours for 27% of patients in Period 1 versus 7% in the same period in 2019 (Period 3) ($P < 0.05$). The time in minutes from first symptoms to first medical contact and from symptoms to revascularization (thrombolysis and/or coronary angiography) tended to be longer in the STEMI subgroup during the first lockdown (Period 1) compared with the other periods, but the differences were not statistically significant (Fig. 4 and Table A.1).

Table 1
Patient characteristics according to the period of hospitalization.

ACS admissions	Period 1 (17 March to 11 May 2020) 56	Period 2 (12 May to 06 July 2020) 63	Period 3 (17 March to 11 May 2019) 83	Period 4 (12 May to 06 July 2019) 87	*P*
STEMI	36 (64)	30 (48)	44 (53)	47 (54)	0.33
NSTEMI	20 (36)	33 (52)	39 (47)	40 (46)	
Male sex	37 (66)	42 (67)	56 (67)	55 (63)	0.94
Age (years)	61.0 [53.25–72.75]	69.0 [55.0–80.0]	65.0 [54.0–76.0]	65.0 [55.0–75.0]	0.37
Medical history					
BMI (kg/m^2)	25.9 [23.4–29.3]	27.1 [24.4–30.3]	26.3 [23.6–29.3]	26.5 [23.4–30.2]	0.67
Hypertension	30 (54)	37 (59)	49 (59)	53 (61)	0.85
Diabetes	11 (20)	19 (30)	25 (30)	36 (41)[a]	**0.05**
Dyslipidaemia	17 (30)	28 (44)	30 (36)	41 (47)	0.17
Smoking					0.95
Active	20 (36)	20 (32)	28 (34)	25 (29)	
Cessation	15 (27)	16 (25)	18 (22)	23 (26)	
Stroke	5 (9)	8 (13)	10 (12)	8 (9)	0.85
PAD	6 (11)	12 (19)	11 (13)	12 (14)	0.61
Myocardial infarction	10 (18)	8 (13)	12 (15)	13 (15)	0.89
CABG	2 (4)	1 (2)	7 (8)	1 (1)	0.06
Coronary angioplasty	7 (13)	8 (13)	13 (16)	13 (15)	0.93
Renal function					0.53
GFR > 90 mL/min/1.73m^2	36 (65)	34 (55)	53 (65)	62 (71)	
GFR 60–90 mL/min/1.73m^2	15 (27)	17 (28)	14 (17)	13 (15)	
GFR 30–60 mL/min/1.73m^2	3 (6)	9 (15)	13 (16)	10 (12)	
GFR 15–30 mL/min/1.73m^2	1 (2)	0	1 (1)	1 (1)	
GFR < 15 mL/min/1.73m^2	0 (0)	1 (2)	1 (1)	1 (1)	
Chronic lung disease	3 (5)	4 (6)	4 (5)	7 (8)	0.84
Previous treatment					
Beta-blocker	14 (25)	18 (29)	22 (27)	26 (30)	0.92
ACE inhibitor or ARB	16 (29)	23 (37)	28 (34)	35 (40)	0.54
Aldosterone antagonist	4 (7)	3 (5)	2 (2)	5 (6)	0.60
Statin	15 (27)	16 (25)	22 (27)	27 (31)	0.87
Aspirin	9 (16)	19 (30)	20 (24)	23 (26)	0.33
$P2Y_{12}$ inhibitor	5 (9)	8 (13)	4 (5)	10 (12)	0.34
Biology					
LDLc (g/L)	1.33 [0.86–1.64]	1.25 [0.80–1.51]	1.19 [0.84–1.54]	1.23 [0.91–1.56]	0.81
HbA1c (%)	5.6 [5.2–6.0]	5.8 [5.5–7.0]	5.8 [5.4–6.6]	6.1 [5.7–7.1][a]	< 0.001
Creatinine (μmol/L)	74.0 [63.0–82.7]	80.0 [62.0–95.2]	74.0 [63.0–100.0]	75 [58.0–94.0]	0.65
Troponin elevation (10 × N)	55.0 [18.6–168.7]	25.1 [9.0–71.4][a]	49.8 [8.2–125.1]	48.2 [15.2–120.7]	0.04

