Angioplastie et COVID-19

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Conflits d'intérêts

Intervenant : Patrick Ohlmann, Strasbourg

☑ Je déclare les liens d'intérêt suivants :

Affiliation/Financial Relationship	Company
• Grant/Research Support	• Abbott, Biosensor, Boston, Edwards-Lifesciences, Medtronic, Terumo
• Consulting Fees/Honoraria	• Astra-Zeneca, Sanofi-Aventis, Zoll, Amgen

Impact du COVID-19 en Alsace: 1ere vague

Rassemblement de l'Eglise Evangélique de Mulhouse 17-24 février 2020

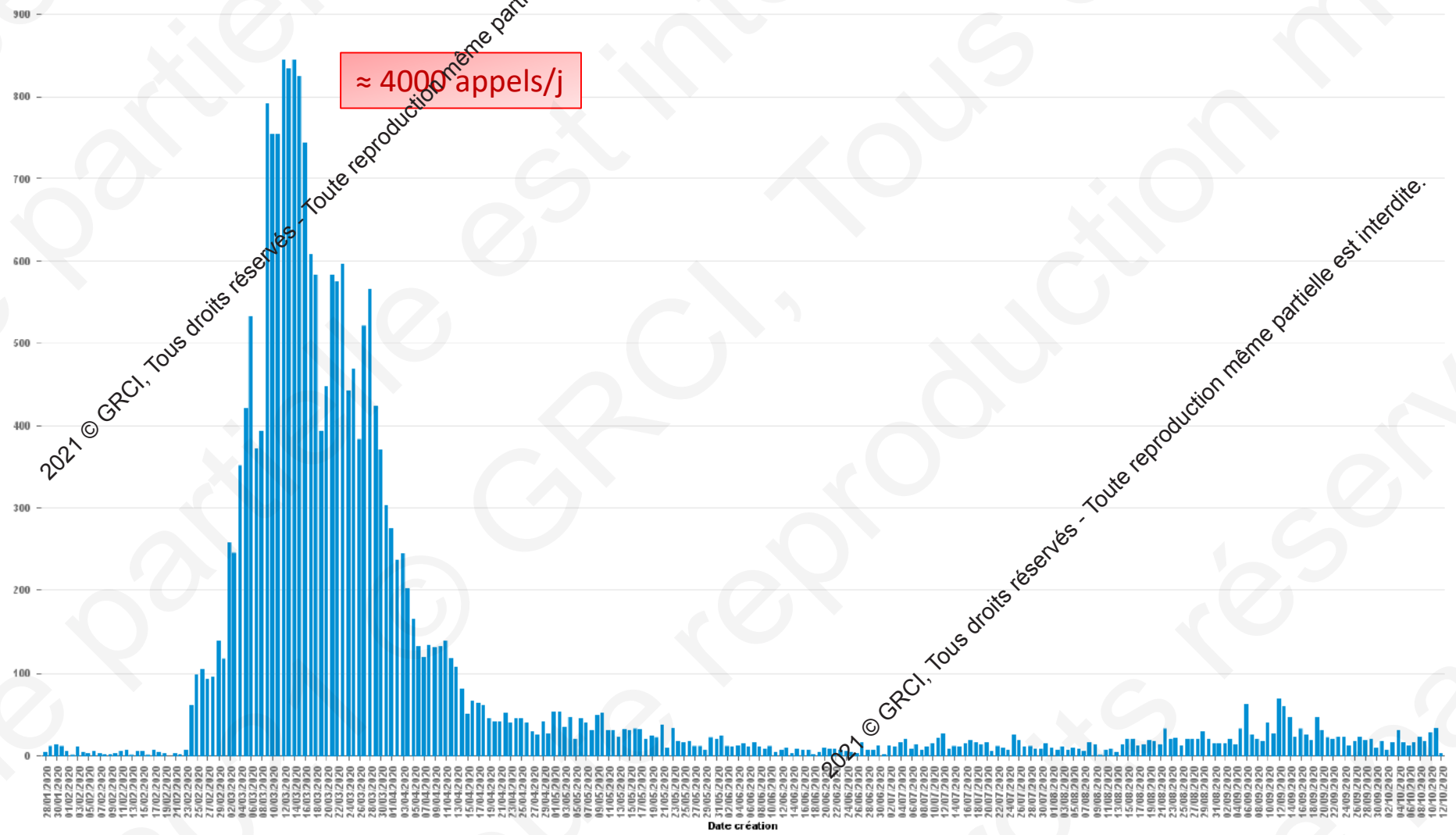
« Mega-church »

Le 26 mars 2020, le service enquête de France Info établit que plus de 1 000 membres contaminés du rassemblement évangélique de février à Mulhouse ont contribué au début de la propagation du Covid-19 en France. Un grand nombre de cas avérés et de décès en France sont liés à ce rassemblement : les participants venus de toute la France, y compris des outre-mers, ainsi que de pays proches comme la Suisse, la Belgique et l'Allemagne, se sont mutuellement contaminés sans le savoir et, en retournant chez eux, ont rapidement essaimé la maladie en Bourgogne-Franche-Comté, Guyane, Corse, Hautes-Alpes, Manche, Nouvelle-Aquitaine, Paris et dans la région Centre-Val de Loire. Pour Christophe Lannelongue, directeur général de l'Agence régionale de santé Grand Est, le rassemblement de février 2020 a fait l'effet d'« une espèce de bombe atomique qui nous est tombée dessus[44] ». Le rassemblement a essaimé également les premiers cas de covid-19 au Burkina-Faso via un pasteur de l'Eglise[45].

Epidémiologie « narrative » Strasbourg – 2020

- Mars
  - 1 er cas: 29 février
  - 1er personnel contaminé: 2 mars
  - Montée en charge « violente »
  - 60-80 hospitalisations/j
  - 20-25 admissions/j en réanimation
- Avril
  - 601 patients, 201 en réanimation (2 avril)
  - Phase de plateau (1ière quinzaine)
  - 550 à 600 patients hospitalisés

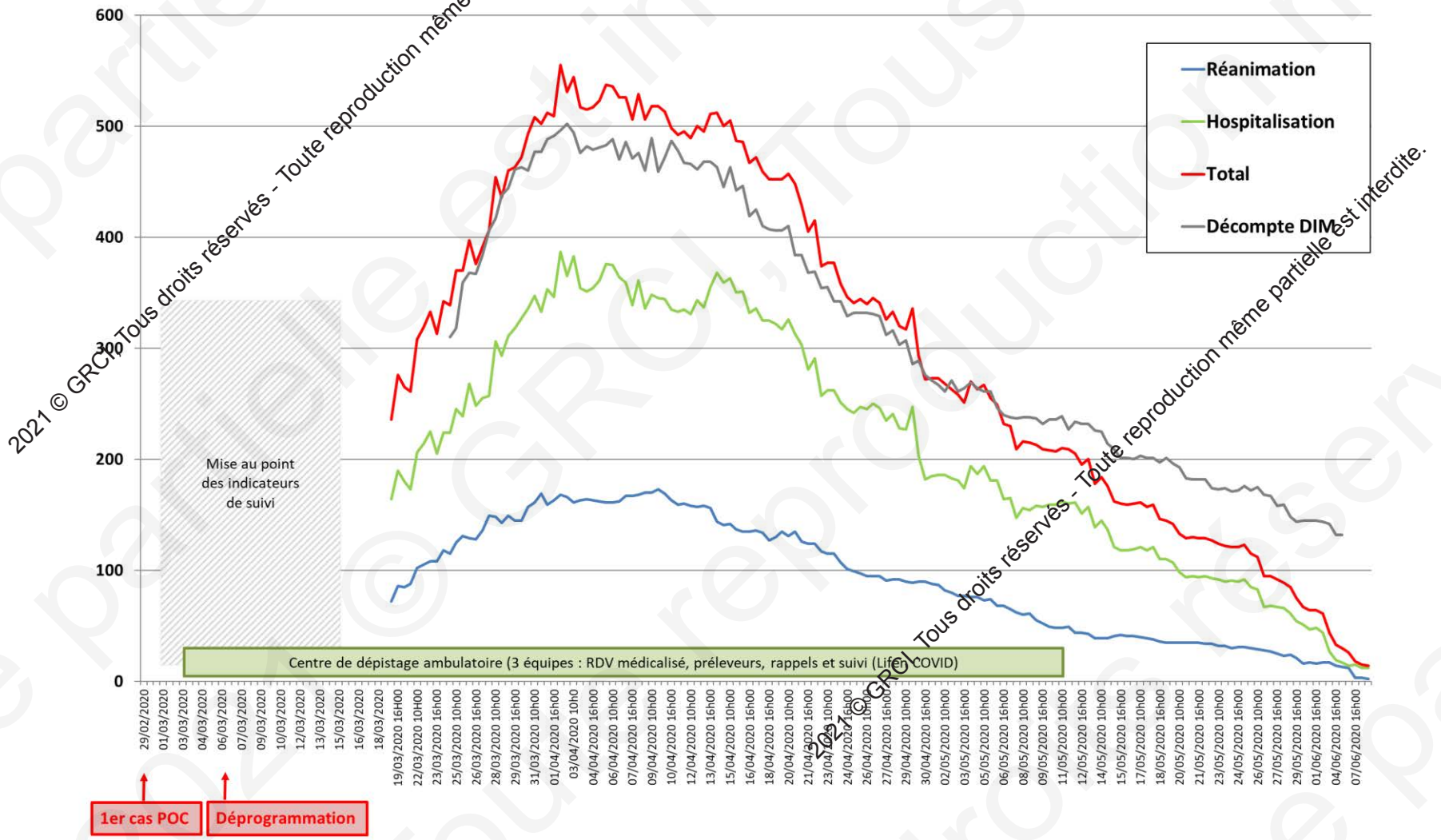
Appels SAMU – Strasbourg
Nombre d'ouverture de Dossier Régulation Médicale par jour



Epidémiologie Strasbourg – 2020

Bilan HUS V1

- Réanimation 492
- Médecine 1364
- Ambulatoire 801



Première vague aux HUS
Réorganisation, bilan chiffré, remarques

- Transformation progressive d'UF
  - Fermeture 250 lits
  - Création de 460 lits de médecine Covid (+)
  - Réanimation
    - Déploiement quotidien de lits (Pic de lits de réanimation : 205, N=95)
    - Croissance très rapide du nb de patients (>100% en 3 semaines)
- Ressources humaines
  - Renforts extérieurs (cliniques locales, extra-territorial)
    - 118 séniors (48 réanimateurs)
    - 250 étudiants infirmiers (fonctions d'AS)
  - Plateforme de délestage SAMU (12 postes > max. 25 postes)
  - Gardes d'enfants (écoles IDE)

Plan

- *1 COVID et activité d'angioplastie dans les SCA*
- *2 COVID et risque thrombotique*
- *3 Physiopathologie COVID*
- *4 COVID et angioplastie en pratique*

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Covid-19
Hospitalisations pour SCA

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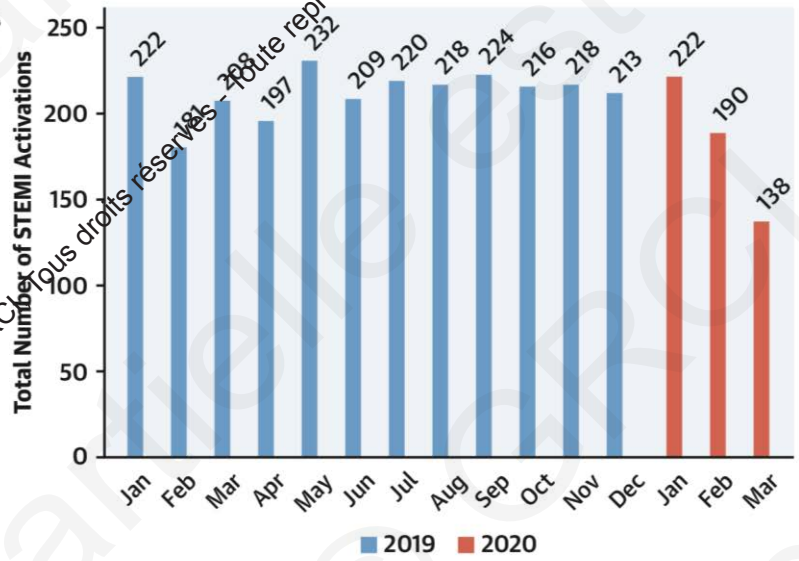
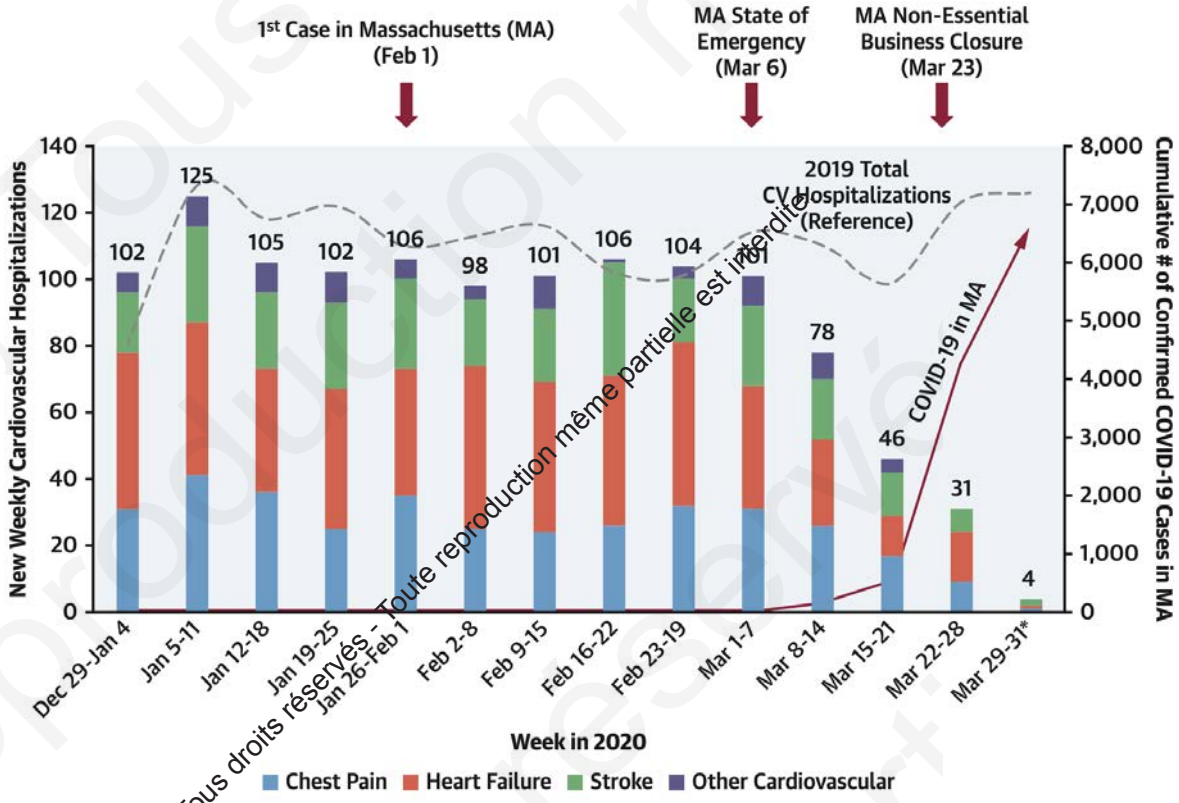
Hospitalisations pour SCA en période COVID-19 USA