Data are expressed as number, number (%) or median [interquartile range]. ACE: angiotensin-converting enzyme; ACS: acute coronary syndrome; ARB: angiotensin receptor blocker; BMI: body mass index; CABG: coronary artery bypass graft; GFR: glomerular filtration rate; HbA1c: glycated haemoglobin; LDLc: low-density lipoprotein cholesterol; N: upper limit; NSTEMI: non-ST-segment-elevation myocardial infarction; PAD: peripheral arterial disease; STEMI: ST-segment-elevation myocardial infarction.
[a] $P < 0.05$ versus Period 1 (interperiod comparison, Bonferroni correction).

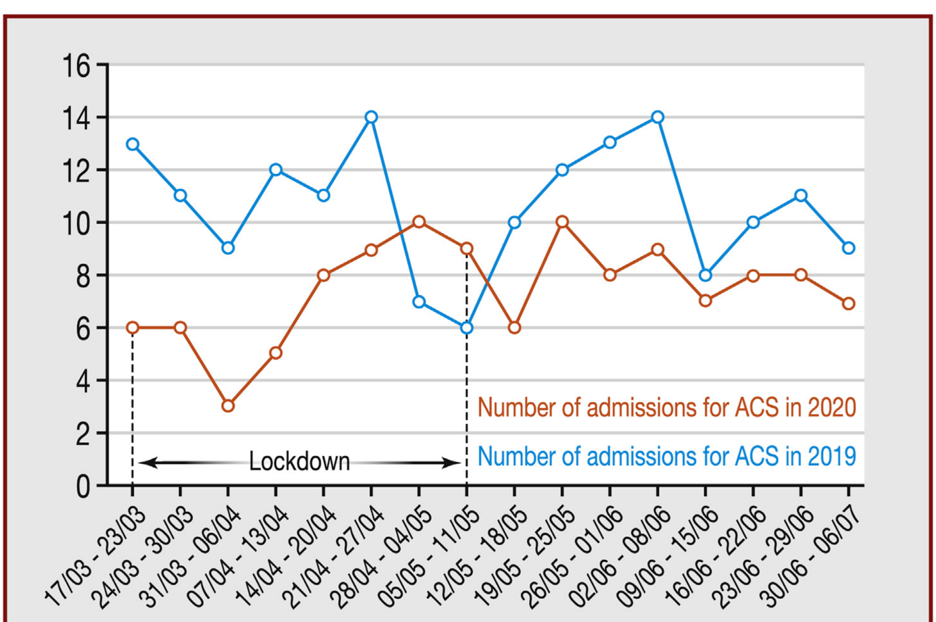


Fig. 2. Number of admissions for acute coronary syndrome (ACS) at Amiens University Hospital during and after the first lockdown in 2020 and during the same period in 2019. The grey and black curves represent the number of patients with ACS admitted per week between 17 March and 06 July in 2019 and 2020, respectively.