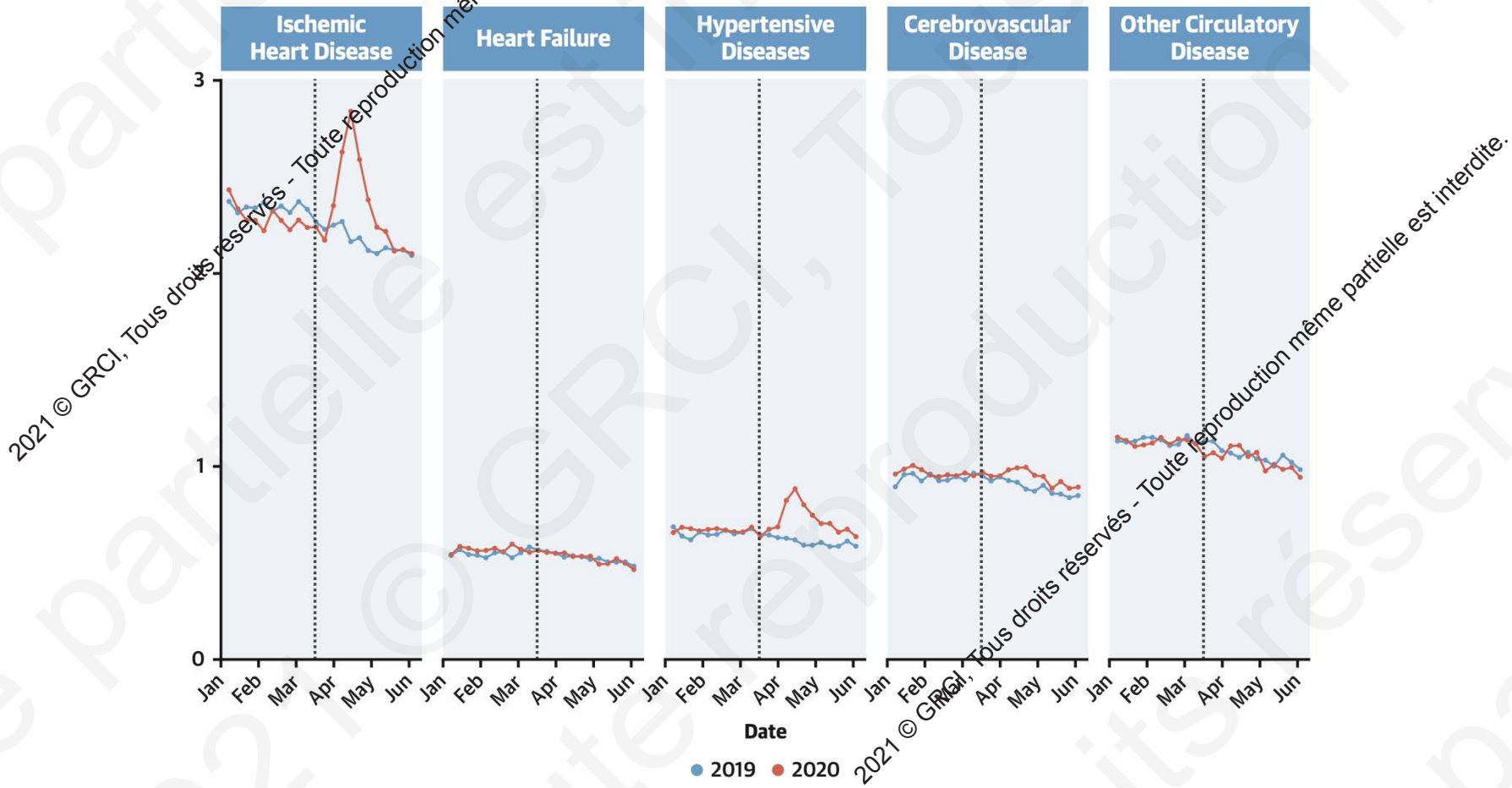


Garcia S *JACC* 2021



Bhatt *JACC* 2020

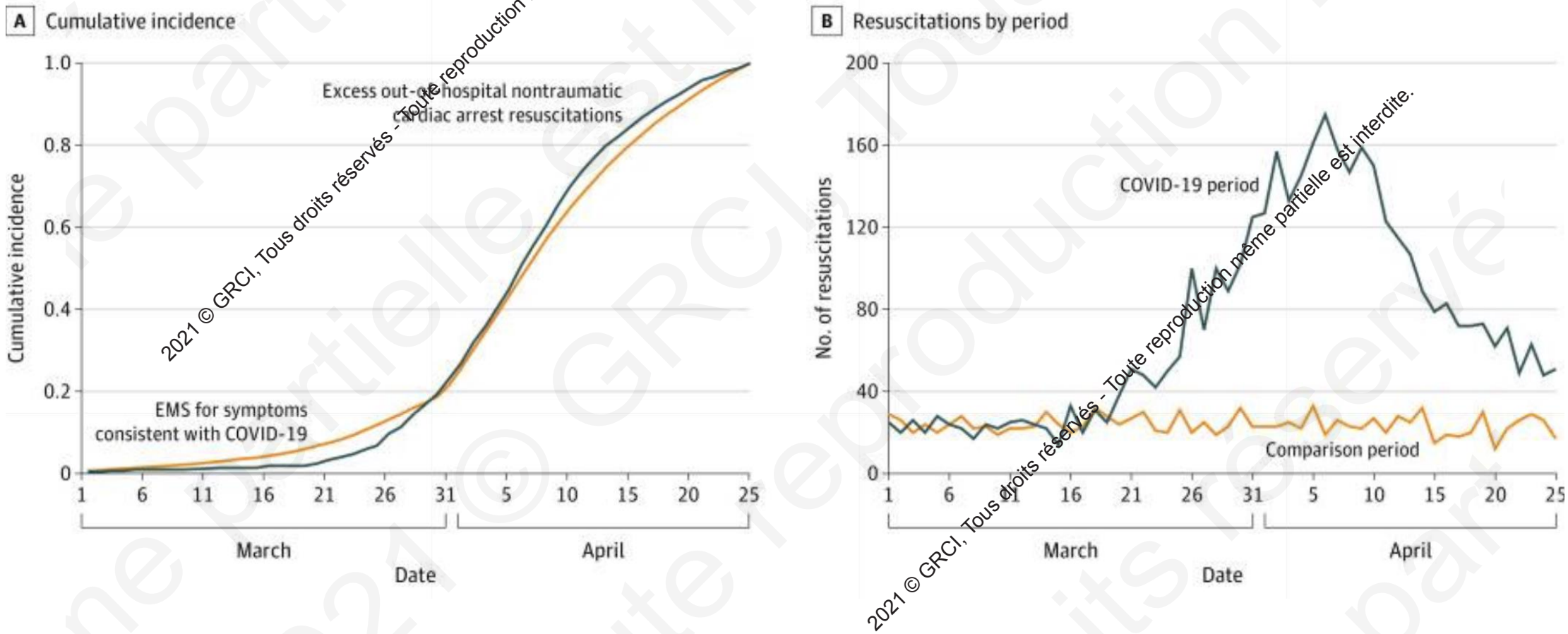
Surmortalité par coronaropathie en période COVID-19 USA: registre national



Wadhera *J Am Coll Cardiol* 2021 p 159

Surmortalité par arrêt cardiaque extra-hospitalier Registre New York

N=5325



LAI PH *JAMA Cardiol* 2020 p 1154

Surmortalité par arrêt cardiaque extra-hospitalier

Table 2. Association of Risk Factors With Out-of-Hospital Nontraumatic Cardiac Arrests in the COVID-19 Period vs 1 Year Before[a]

	Main analysis[b]		Sensitivity analysis peak period[c]	
Risk factor	OR (95% CI)	*P* value	OR (95% CI)	*P* value
Age (per 10 y)	1.12 (1.07-1.18)	<.001	1.16 (1.05-1.27)	.003
Sex				
Female	1 [Reference]		1 [Reference]	
Male	0.91 (0.79-1.06)	.25	1.05 (0.79-1.39)	.74
Race/ethnicity				
White	1 [Reference]		1 [Reference]	
Asian	1.43 (1.08-1.91)	.01	1.82 (1.01-3.28)	.05
Black	1.90 (1.57-2.29)	<.001	1.91 (1.33-2.74)	<.001
Hispanic	2.06 (1.68-2.52)	<.001	2.28 (1.54-3.37)	<.001
Mixed	1.96 (1.52-2.53)	<.001	1.99 (1.21-3.28)	.007
Medical history				
Cardiac disease	0.72 (0.61-0.86)	<.001	0.67 (0.49-0.93)	.02
Hypertension	1.28 (1.09-1.50)	.002	1.27 (0.94-1.73)	.12
Diabetes	1.45 (1.23-1.71)	<.001	1.81 (1.31-2.51)	<.001
Renal disease	0.79 (0.60-1.03)	.08	0.64 (0.39-1.06)	.09
Asthma/COPD	0.78 (0.64-0.95)	.02	0.67 (0.45-0.99)	.05
Cancer	0.72 (0.56-0.92)	.009	0.59 (0.37-0.94)	.03
CVA	0.70 (0.52-0.94)	.02	0.74 (0.41-1.32)	.30
Physical limitations	1.27 (1.09-1.49)	.002	1.38 (1.03-1.86)	.04
Presenting rhythm[d]				
Ventricular rhythms[e]	1 [Reference]		1 [Reference]	
Asystole	3.50 (2.53-4.84)	<.001	5.37 (3.01-9.58)	<.001
PEA	1.99 (1.31-3.02)	.001	2.77 (1.29-5.91)	.009

Abbreviations: COPD, chronic obstructive pulmonary disease; COVID-19, coronavirus disease 2019; CVA, cerebrovascular accident; OR, odds ratio; PEA, pulseless electrical activity.

[a] Study population used for these estimates includes only those out-of-hospital cardiac arrests who received resuscitation by emergency medical services.

[b] Covers March 1 to April 25, 2019 (comparison period) and 2020 (COVID-19 period).

[c] Covers March 29 to April 11, 2019 (comparison period) and 2020 (COVID-19 period).

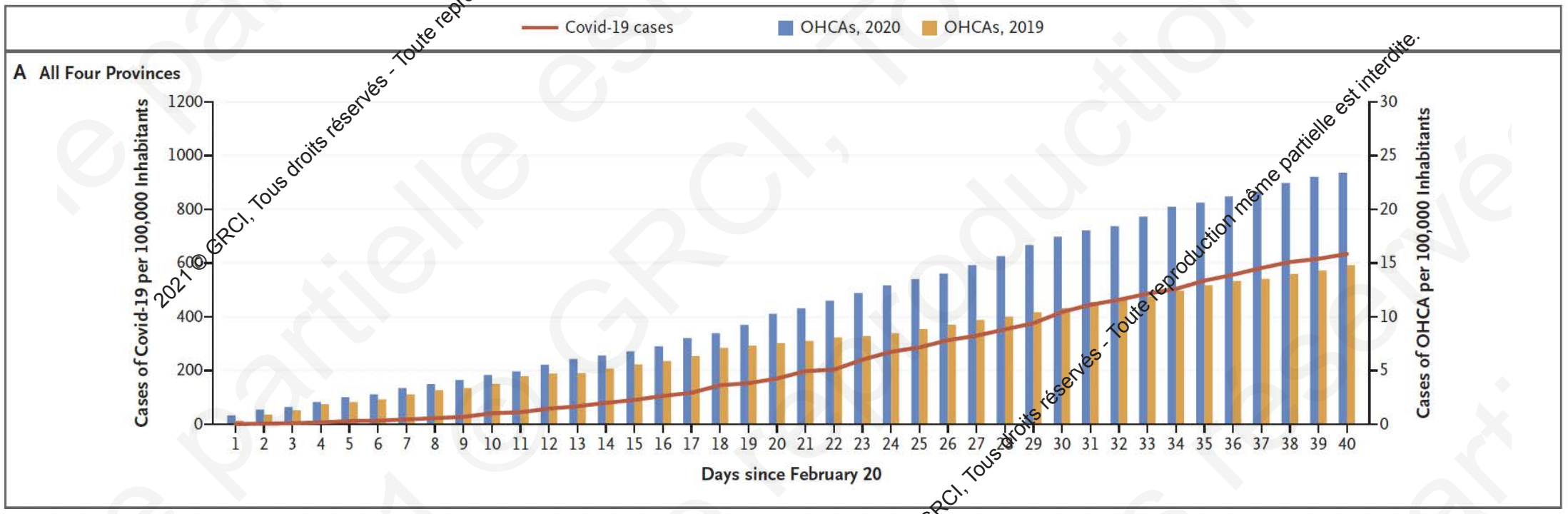
[d] Presenting rhythm data were only collected for those out-of-hospital cardiac arrests in which an advanced life support unit was first on the scene; however, an unclassified category was added for missing data to bolster model observations.

[e] Ventricular rhythms include ventricular fibrillation and ventricular tachycardia.

LAI PH *JAMA Cardiol* 2020 p 1154

Surmortalité par arrêt cardiaque extra-hospitalier Registre Italien

N=362



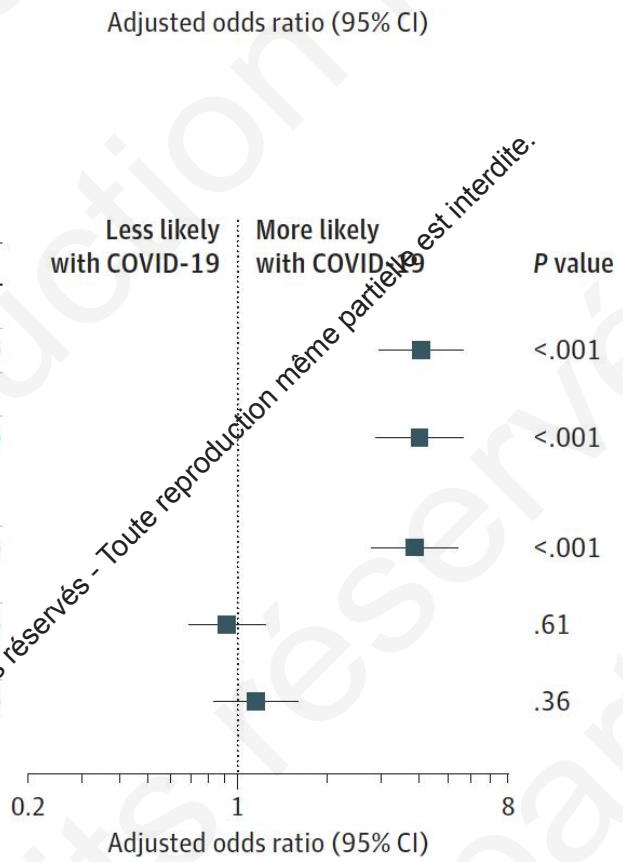
Baldi *N Engl J Med* 2020

Surmortalité hospitalière des STEMI COVID+ USA

Surmortalité hospitalière des patients STEMI avec COVID

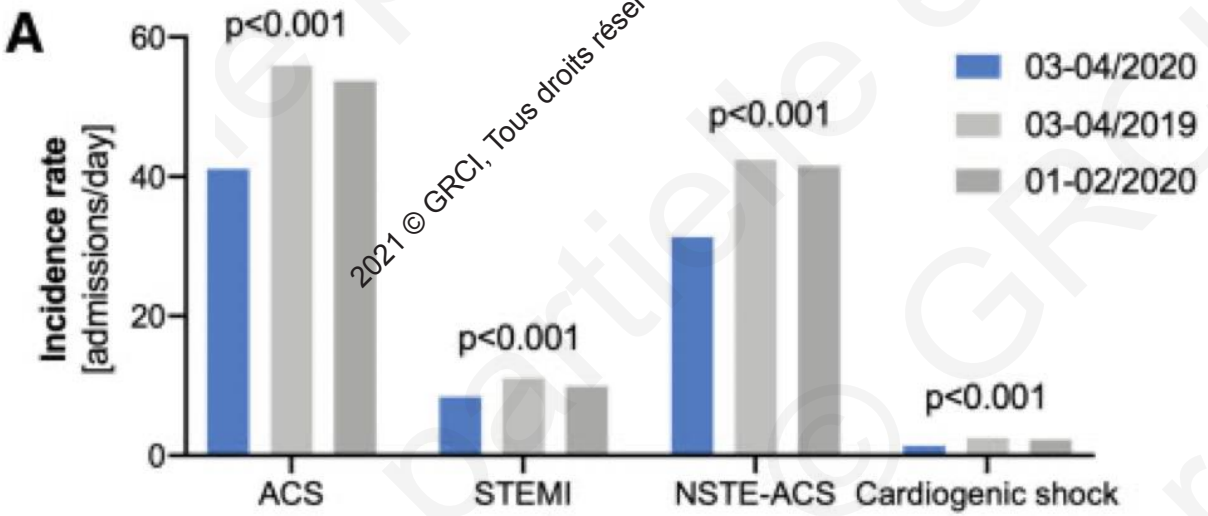
B In-hospital STEMI

Outcome	Patients, No. (%) With COVID-19 (n = 257)	Patients, No. (%) Without COVID-19 (n = 756)	Absolute difference (95% CI)	Odds ratio (95% CI) Unadjusted	Odds ratio (95% CI) Adjusted
Primary					
In-hospital death	193 (76.6)	335 (44.3)	32.3 (25.15 to 39.40)	6.23 (4.83 to 8.04)	4.11 (2.97 to 5.69)
Secondary					
Composite of death, stroke, or myocardial infarction	199 (79.0)	369 (48.8)	30.2 (23.09 to 37.23)	5.76 (4.41 to 7.52)	3.94 (2.82 to 5.50)
Composite of death or stroke	199 (79.0)	364 (48.1)	30.8 (23.74 to 37.90)	5.66 (4.33 to 7.39)	4.04 (2.89 to 5.65)
Acute decompensated heart failure	107 (42.5)	335 (44.3)	-1.9 (-8.93 to 5.22)	0.56 (0.45 to 0.69)	0.93 (0.70 to 1.24)
Cardiogenic shock	69 (27.4)	185 (24.5)	2.9 (-3.28 to 9.10)	0.94 (0.74 to 1.19)	1.16 (0.84 to 1.61)



Saad *JAMA oct* 2021

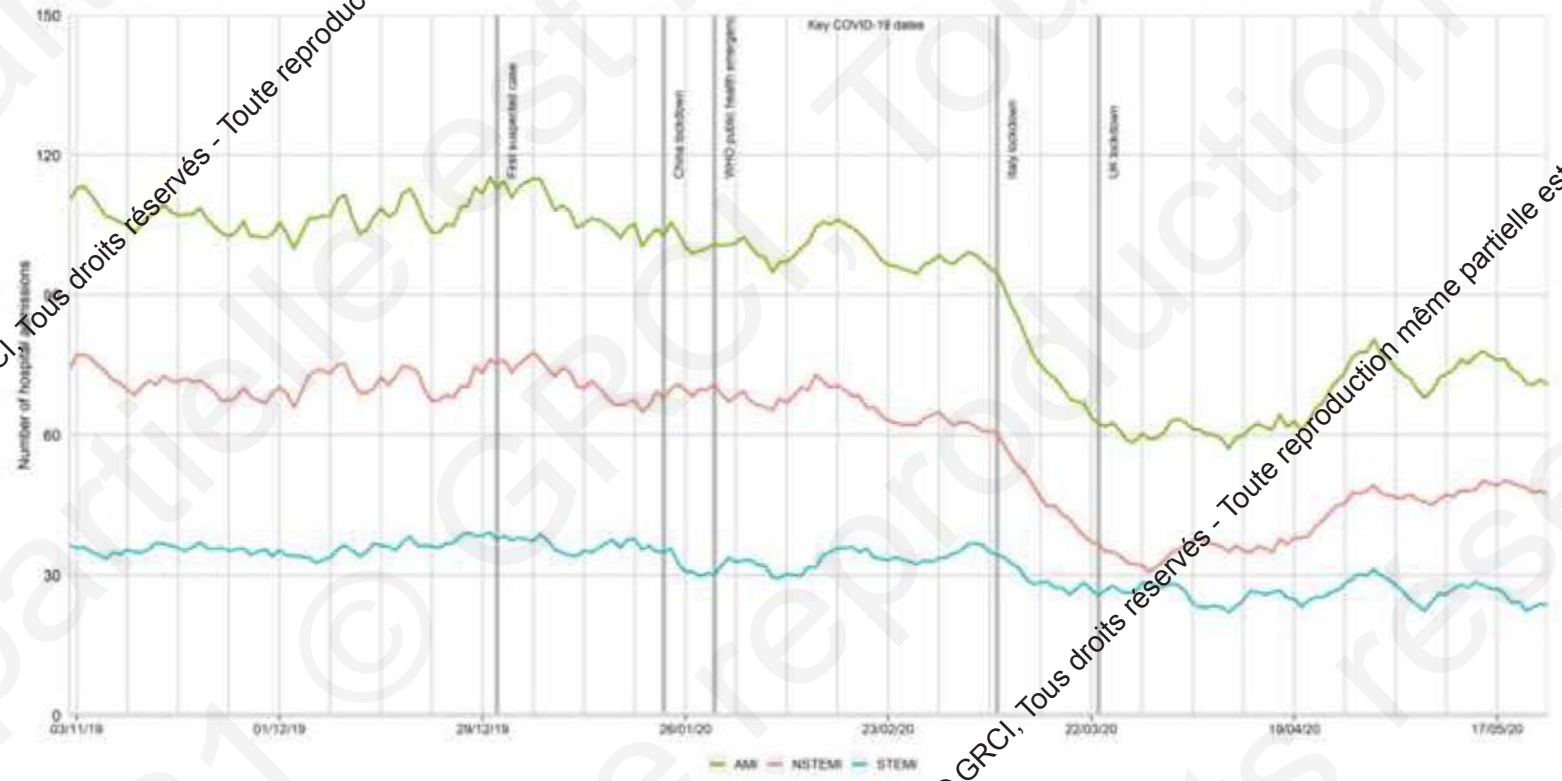
Hospitalisations pour SCA en période COVID-19 Allemagne



Manifestation	No. of patients	Study period 03-04/2020	Control periods 03-04/2019	Control periods 01-02/2020	p-value
ACS	N=9,143	N=2,509	N=3,411	N=3,223	
Daily admissions		41.1	55.8	53.7	
IRR (95% CI)			0.73 (0.70-0.77)	0.77 (0.73-0.81)	<0.001
STEMI	N=1,783	N=510	N=677	N=596	
Daily admissions		8.4	11.1	9.9	
IRR (95% CI)			0.75 (0.67-0.85)	0.84 (0.75-0.95)	<0.001
NSTE-ACS	N=6,986	N=1,99[illegible]	N=2,584	N=2,491	
Daily admissions		[illegible].3	42.4	41.5	
IRR (95% CI)			0.74 (0.70-0.78)	0.75 (0.71-0.80)	<0.001
NSTEMI	N=4,035	N=1,100	N=1,482	N=1,453	
Daily admissions		18.0	24.3	24.2	
IRR (95% CI)			0.74 (0.69-0.80)	0.74 (0.69-0.81)	<0.001
Unstable angina	N=2,951	N=811	N=1,102	N=1,038	
Daily admissions		13.3	18.1	17.3	
IRR (95% CI)			0.74 (0.67-0.81)	0.77 (0.70-0.84)	<0.001
Cardiogenic shock	N=374	N=88	N=150	N=136	
Daily admissions		1.4	2.5	2.3	
IRR (95% CI)			0.59 (0.45-0.76)	0.64 (0.49-0.83)	<0.001

Kessler T *Cardio Vasc Researh 2020*

Hospitalisations pour SCA en période COVID-19 Angleterre



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Wu *Eur H J Qual Care Clin Outcomes* 2001 p 238

STEMI et COVID-19
Allongement des délais de prise en charge

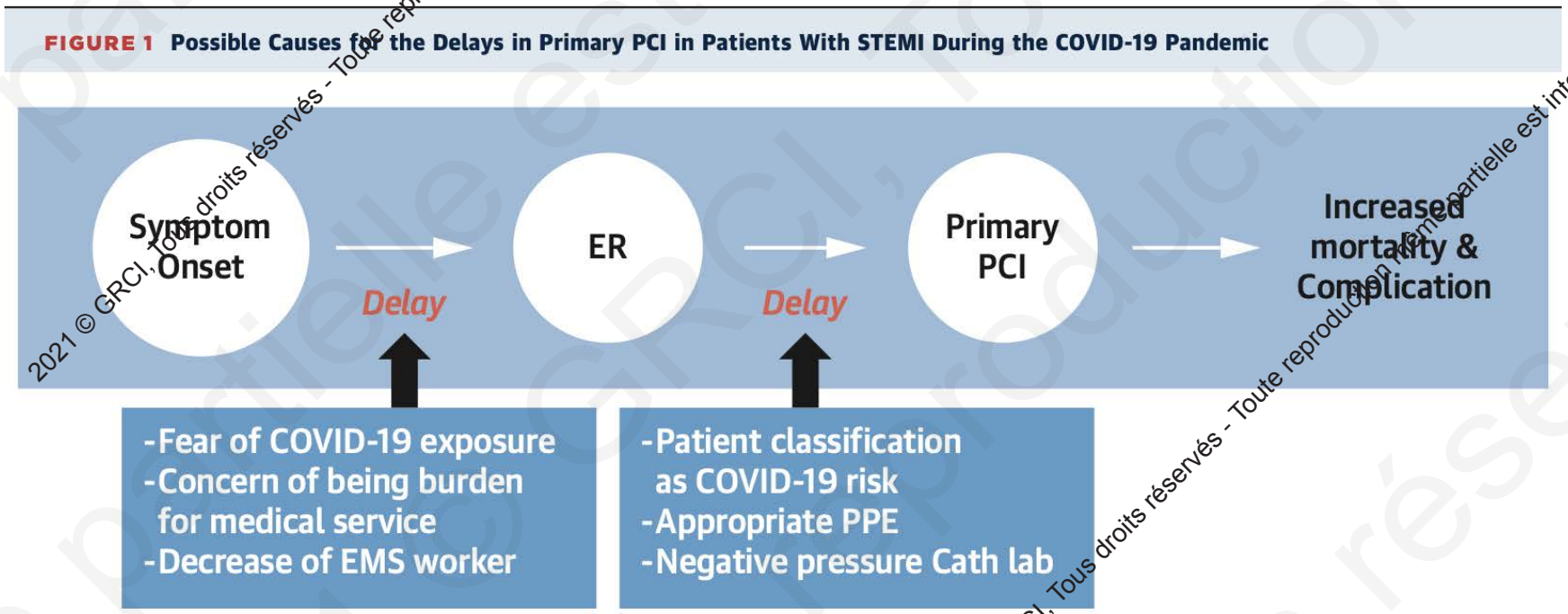


FIGURE 1 Possible Causes for the Delays in Primary PCI in Patients With STEMI During the COVID-19 Pandemic