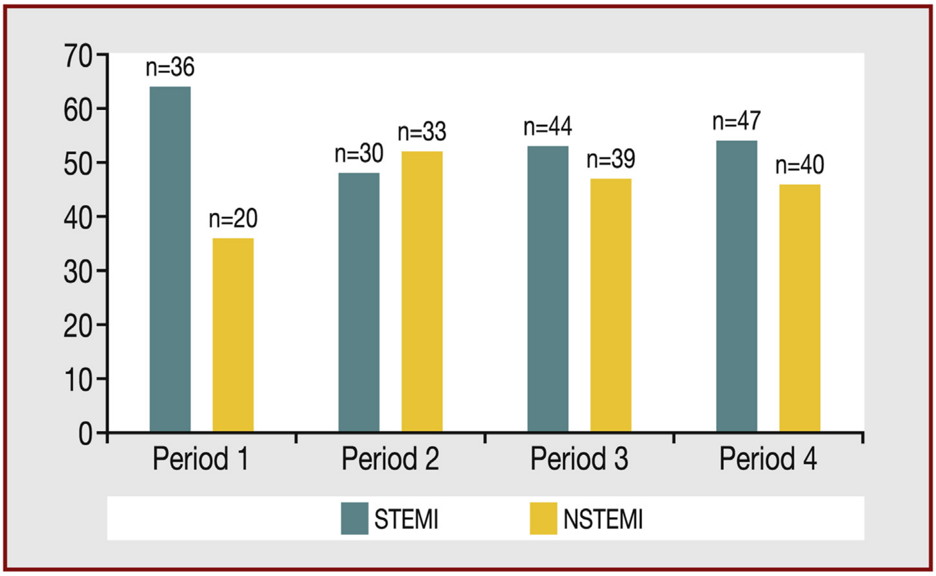


Fig. 3. Proportions of ST-segment-elevation myocardial infarction (STEMI) and non-ST-segment-elevation myocardial infarction (NSTEMI) according to the period of hospitalization.

Table 2
Nature of first medical contact, time between first symptoms and first medical contact, and revascularization strategy.

	Period 1 (17 March to 11 May 2020) (n = 56)	Period 2 (12 May to 06 July 2020) (n = 63)	Period 3 (17 March to 11 May 2019) (n = 83)	Period 4 (12 May to 06 July 2019) (n = 87)	P
Nature of first medical contact					0.85
General practitioner	13 (23)	11 (18)	16 (19)	15 (17)	
SAMU	25 (45)	26 (42)	35 (42)	34 (39)	
Emergency doctor	15 (27)	22 (35)	27 (32)	34 (39)	
Hospital doctor	2 (4)	3 (5)	5 (6)	4 (5)	
Specialist doctor (consultation)	1 (2)	0	0 (0)	0	
Initial presentation					0.002
Time between first symptoms and first medical contact > 24 hours	15 (27)	20 (32)	6 (7)[a]	16 (19)	
Initial presentation as cardiorespiratory arrest	6 (11)	2 (3)	11 (13)	8 (9)	0.22
Revascularization strategy					0.63
Medical treatment alone	7 (12)	8 (13)	12 (14)	13 (15)	
Thrombolysis	1 (2)	1 (2)	0 (0)	0	
Thrombolysis and rescue angioplasty	1 (2)	2 (3)	5 (6)	3 (3)	
Primary angioplasty	46 (82)	51 (82)	62 (75)	68 (80)	
Coronary bypass	1 (2)	0	4 (5)	1 (1)	

Data are expressed as number (%). SAMU: Emergency Medical Assistance Service.
[a] $P < 0.05$ versus Period 1 (interperiod comparison, Bonferroni correction).

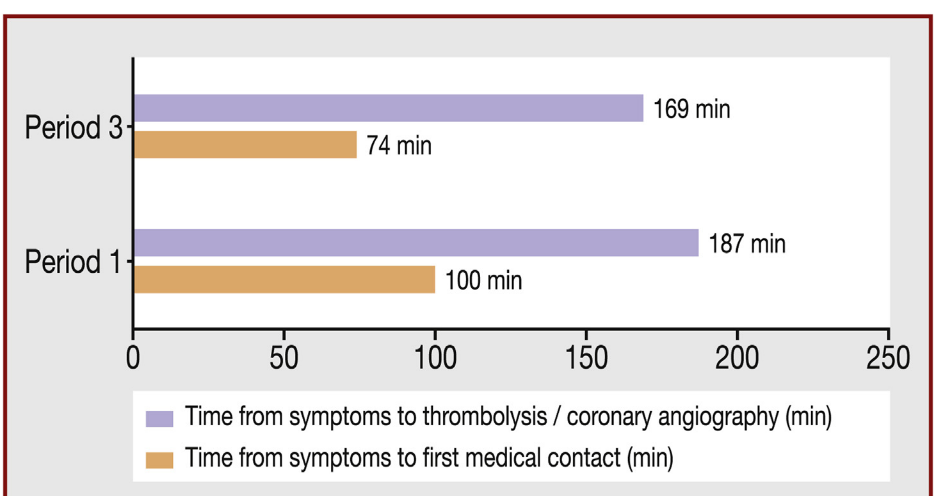


Fig. 4. Time to management of ST-segment-elevation myocardial infarction by period.

Table 3
Number of major adverse cardiovascular events and all-cause deaths during follow-up.

	Period 1 (17 March to 11 May 2020) (*n* = 52)	Period 2 (12 May to 06 July 2020) (*n* = 61)	Period 3 (17 March to 11 May 2019) (*n* = 74)	Period 4 (12 May to 06 July 2019) (*n* = 83)
MACE				
Myocardial infarction	1 (2)	5 (8)	4 (5)	7 (8)
Urgent revascularization	5 (10)	1 (1.5)	2 (3)	4 (5)
Heart failure	2 (4)	3 (5)	5 (7)	7 (8)
Stroke	1	2 (3)	1 (1)	2 (2)
Total	9 (17)	11 (18)	12 (16)	20 (24)
Death	2 (4)	5 (8)	7 (9)	11 (13)
Estimated 2-year survival (%) [confidence interval]	81 [75–86]	79 [73–84]	83 [79–88]	73 [68–78]

Data are expressed as number (%). ACS: acute coronary syndrome, ICD: implantable cardioverter defibrillator, MACE: major adverse cardiovascular events.

4.4. Acute phase complications

Patient severity at admission, estimated by Killip class, GRACE 2.0 score and IGS II score (Index de Gravité Simplifié [Simplified Severity Index]), showed no differences between groups. In addition, there was no more respiratory or circulatory support during lockdown compared with the other periods.

The length of stay in intensive care was significantly longer during lockdown than during the other periods, with no difference in the total length of stay.

The period of hospitalization was not shown to be a predictor of intrahospital complications ($P = 0.45$). In contrast, an initial presentation of STEMI (odds ratio [OR] 1.9, 95% CI 1.1–3.3; $P = 0.02$) or cardiopulmonary arrest (OR 31, 95% CI 9–106; $P < 0.05$) as well as time from first symptoms to first medical contact of > 24 hours (OR 5, 95% CI 1.5–17; $P = 0.009$) were predictive of complications (MACE or death).

4.5. Follow-up

After the initial hospitalization, 270 patients were alive, and 25 patients died during follow-up. A follow-up of at least 24 months was possible for 223 of the 245 remaining patients (91%). The median duration of follow-up was 26 months [interquartile range 25–34 months].

The numbers of events that occurred during follow-up according to the initial period of hospitalization are summarized in Table 3.

At 2 years, there were no significant differences in the occurrence of the composite endpoint (MACE and death from any causes) between the different periods ($P = 0.34$) (Fig. 5). Two-year rates of survival free of occurrences of the composite endpoint, estimated by the Kaplan-Meier method, were 81% (95% CI 75–86%) for hospitalizations during Period 1 (lockdown), 79% (95% CI 73–84%) for those during the following 6 weeks (Period 2), 83% (95% CI 79–88%) for those during Period 3 (2019) and 73% (95% CI 68–78%) for those during Period 4 (2019). Of note, there were also no significant differences in the occurrence of death from any cause between the different periods ($P = 0.57$) (Fig. A.1).

In univariate analysis (Table 4), being hospitalized for ACS during confinement was not found to be a predictive factor for the occurrence of the composite endpoint (MACE or death from any cause) during follow-up (HR 0.87, 95% CI 0.45–1.66; $P = 0.67$).