Park *JACC* 2020;p 2331

STEMI et Covid-19 France-PCI

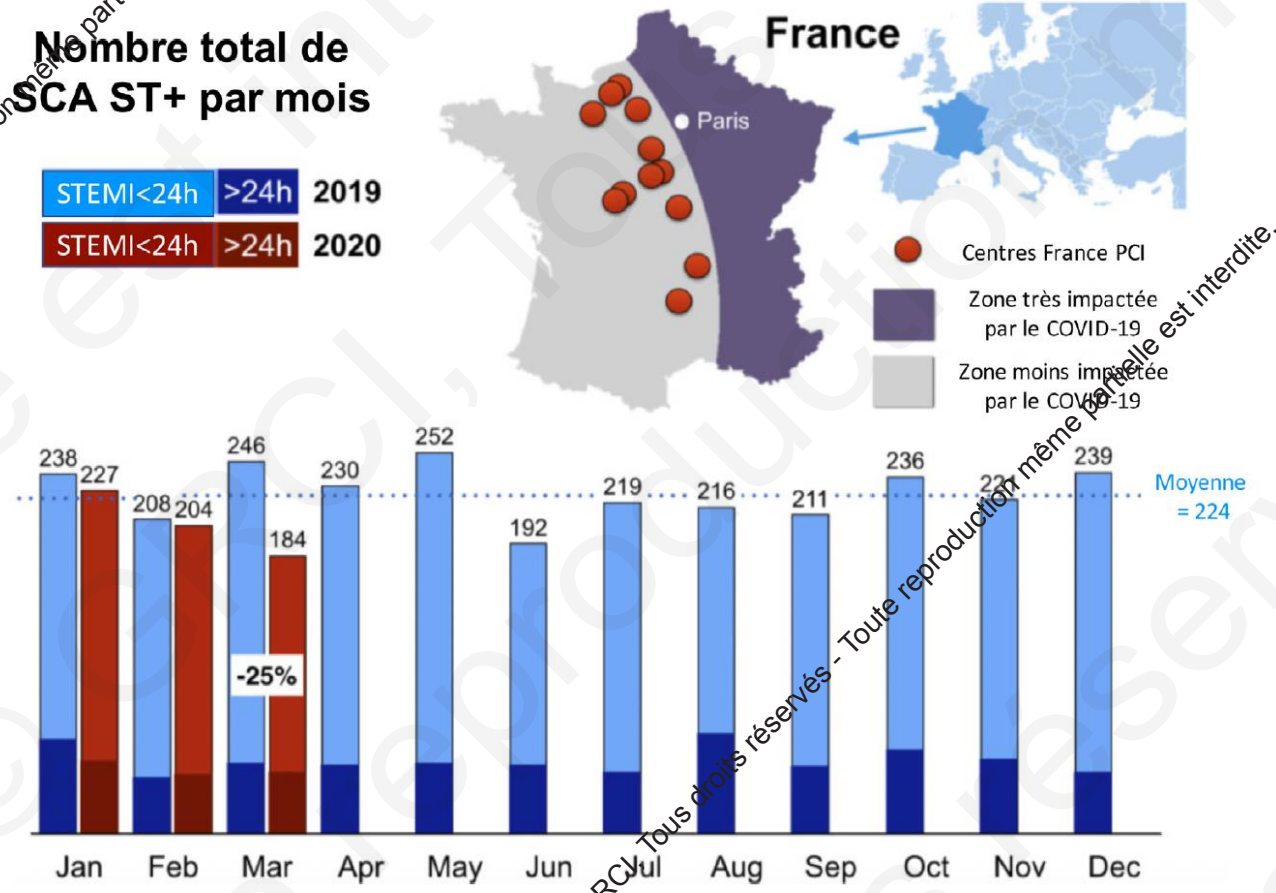
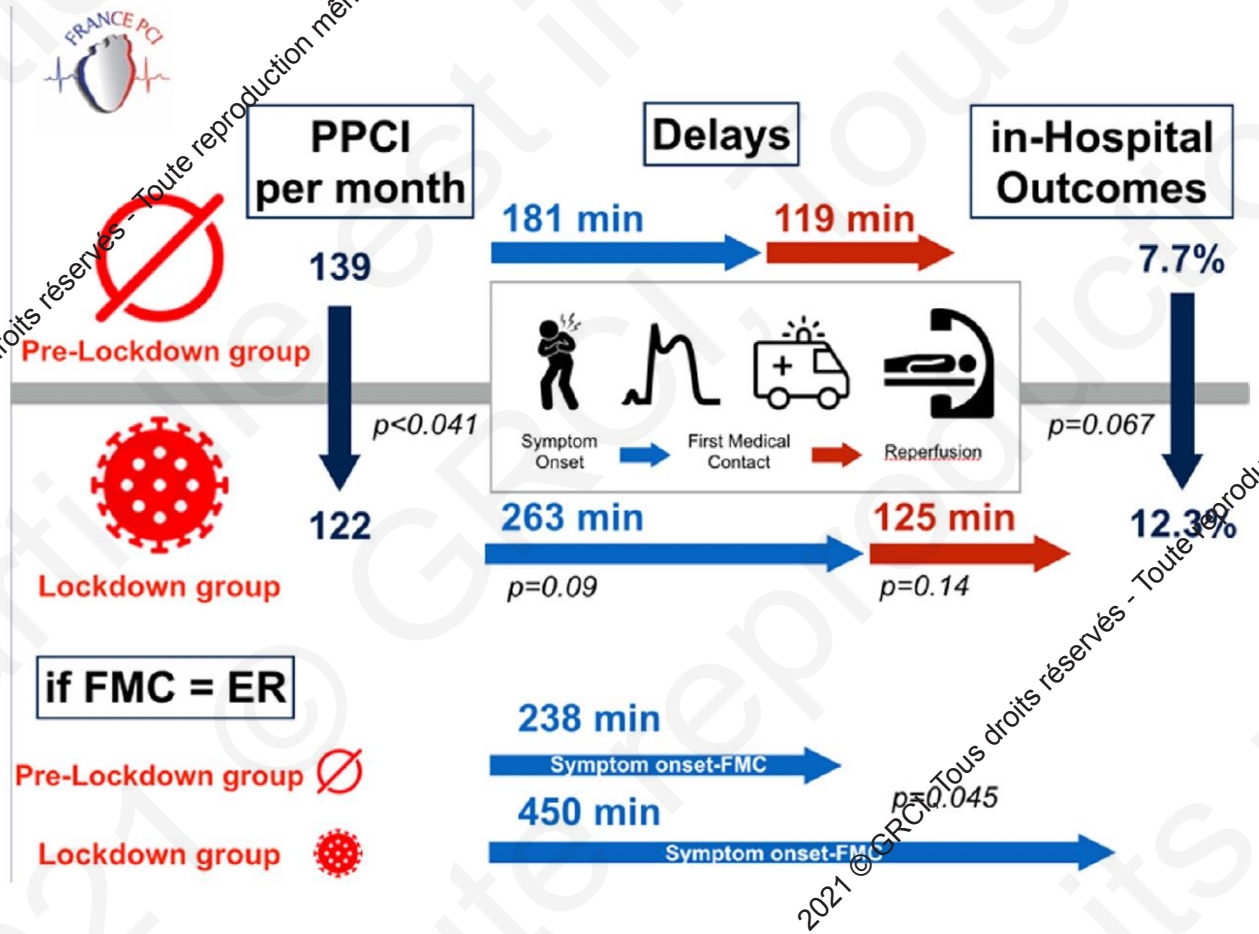


Fig. 1. Nombre de SCA ST+ < et > 24 heures par mois adressés en salle de cathétérisme dans le registre France PCI du 15 janvier 2019 au 14 avril 2020 [1].

Hakim *Annales de Cardiol et d'Angiol* 2020

STEMI et Covid-19
France-PCI



Hakim *Annales de Cardiol et d'Angiol* 2020

STEMI et Covid-19
CHU Strasbourg

1er mars-20 avril 2020 vs. 2019

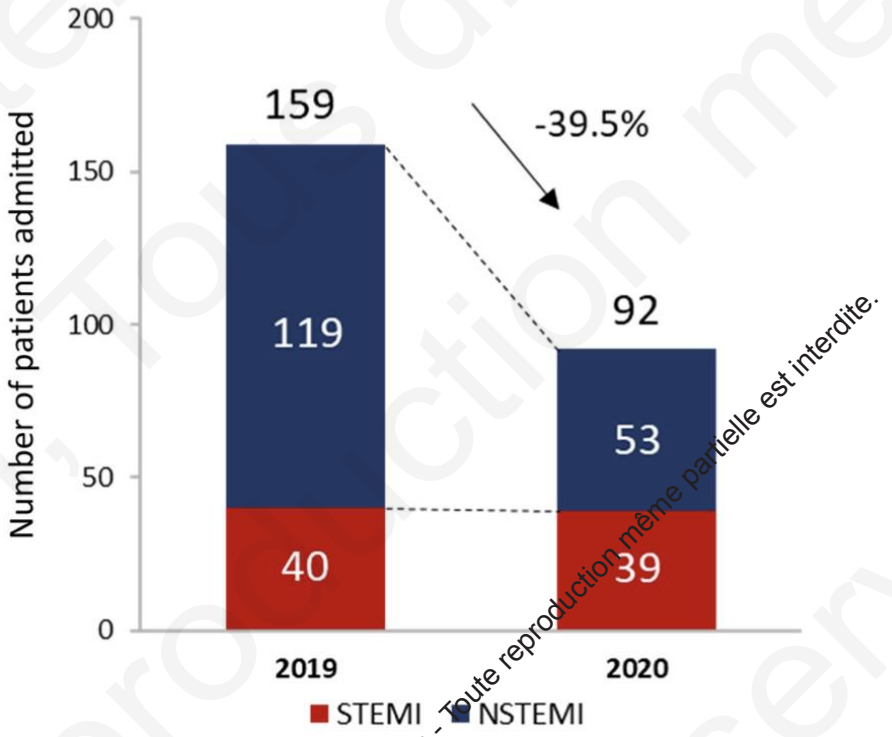
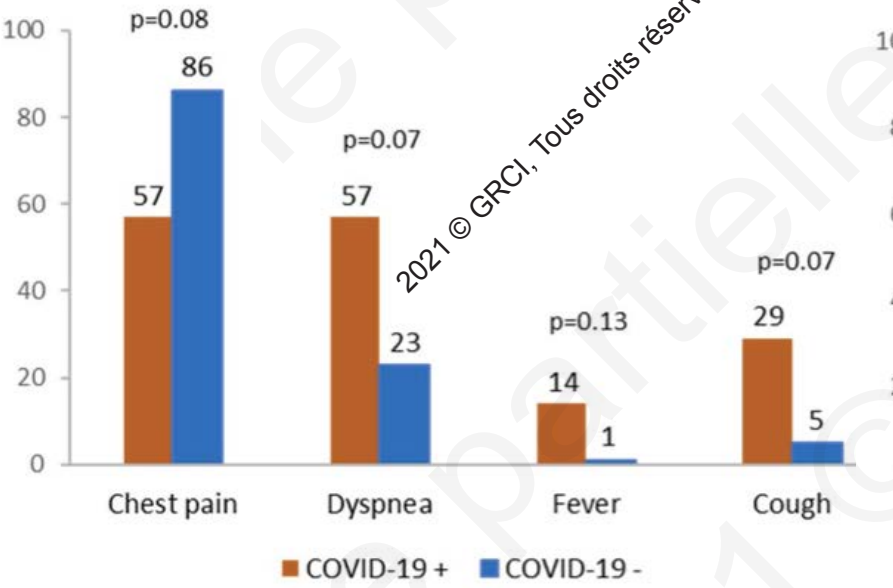


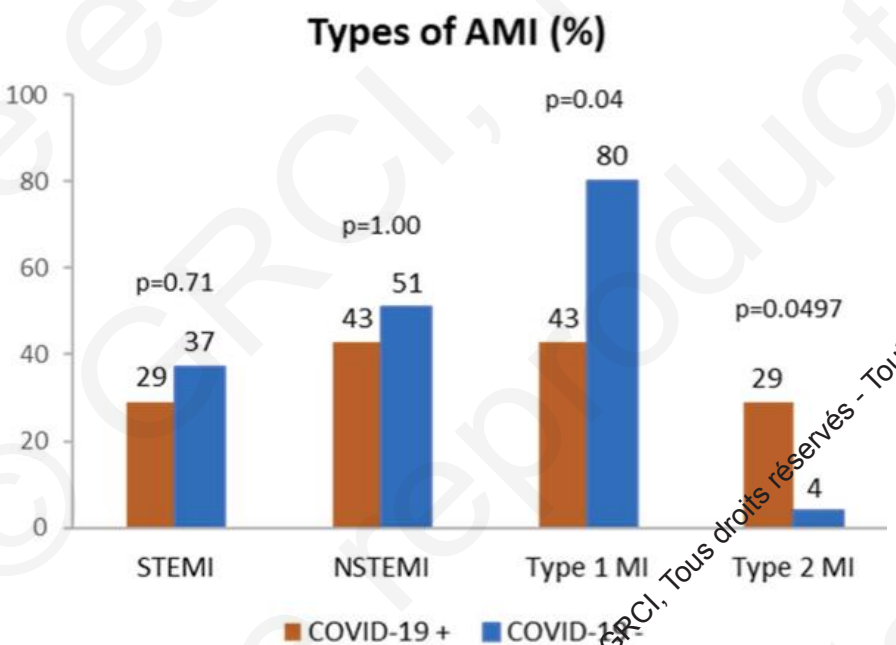
Fig. 1 Numbers of myocardial infarction before and after COVID-19 pandemic. *COVID-19* coronavirus disease 2019, *NSTEMI* non-ST-segment elevation myocardial infarction, *STEMI* ST-segment elevation myocardial infarction