Independent factors associated with the occurrence of an event during follow-up (multivariable analysis including age, hypertension, diabetes, dyslipidaemia, history of myocardial infarction, left ventricular ejection fraction, left main artery lesion, in-hospital complications and peak troponin) were age (HR 1.05, 95% CI 1.02–1.07; $P < 0.001$, per 1-year increase), diabetes (HR 1.81, 95% CI 1.01–3.23; $P = 0.05$), dyslipidaemia (HR 1.97, 95% CI 1.06–3.68; $P = 0.03$), previous myocardial infarction (HR 2.86, 95% CI 1.56–5.23; $P = 0.001$) and peak troponin (HR 1.003, 95% CI 1.001–1.005; $P = 0.001$, per $10 \times$ upper limit increase).

5. Discussion

We did not observe an increased risk of MACE or all-cause death 2 years after the initial ACS when it occurred during the first lockdown, despite a longer time to first medical contact, with more patients seen > 24 hours after the onset of symptoms. This result could arise from a lack of statistical power. We confirm a significant drop in ACS admissions of approximately 30%, which showed no rebound in the 6 weeks after confinement. We did not find an increased risk of mechanical or rhythmic complications in the acute phase of an episode of ACS declared during lockdown.

5.1. Epidemiology

As for all the data in the literature [3–9,19], we observed a drop in the number of ACS admissions of approximately 30% during the March 2020 lockdown. There are several possible explanations for this phenomenon.

First, during the first strict lockdown, air pollution decreased significantly in Asia, Europe and the USA (notably fewer fine particles and nitrogen dioxide) [20–23]. In the Amiens region, the concentration of nitrogen dioxide in the air decreased by 69% during lockdown (Period 1) relative to the same period in 2019 (Period 3), and that of PM10 decreased by 12% [24]. The association between air pollution (nitrogen dioxide concentration and fine particles [PM2.5 and PM10]) and the occurrence of myocardial infarction has been demonstrated [20,25]. Part of the drop in ACS may be related to this phenomenon.

Second, physical activity during lockdown was reduced [26], which could explain the decrease in the incidence of ACS, as sport has already been identified as a factor that favours the occurrence of a myocardial infarction within an hour of its practice [27]. Psychological stress, a short-term factor that also correlates with the occurrence of acute coronary events [28], also decreased for some: teleworking, less daily stress and the exodus of city dwellers to regions deemed more "soothing". This specific element must be weighed against the results of other studies reporting greater anxiety or depressive symptoms during the first weeks of lockdown [29].

The decrease in air pollution and physical and psychological stress may truly explain the decrease in the incidence of ACS in the general population. However, other information suggests that the incidence remained similar, but with patients not consulting. Indeed, the fear of visiting a hospital and being infected by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was highlighted by Schmitz et al. [8] in a German registry. Ciofani et al. [30] also showed that Internet searches for "chest pain" increased significantly during the pandemic, which may indicate a tendency towards self-diagnosis in the population. There may, therefore, have been a number of undiagnosed or overdiagnosed cases of ACS, as indicated by an increase in the number of out-of-hospital

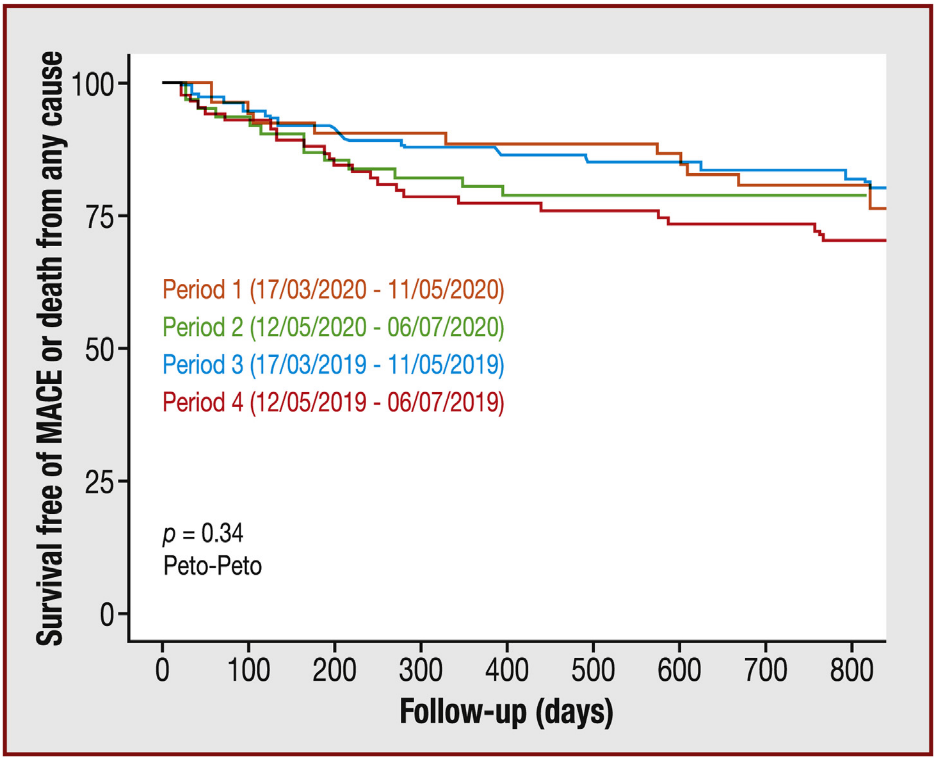


Fig. 5. Cumulative survival free of major adverse cardiovascular events (MACE) or death from any cause (Kaplan-Meier).

Table 4
Univariate analysis of event occurrence (major adverse cardiovascular events and death) during follow-up.

Variables	Patients without events (n = 205; 76%)	Patients with events (n = 65; 24%)	HR	95% CI	P
Age (years)	62.0 [53.0–72.0]	74.0 [65.0–82.5]	1.06	1.04–1.08	< 0.001
Male sex	138 (67)	40 (61)	1.28	0.76–2.13	0.33
Hospitalization during lockdown	41 (20)	11 (17)	0.87	0.45–1.66	0.67
Time from first symptoms to first medical contact > 24 hours	39 (19)	17 (27)	1.54	0.88–2.69	0.13
Initial presentation as STEMI	112 (55)	30 (46)	0.70	0.43–1.14	0.16
Dyslipidaemia	67 (33)	42 (65)	3.40	2.04–5.65	< 0.001
Diabetes	49 (24)	35 (54)	3.32	2.03–5.41	< 0.001
Hypertension	102 (50)	55 (85)	4.82	2.46–9.47	< 0.001
BMI (kg/m^2)	26.3 [23.5–29.8]	26.6 [23.8–28.9]	0.98	0.94–1.03	0.55
History of PAD	18 (9)	18 (28)	3.17	1.84–5.47	< 0.001
History of stroke	17 (8)	10 (15)	1.85	0.94–3.62	0.07
History of myocardial infarction	18 (9)	21 (32)	3.61	2.14–6.07	< 0.001
Previous coronary angioplasty	18 (9)	19 (29)	3.14	1.84–5.36	< 0.001
Peak troponin (10 × N)	33.6 [9.0–89.2]	60.2 [18.0–145.8]	1.002	1–1.003	0.014
Left ventricular ejection fraction (%)	50.0 [45.0–55.0]	40.0 [30.0–50.0]	0.95	0.93–0.97	< 0.001
GRACE 2.0 score	108.0 [86.5–137.0]	149.0 [121.5–168.0]	1.02	1.01–1.02	< 0.001
IGS II score	20.0 [13.0–24.0]	27.0 [22.0–33.0]	1.02	1.005–1.03	0.004
Left main lesion	14 (7)	13 (21)	3.09	1.67–5.69	< 0.001
LAD artery lesion	78 (38)	28 (45)	1.43	0.86–2.35	0.16
In-hospital complication (excluding in-hospital death)	38 (18)	21 (33)	1.99	1.18–3.35	0.01