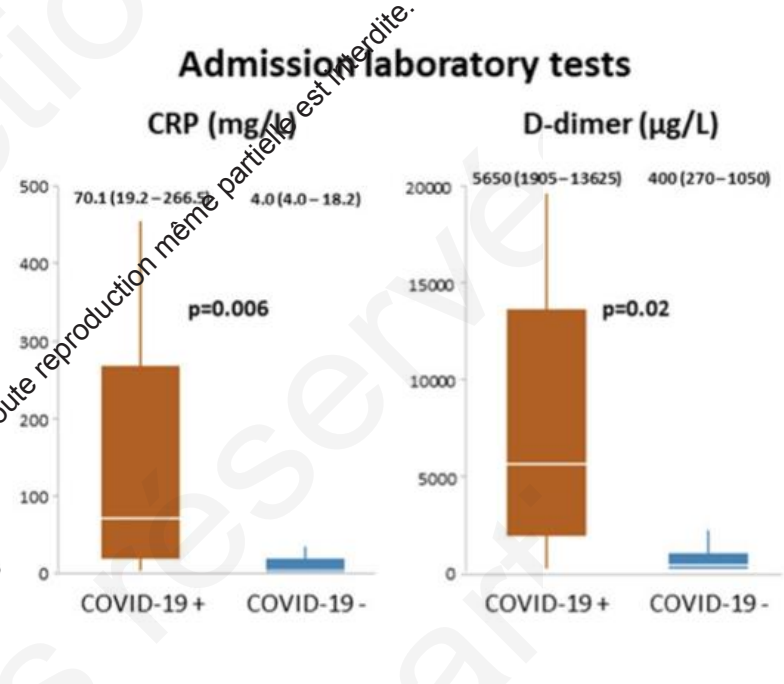
Matsushita *J Thromb Haemostasis* 2020

STEMI et Covid-19 présentation clinique CHU Strasbourg

1er mars-20 avril 2020



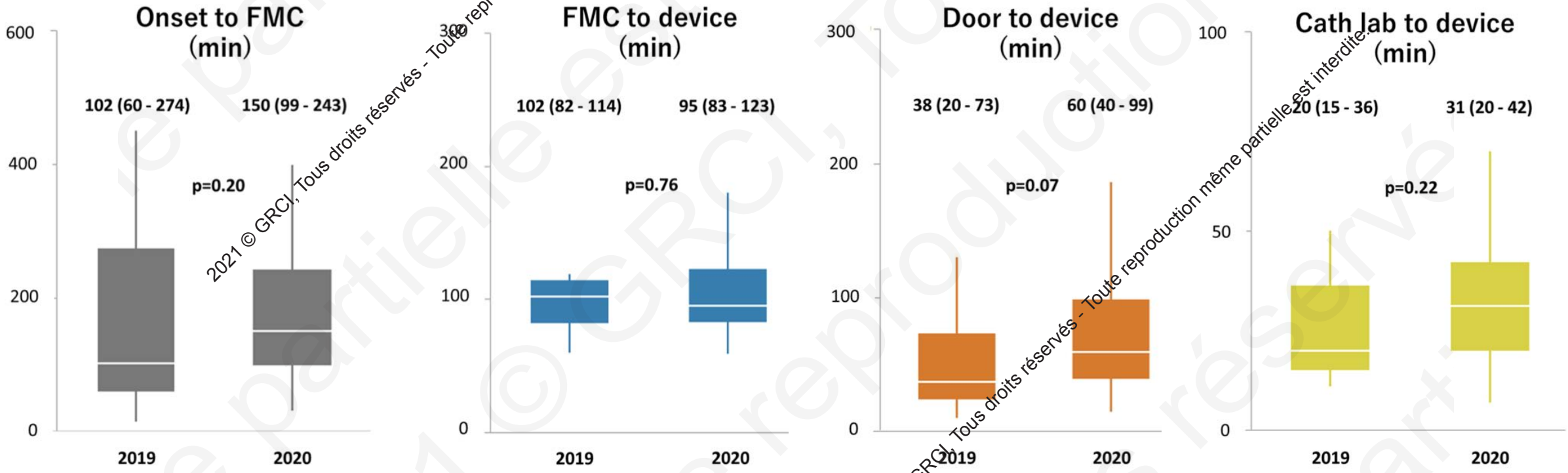




Matsushita *J Thromb Haemostasis* 2020

STEMI et Covid-19 logistique CHU Strasbourg

1er mars-20 avril 2020 vs 2019



Matsushita *J Thromb Haemostasis* 2020

Covid-19
Sur-risque thrombotique

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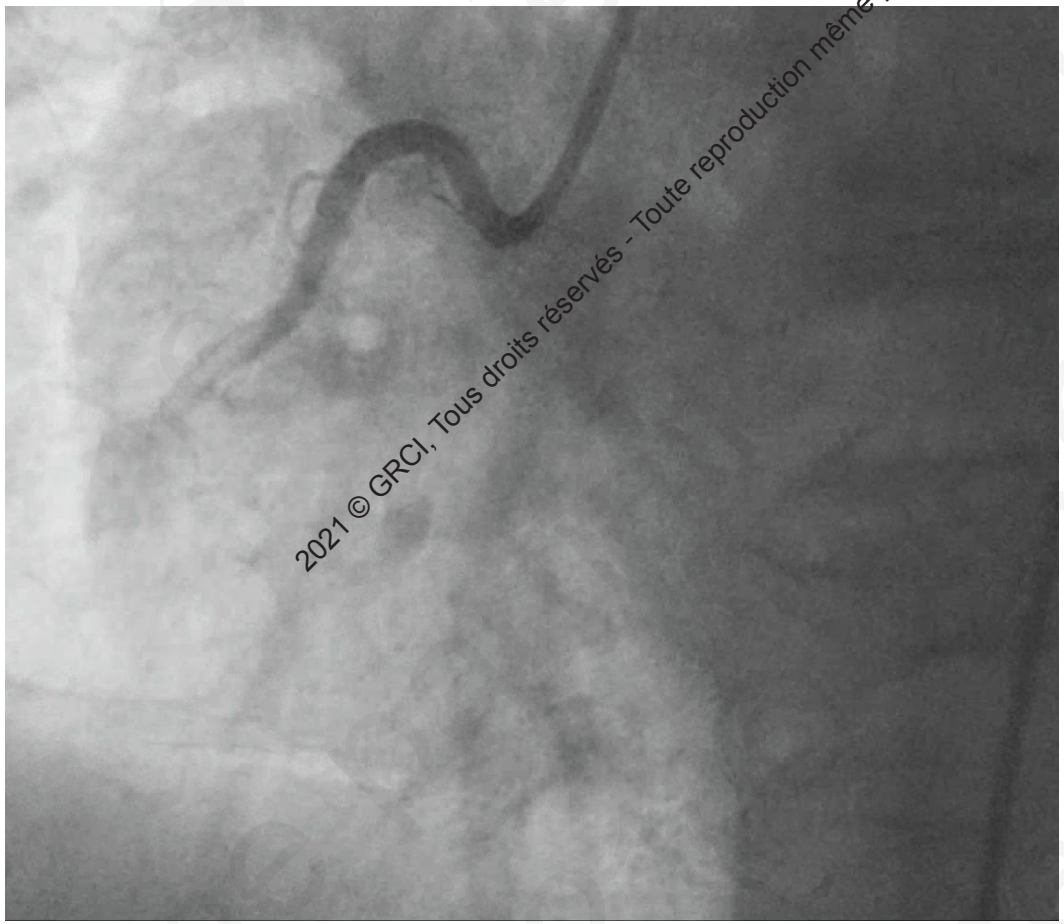
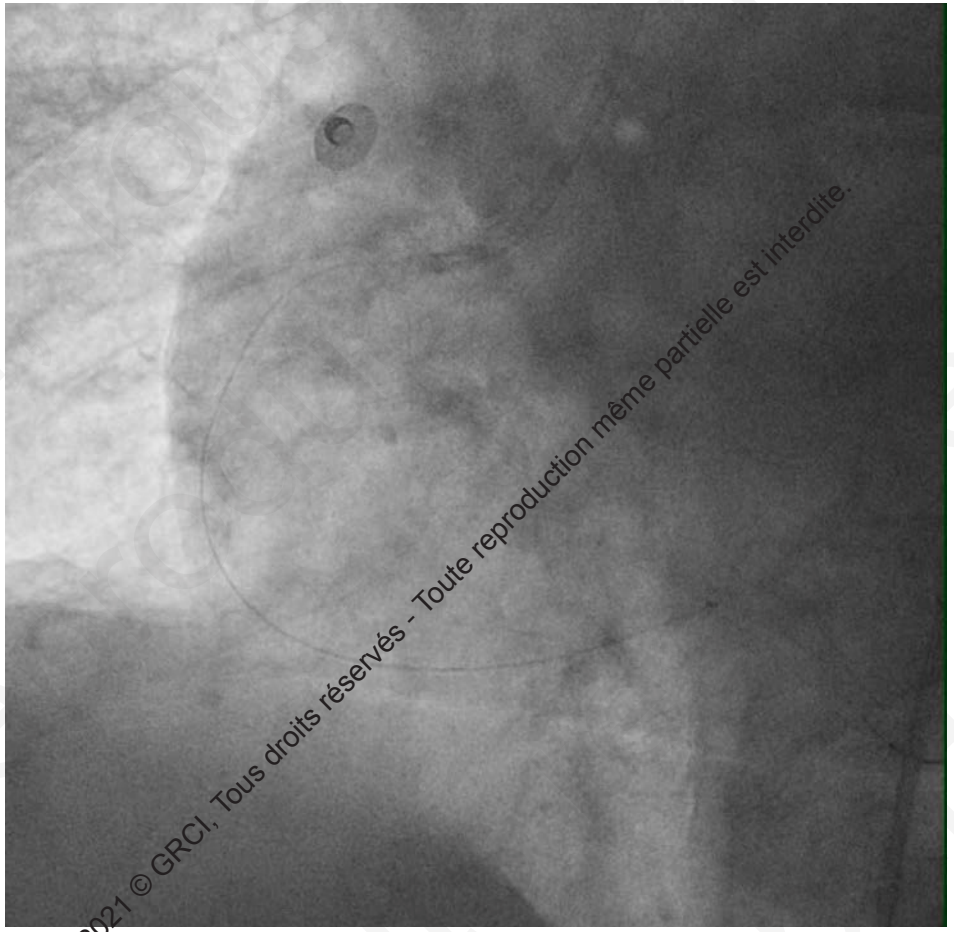
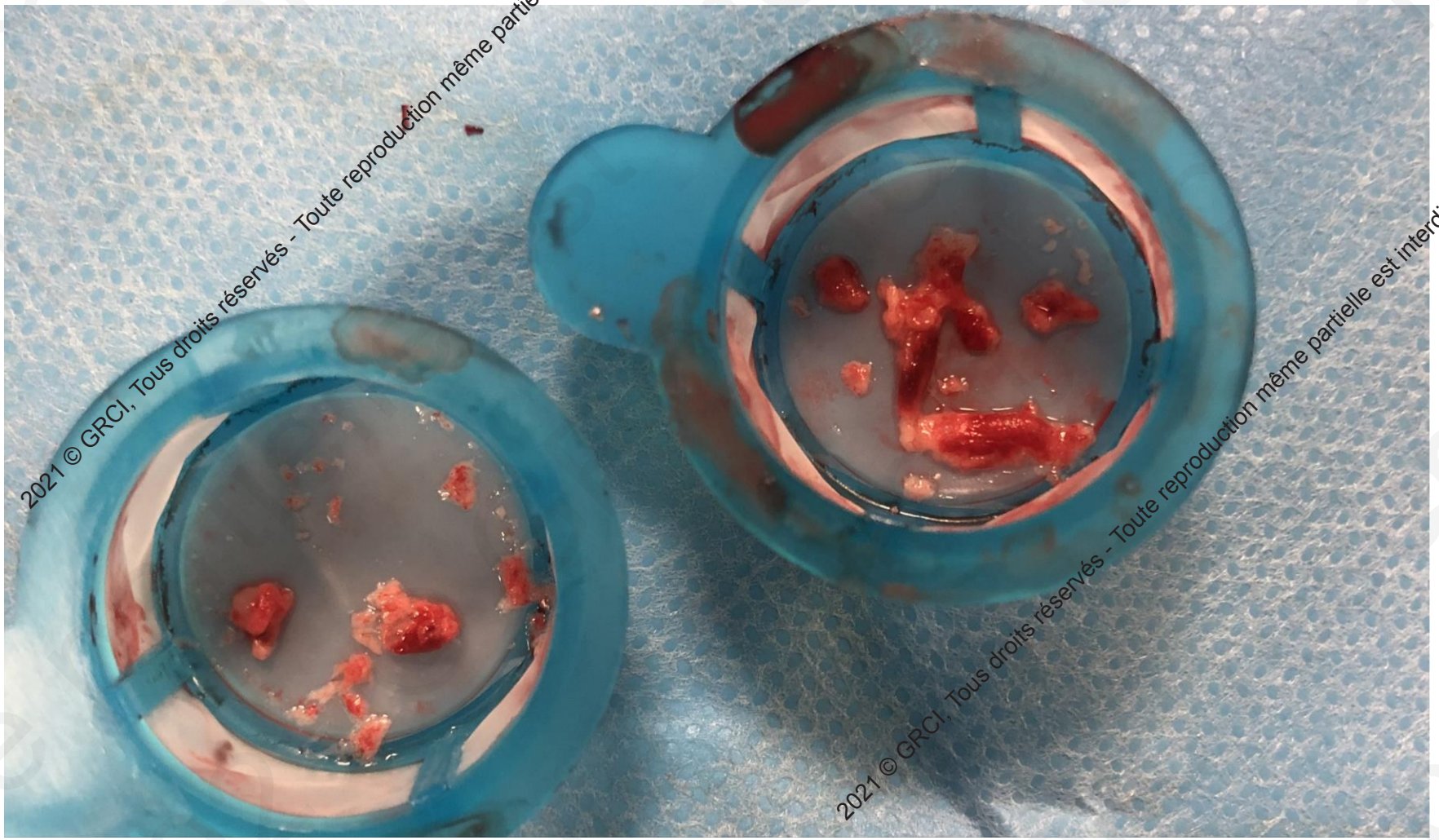
Cas: patient de 60 ans, obèse, PnP COVID, Sus-ST inferieur, tropo 35 000 ng/mL