Data are expressed as number (%) or median [interquartile range]. BMI: body mass index; CI: confidence interval; GRACE: Global Registry of Acute Coronary Events; HR: hazard ratio; IGS: Index de gravité simplifié (Simplified Severity Index); LAD: left anterior descending; N: upper limit; PAD: peripheral arterial disease; STEMI: ST-segment elevation myocardial infarction.

cardiac arrests observed during lockdown (up to +50% reported by Marijon et al.) [31].

The decrease in ACS admissions persisted after lockdown was lifted (Period 2) in our study. This can be explained by the excess of mortality linked to COVID-19, which mainly affected people aged > 65 years and/or those with cardiovascular co-morbidities (the population generally found in ACS series). In the Somme (the department in which Amiens is located), deaths at the peak of the epidemic in March–April 2020 were 27% higher than in 2019, and occurred mainly among people aged > 50 years [32], i.e. the same patients who are more likely to present with ACS.

5.2. *Acute morbidity and mortality*

We did not observe more complications in the acute phase of myocardial infarction among patients hospitalized during the first lockdown (Period 1) in our centre; this has also been reported in other studies [5,19,33]. Primary angioplasty, the gold standard of treatment for ACS, remained the predominant strategy in our centre, which may explain these results. Furthermore, although we found a trend towards an increase in the time from first symptoms to revascularization during lockdown, it was only 18 minutes for STEMI.

In contrast, other authors [3,10,13,34,35] have suggested more frequent complications in the acute phase, particularly those that are mechanical in nature. This can be explained by a prolonged period of ischaemia as a result of a longer time before calling for help, particularly in STEMI, as well as the adaptation of therapeutic strategies. In China, for example, many centres brought thrombolysis protocols back to the forefront, with up to 20% of patients treated with fibrinolysis, and observed an increase in the rate of recurrence of myocardial ischaemia, cardiogenic shock and heart failure [35].

5.3. Longer-term prognosis

A retrospective Lithuanian study of 269 patients analysed the longer-term prognosis of ACS that occurred during a local lockdown [33]. At 6-month follow-up, the authors found more adverse events (composite of stroke, myocardial infarction, urgent coronary revascularization, heart failure and cardiovascular death) in the group of patients hospitalized in March and April 2020, driven by heart failure, and explained by a lower left ventricular ejection fraction after revascularization in this group.

Our study did not show such a difference at 2-year follow-up, which is consistent with our clinical data, which were superimposable between the groups at baseline (acute phase).

However, there may be a longer-term impact. Many cardiovascular rehabilitation centres closed their doors during the first weeks of the pandemic, and some were even converted into convalescent centres dedicated to patients with COVID-19. Although only 30% of patients follow a postinfarction rehabilitation programme in France [36], it was shown to be beneficial in terms of cardiac mortality (relative risk 0.76) and recurrence of ACS (relative risk 0.66) in a randomized study with a 10-year follow-up [37]. Patients who could have benefited from rehabilitation after an ACS during the confinement period, did not, which may affect their long-term prognosis.

5.4. Limitations

The main limitation of our study was its monocentric and retrospective nature. Although the lockdown was national, France was unevenly affected by the COVID-19 epidemic, and our results are therefore not necessarily transposable to the entire country.