Thromboaspiration 7F
Agrastat



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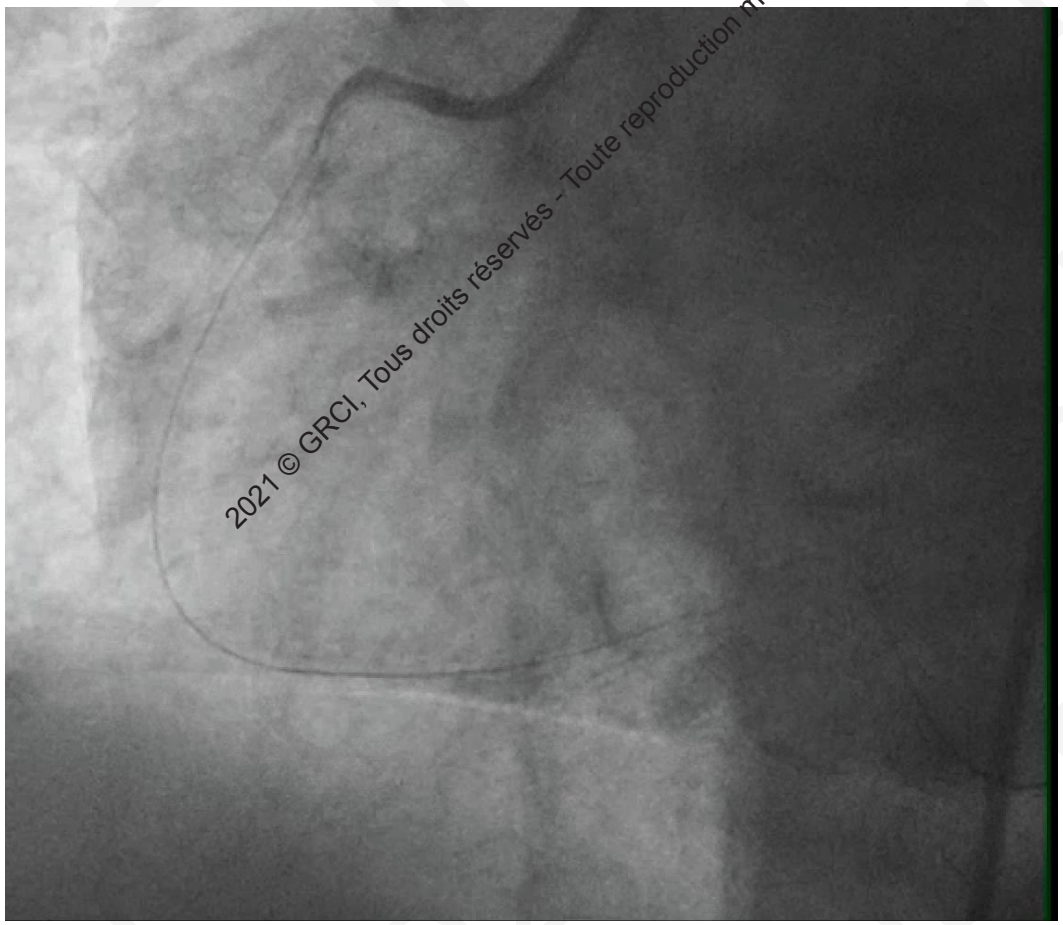
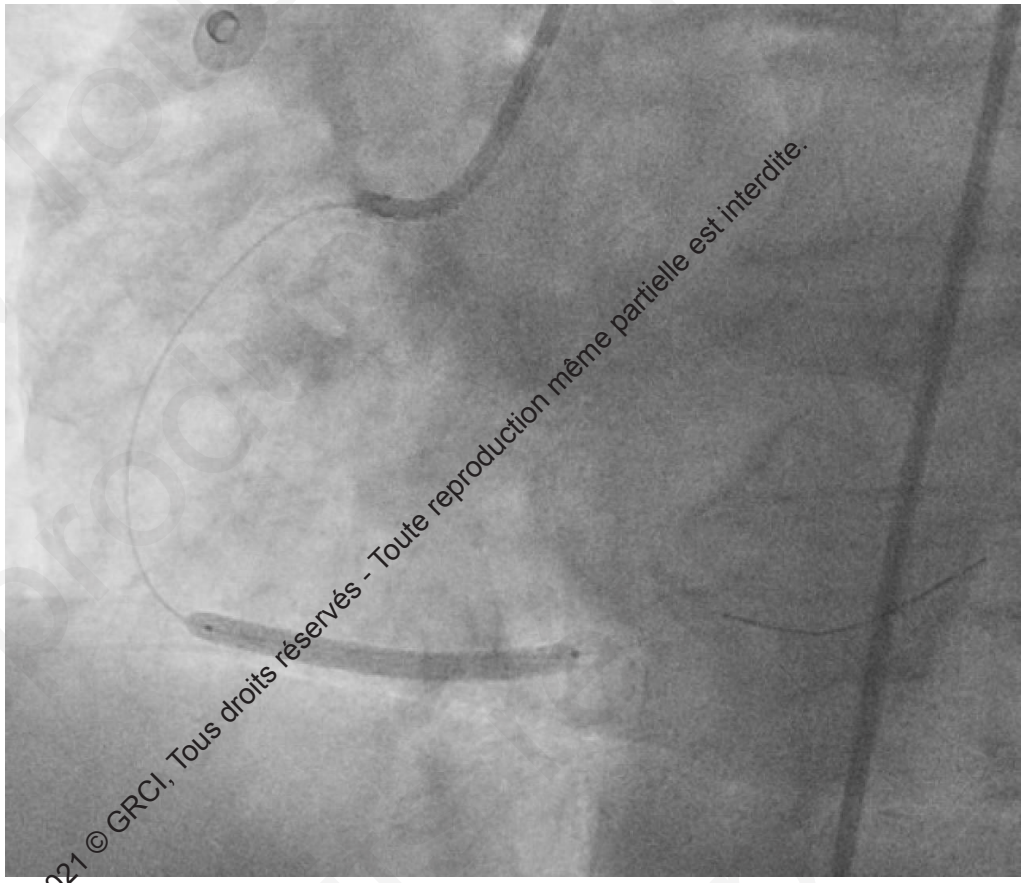
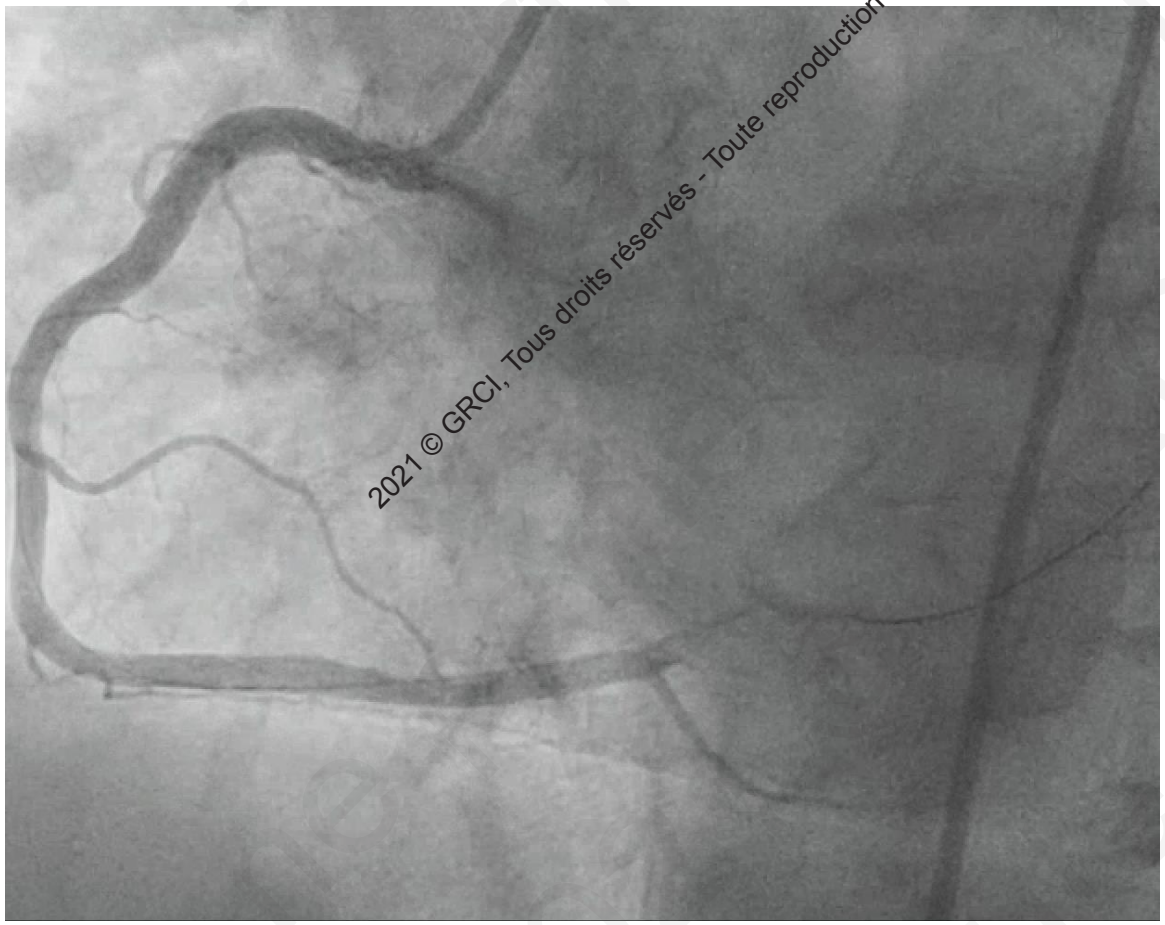
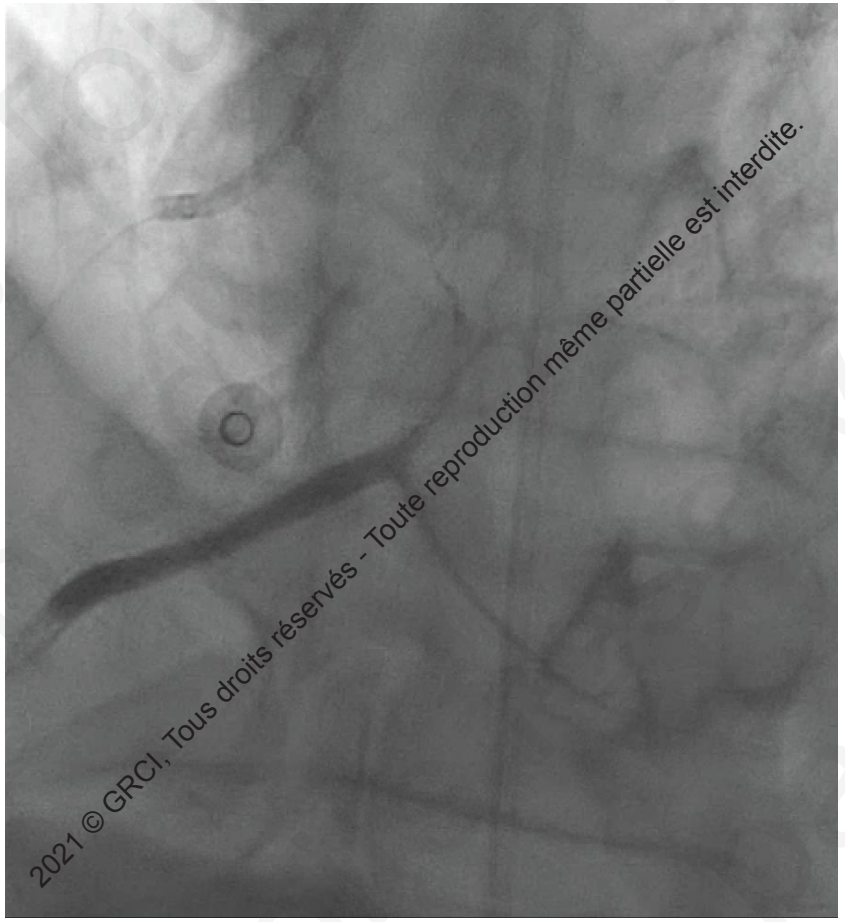
Cas

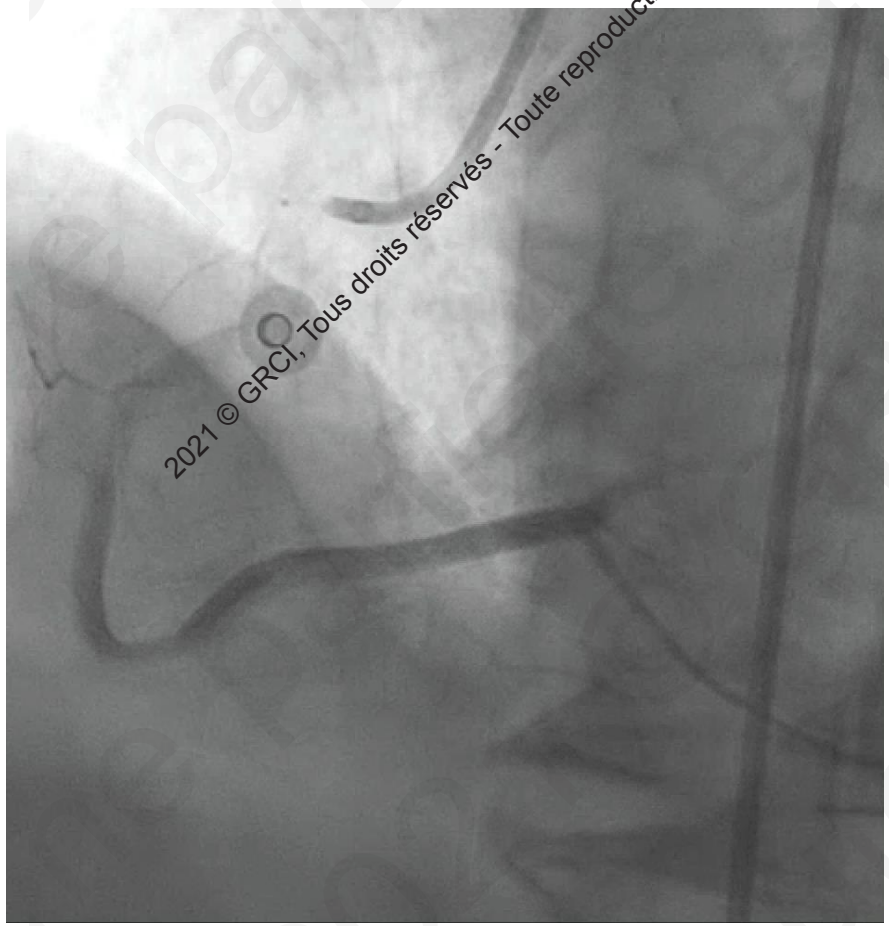




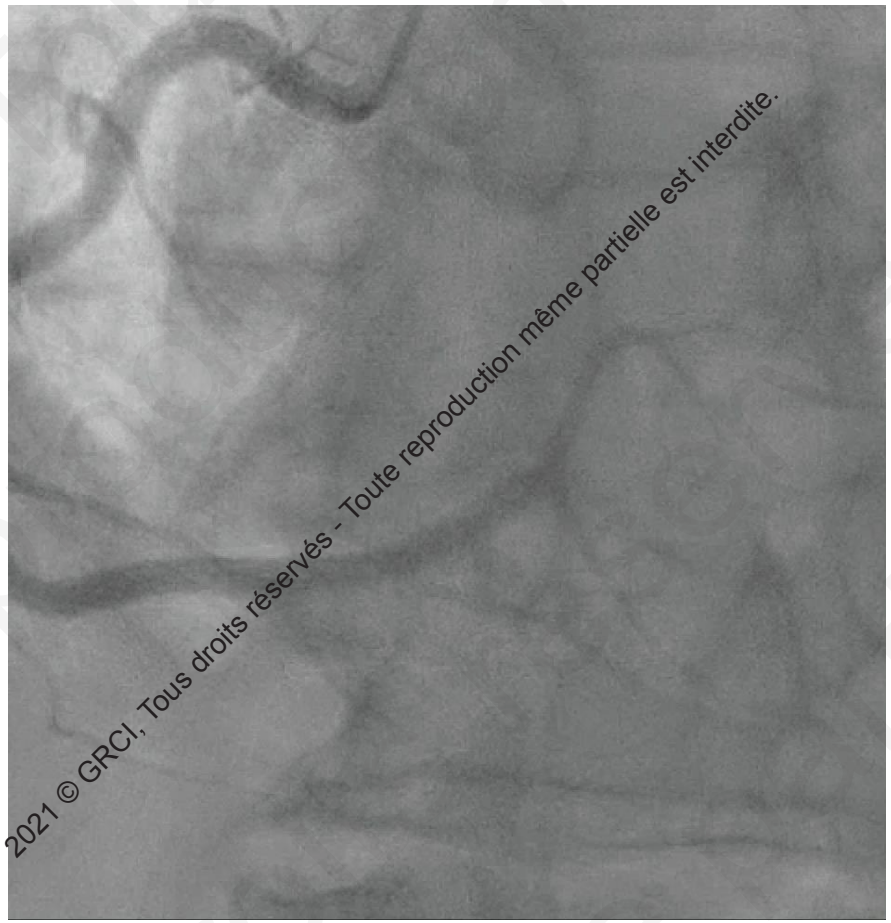




Actilyse 10 mg IC



Suivi à J30



Characteristics and Outcomes in Patients Presenting With COVID-19 and ST-Segment Elevation Myocardial Infarction