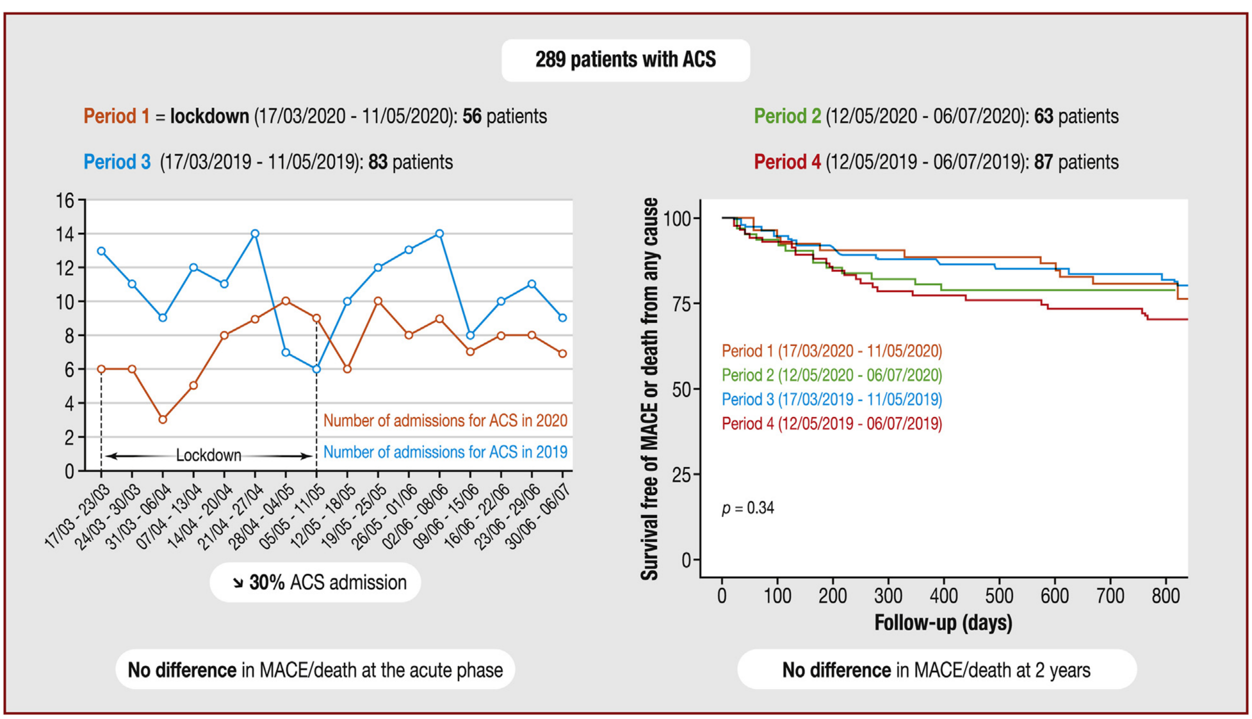
Furthermore, the small size of our cohort resulted in a lack of statistical power (calculated to be 37%), with a limited number of events occurring during hospitalization and follow-up (65 events observed, whereas 191 events would have been needed). No firm conclusions can thus be drawn.

Some patients were followed up by their treating cardiologist after the initial 1-year follow-up period in Amiens University Hospital; this could have altered the exhaustive collection of events for these specific patients.

Finally, endpoints were not adjudicated blindly.

6. Conclusions

We did not observe an increased risk of major cardiovascular events or death at 2 years from initial hospitalization for patients hospitalized during the first lockdown adopted in March 2020 in response to the COVID-19 pandemic, potentially as a result of the lack of power of the study. Lockdown did not have a significant impact on mechanical or rhythmic complications in the acute phase of ACS, despite an increase in the time between first symptoms and first medical contact (Central Illustration).



Central Illustration. We found a significant drop in ACS admissions of approximately 30%, which showed no rebound in the 6 weeks after confinement. We did not find an increased risk of mechanical or rhythmic complications in the acute phase of an episode of ACS declared during lockdown. We did not observe an increased risk of MACE or all-cause death 2 years after the initial ACS when it occurred during the first lockdown. ACS: acute coronary syndrome; MACE: major adverse cardiovascular events.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.acvd.2023.03.001.

Disclosure of interest

The authors declare that they have no competing interest.

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