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There is limited information regarding clinical characteristics and outcomes of patients with SARS-CoV-2 (COVID-19) disease presenting with ST-segment elevation myocardial infarction (STEMI). In this multicenter retrospective study, we reviewed charts of patients admitted with symptomatic COVID-19 infection and STEMI to a total of 4 hospitals spanning Italy, Lithuania, Spain and Iraq from February 1, 2020 to April 15, 2020. A total of 78 patients were included in this study, 49 (63%) of whom were men, with a median age of 65 [58, 71] years, and high comorbidity burden. During hospitalization, 8 (10%) developed acute respiratory distress syndrome, and 14 (18%) required mechanical ventilation. 19 (24%) patients were treated with primary Percutaneous Coronary Intervention (PCI) and 59 (76%) were treated with fibrinolytic therapy. 13 (17%) patients required cardiac resuscitation, and 9 (11%) died. For the 19 patients treated with primary PCI, 8 (42%) required intubation and 8 (42%) required cardiac resuscitation; stent thrombosis occurred in 4 patients (21%). A total of 5 patients (26%) died during hospitalization. 50 (85%) of the 59 patients initially treated with fibrinolytic therapy had successful fibrinolysis. The median time to reperfusion was 27 minutes [20, 34]. Hemorrhagic stroke occurred in 5 patients (9%). Six patients (10%) required invasive mechanical ventilation; 5 (9%) required cardiac resuscitation, and 4 (7%) died. In conclusion, this is the largest case series to-date of COVID-19 positive patients presenting with STEMI and spans 4 countries. We found a high rate of stent thrombosis, indicating a possible need to adapt STEMI management for COVID-19 patients. **(Am J Cardiol 2020;131:1–6)**

Evènements post PCI

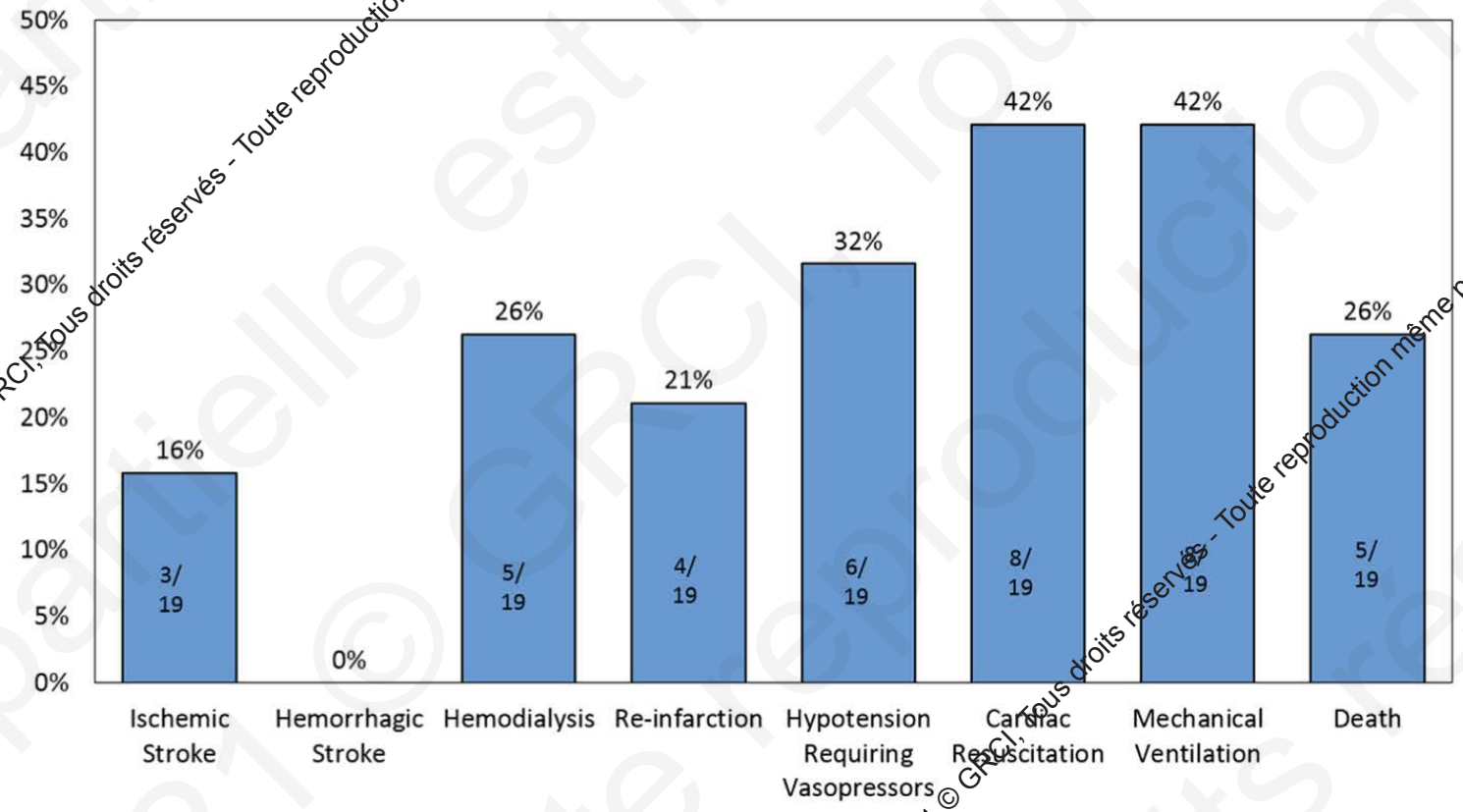


Figure 1. Clinical course and outcomes of COVID-19 patients presenting with STEMI who underwent primary PCI.

Hamadeh *Am J Cardiol.* 2020;p 131

STEMI et COVID-19

TABLE 2 Procedural Characteristics

	Non-COVID-19 (n = 76)	COVID-19 (n = 39)	p Value
Coronary intervention	74 (97.3)	38 (97.4)	1.000
Door-to-balloon time, min	50 (34.5-57.5)	52 (39-70)	0.248
Duration of case, min	55 (39-70)	55 (44-90)	0.054
Culprit vessel			0.621
LMS	1 (1.4)	2 (5.1)	-
LAD	41 (55.4)	22 (56.4)	-
Cx	1 (1.4)	4 (10.3)	-
RCA	24 (32.4)	10 (25.6)	-
Multivessel thrombosis	0 (0.0)	7 (17.9)	0.0003‡
Stent thrombosis	1 (1.2)	4 (10.3)	0.0445†
Baseline TIMI flow grade 0-1	60 (80.0)	32 (82.1)	0.798
Baseline thrombus grade (4-5)	59 (77.3)	33 (84.6)	0.440
Modified thrombus grade post first device	51	28	0.005*
0	2 (3.9)	0 (0.0)	
1	9 (17.6)	0 (0.0)	
2	11 (21.6)	1 (3.6)	
3	13 (25.5)	7 (25.0)	
4	12 (23.5)	12 (42.9)	
5	4 (7.8)	8 (28.6)	

TABLE 2 Procedural Characteristics

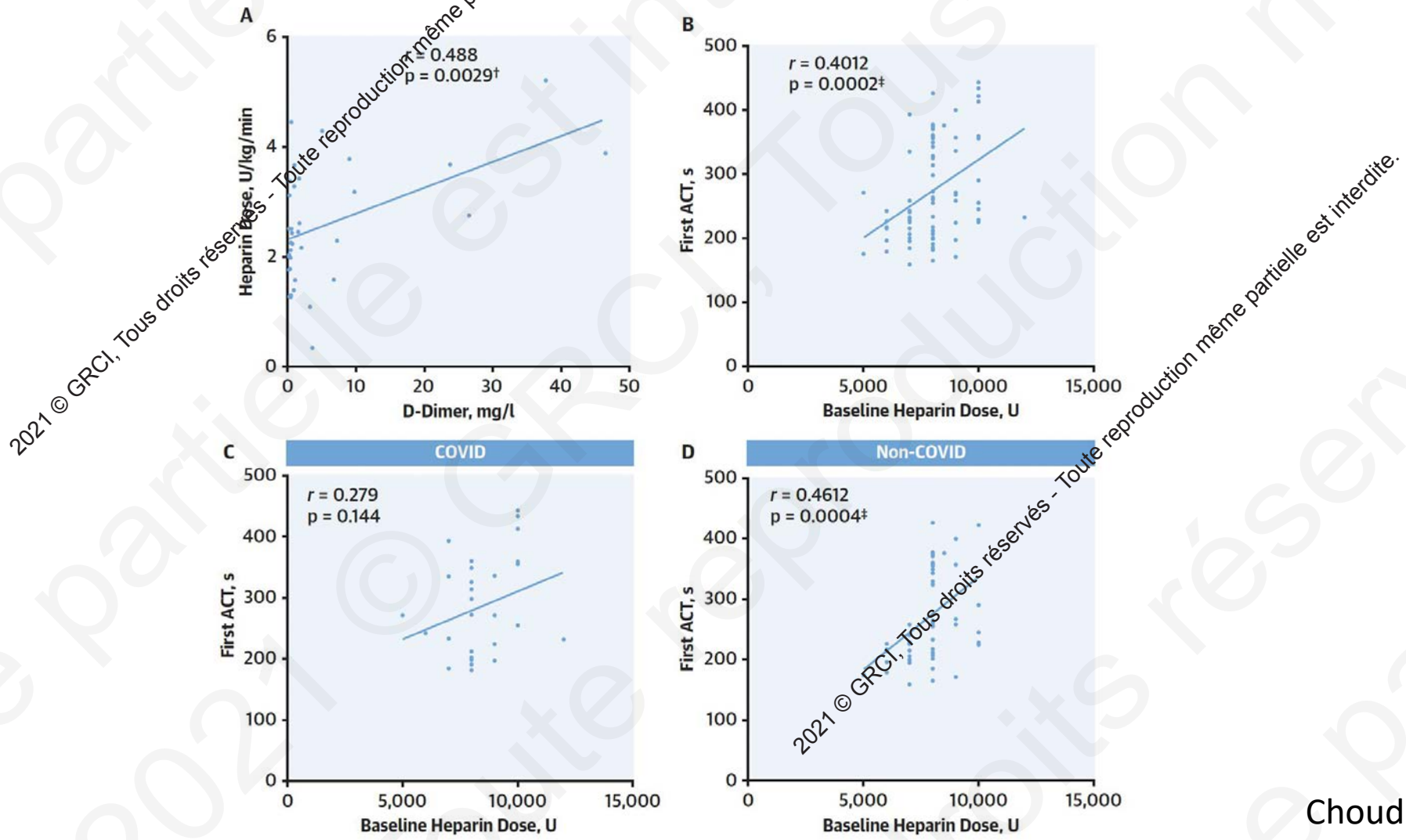
	Non-COVID-19 (n = 76)	COVID-19 (n = 39)	p Value
Modified thrombus grade (4-5)	16 (31.4)	21 (75)	0.0006‡
GP IIb/IIIa inhibitor use	7 (9.2)	23 (59.0)	<0.0001‡
Aspiration thrombectomy use	1 (1.3)	7 (17.9)	0.0021*
Total heparin dose, U	10,066 ± 3,176	11,125 ± 3,875	0.151
Average ACT	287.8 ± 66.9	270.6 ± 69.5	0.261
Total heparin dose per weight, U/kg	134.1 ± 35.9	146.2 ± 43.5	0.151
Total heparin dose per kg per min of case, units/kg/min	2.0 ± 0.9	2.3 ± 0.8	0.144
Multivessel PCI	5 (6.8)	8 (20.5)	0.033†
Procedural success			
Post-PCI TIMI flow grade 3	70 (93.3)	35 (89.7)	0.687
Myocardial blush grade (end) 2	70 (93.3)	21 (53.8)	<0.0001‡
LV ejection fraction, %	45 (40-55)	42.5 (30-50)	0.019†

Values are n (%), median (interquartile range), mean ± SD, or n. *p < 0.01, †p < 0.05, ‡p<0.001

ACT = active clotting time; Cx = circumflex; GP = glycoprotein; LAD = left anterior descending; LMS = left main stem; LV = left ventricular; RCA = right coronary artery; TIMI = Thrombolysis In Myocardial Infarction. Other abbreviations as in Table 1.

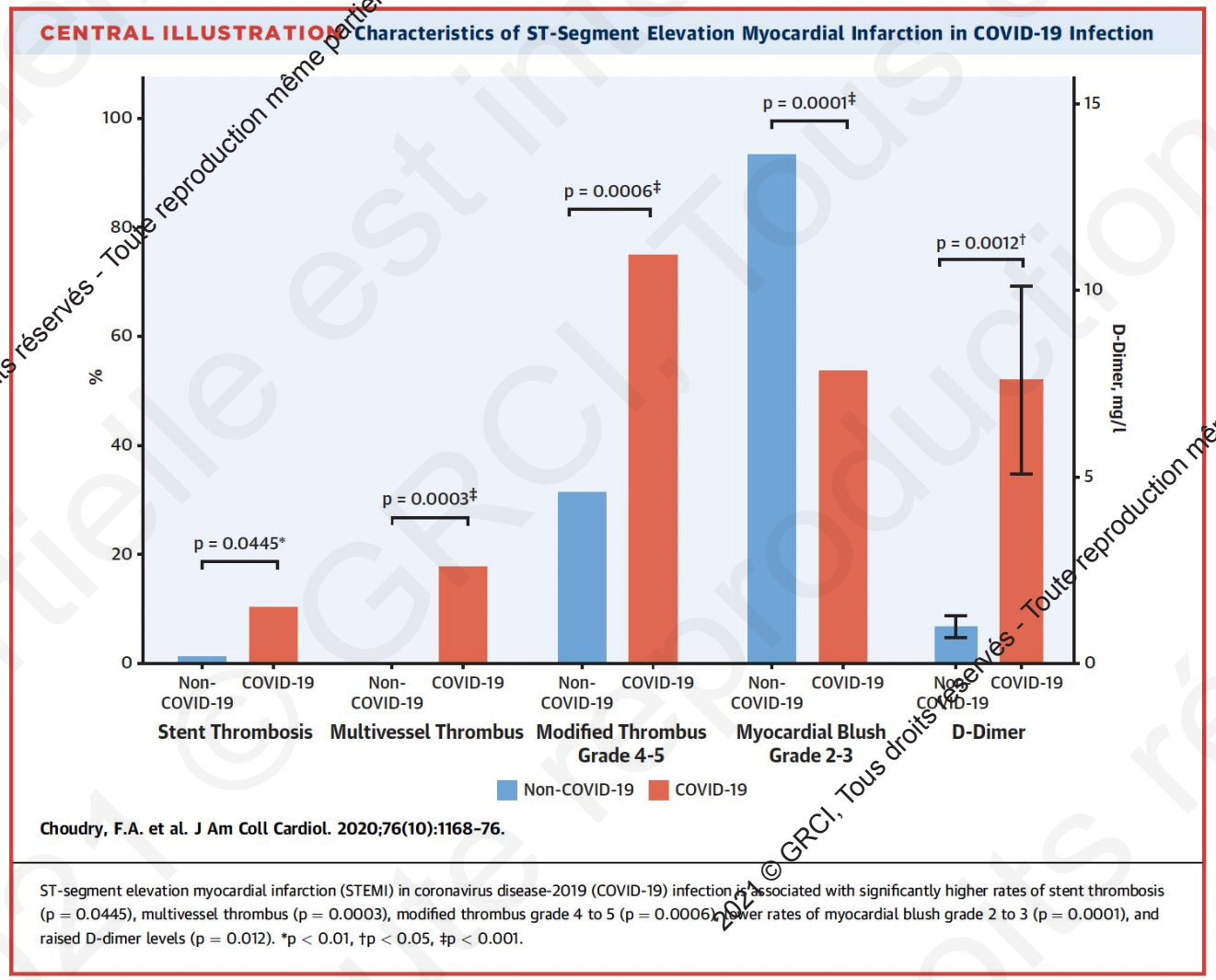
Choudry *JACC* 2020

STEMI et Covid-19



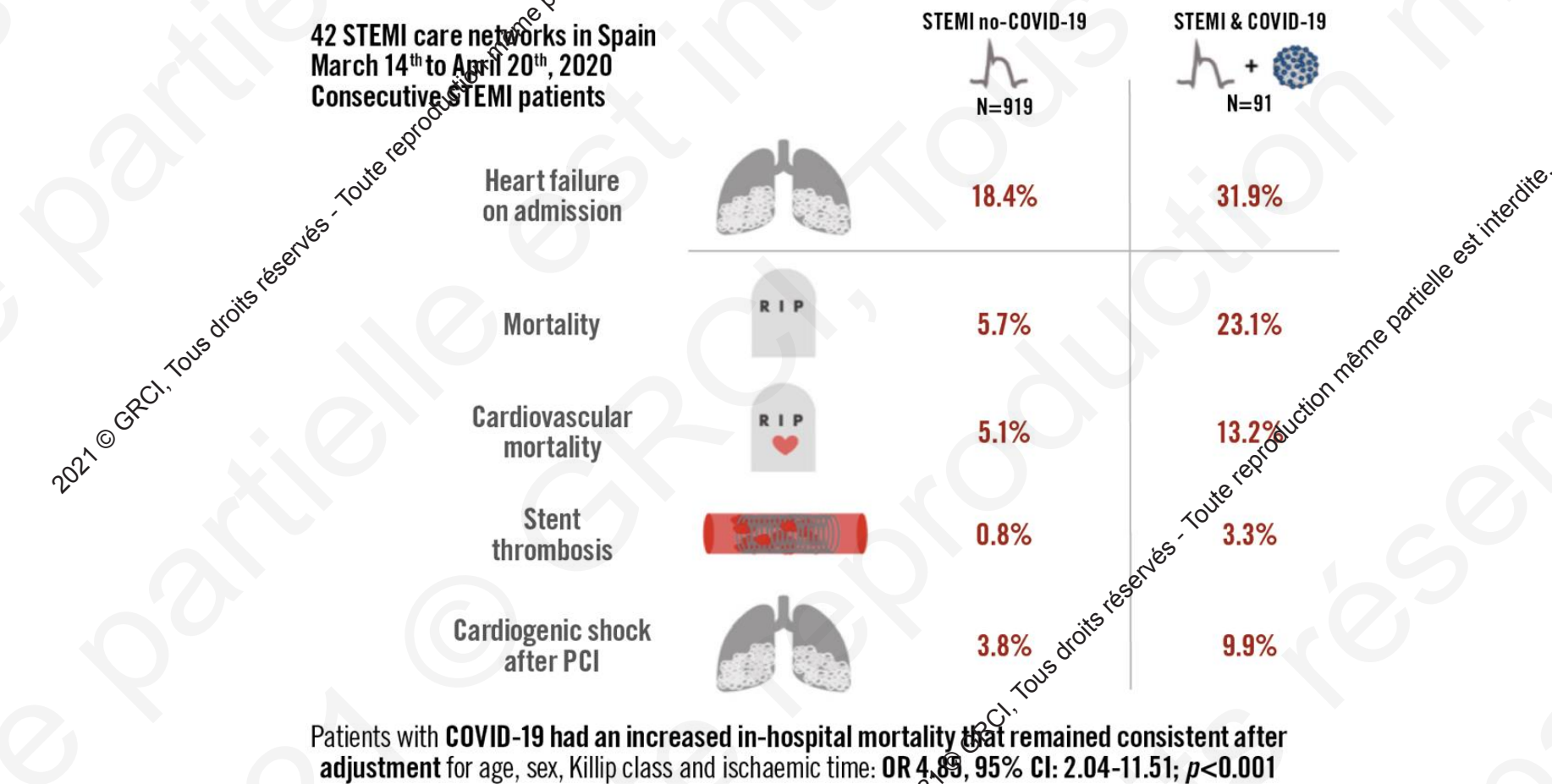
Choudry *JACC* 2020

STEMI et Covid-19



Choudry *JACC* 2020

STEMI et Covid-19



Rodriguez *Eurointervention* 2021

COVID-19
Sur-risque de STEMI et d'AVC

Registre suédois 86 742 pts COVID

	Acute myocardial infarction		Univariable models	Multivariable model
	No (n=424 320)	Yes (n=49)	OR (95% CI; p value)	OR (95% CI; p value)
COVID-19 diagnosis				
No	340 407 (99·99%)	25 (0·01%)	1 (ref)	1 (ref)
Yes	83 913 (99·97%)	24 (0·03%)	4·06 (2·27–7·25; p<0·0001)	3·41 (1·58–7·36; p=0·0017)
wCCI				
Mean	1 (2·02)	3·53 (2·48)	1·22 (1·08–1·38; p=0·0012)	1·41 (1·18–1·68; p=0·0002)
Income quintile*				
1	82 972 (99·99%)	7 (0·01%)	1 (ref)	1 (ref)
2	83 053 (99·99%)	5 (0·01%)	1·01 (0·28–3·60; p=0·98)	1·14 (0·26–5·06; p=0·87)
3	82 607 (99·99%)	11 (0·01%)	1·53 (0·48–4·88; p=0·47)	1·76 (0·41–7·55; p=0·45)
4	80 249 (99·98%)	14 (0·02%)	1·30 (0·44–3·85; p=0·64)	0·96 (0·23–3·98; p=0·96)
5	81 296 (99·99%)	12 (0·01%)	3·05 (0·94–9·88; p=0·064)	4·17 (0·76–22·8; p=0·10)
Data missing	14 143 (3·33%)	0	..	..
Education				
Tertiary	154 667 (99·99%)	8 (0·01%)	1 (ref)	1 (ref)
Secondary	172 934 (99·99%)	19 (0·01%)	2·11 (0·83–5·34; p=0·12)	1·51 (0·50–4·53; p=0·46)
Primary	76 245 (99·98%)	19 (0·02%)	2·34 (0·91–6·04; p=0·079)	1·25 (0·37–4·23; p=0·72)
Data missing	20 474 (4·83%)	3 (6·12%)	..	..
Country of birth				
Sweden	324 733 (99·99%)	37 (0·01%)	1 (ref)	1 (ref)
Other high-income country	33 377 (99·99%)	5 (0·01%)	1·09 (0·37–3·20; p=0·88)	1·30 (0·32–5·24; p=0·71)
Middle-income country	45 128 (99·99%)	6 (0·01%)	5·76 (1·54–21·63; p=0·094)	1·71 (0·23–12·97; p=0·60)
Low-income country	20 870 (100%)	1 (0%)	1·30 (0·13–12·58; p=0·82)	0·98 (0·06–17·32; p=0·99)
Data missing	212 (0·04%)	0	..	..

Data are n (%) or mean (SD) except where otherwise stated. Percentages are calculated as a proportion of the included study population; individuals with a previous acute myocardial infarction or stroke were excluded from the study. Day 0 is excluded from the study period due to risk of selection bias. OR=odds ratio. wCCI=weighted Charlson Comorbidity Index. *Quintile 1 is the highest income, quintile 5 is the lowest income.

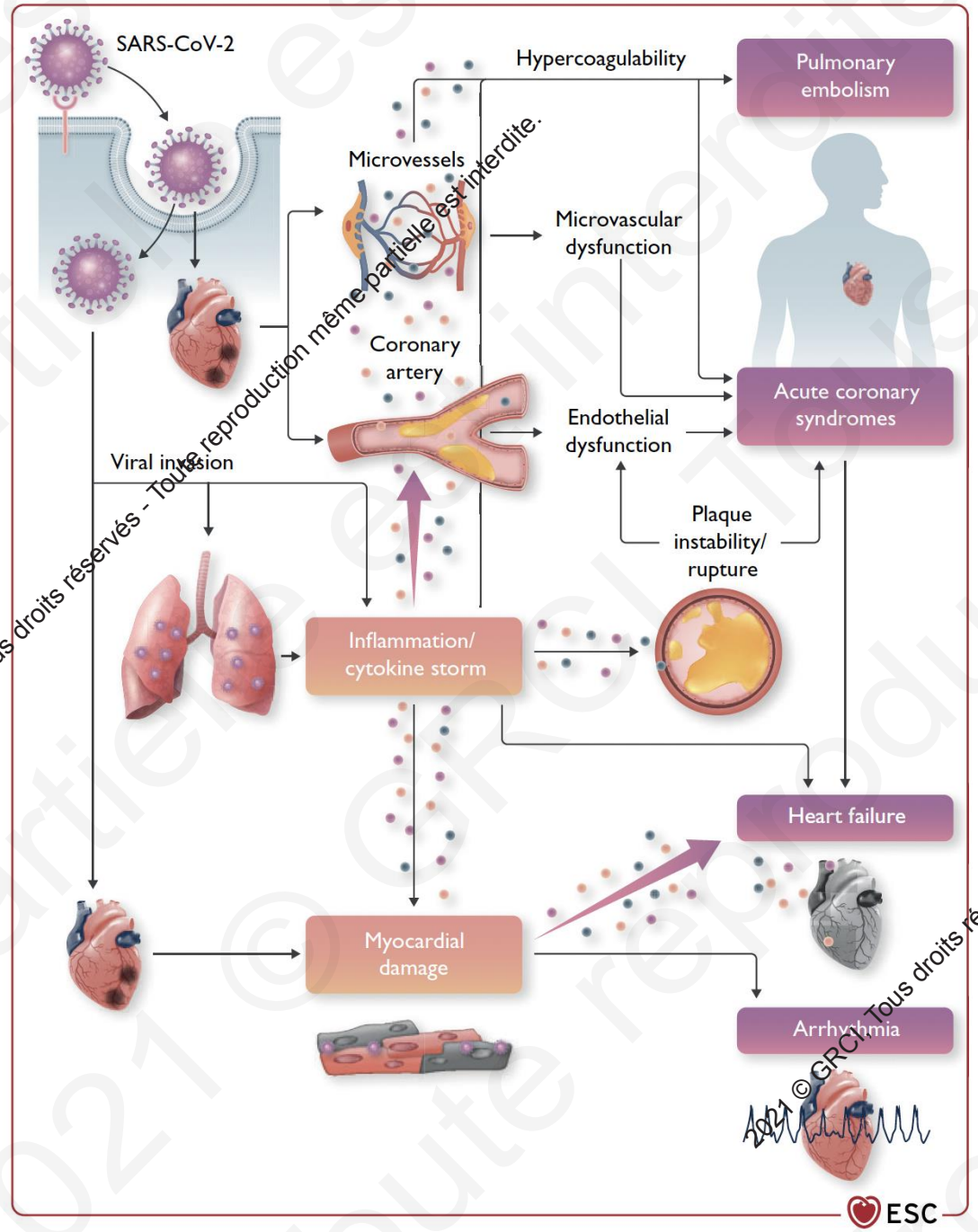
Table 2: **Unadjusted and adjusted conditional logistic regression models for acute myocardial infarction within 14 days following COVID-19 onset in the matched cohort study**

	Stroke		Univariable models	Multivariable model
	No (n=424 406)	Yes (n=62)	OR (95% CI; p value)	OR (95% CI; p value)
COVID-19 diagnosis				
No	340 920 (99·99%)	32 (0·01%)	1 (ref)	1 (ref)
Yes	83 486 (99·96%)	30 (0·04%)	4·52 (2·65–7·70; p<0·0001)	3·63 (1·69–7·80; p=0·0009)
wCCI				
Mean	1·05 (2·06)	4·85 (3·69)	1·41 (1·25–1·59; p<0·0001)	1·46 (1·25–1·71; p<0·0001)
Income quintiles*				
1	83 121 (99·99%)	10 (0·01%)	1 (ref)	1 (ref)
2	83 329 (99·99%)	8 (0·01%)	0·80 (0·28–2·29; p=0·68)	0·40 (0·09–1·75; p=0·23)
3	82 626 (99·99%)	5 (0·01%)	0·63 (0·19–2·07; p=0·44)	0·44 (0·10–1·99; p=0·29)
4	80 142 (99·97%)	21 (0·03%)	1·62 (0·65–4·04; p=0·30)	1·24 (0·37–4·12; p=0·73)
5	81 057 (99·98%)	18 (0·02%)	1·59 (0·63–4·00; p=0·32)	0·48 (0·12–1·94; p=0·30)
Data missing	14 131 (3·33%)	0	..	..
Education				
Tertiary	154 519 (99·99%)	17 (0·01%)	1 (ref)	1 (ref)
Secondary	173 072 (99·99%)	25 (0·01%)	1·15 (0·58–2·29; p=0·68)	1·95 (0·73–5·23; p=0·19)
Primary	76 412 (99·98%)	19 (0·02%)	1·22 (0·58–2·56; p=0·59)	1·63 (0·54–4·92; p=0·39)
Data missing	20 406 (4·81%)	1 (1·61%)	..	..
Country of birth				
Sweden	324 551 (99·99%)	45 (0·01%)	1 (ref)	1 (ref)
Other high-income country	33 389 (99·98%)	7 (0·02%)	1·34 (0·52–3·44; p=0·55)	1·44 (0·43–4·74; p=0·55)
Middle-income country	45 440 (99·99%)	5 (0·01%)	2·00 (0·68–5·85; p=0·21)	1·17 (0·25–5·45; p=0·84)
Low-income country	20 911 (99·98%)	5 (0·02%)	10·13 (1·90–54·05; p=0·0067)	11·92 (0·78–181·12; p=0·074)
Data missing	212 (0·05%)	0	..	..

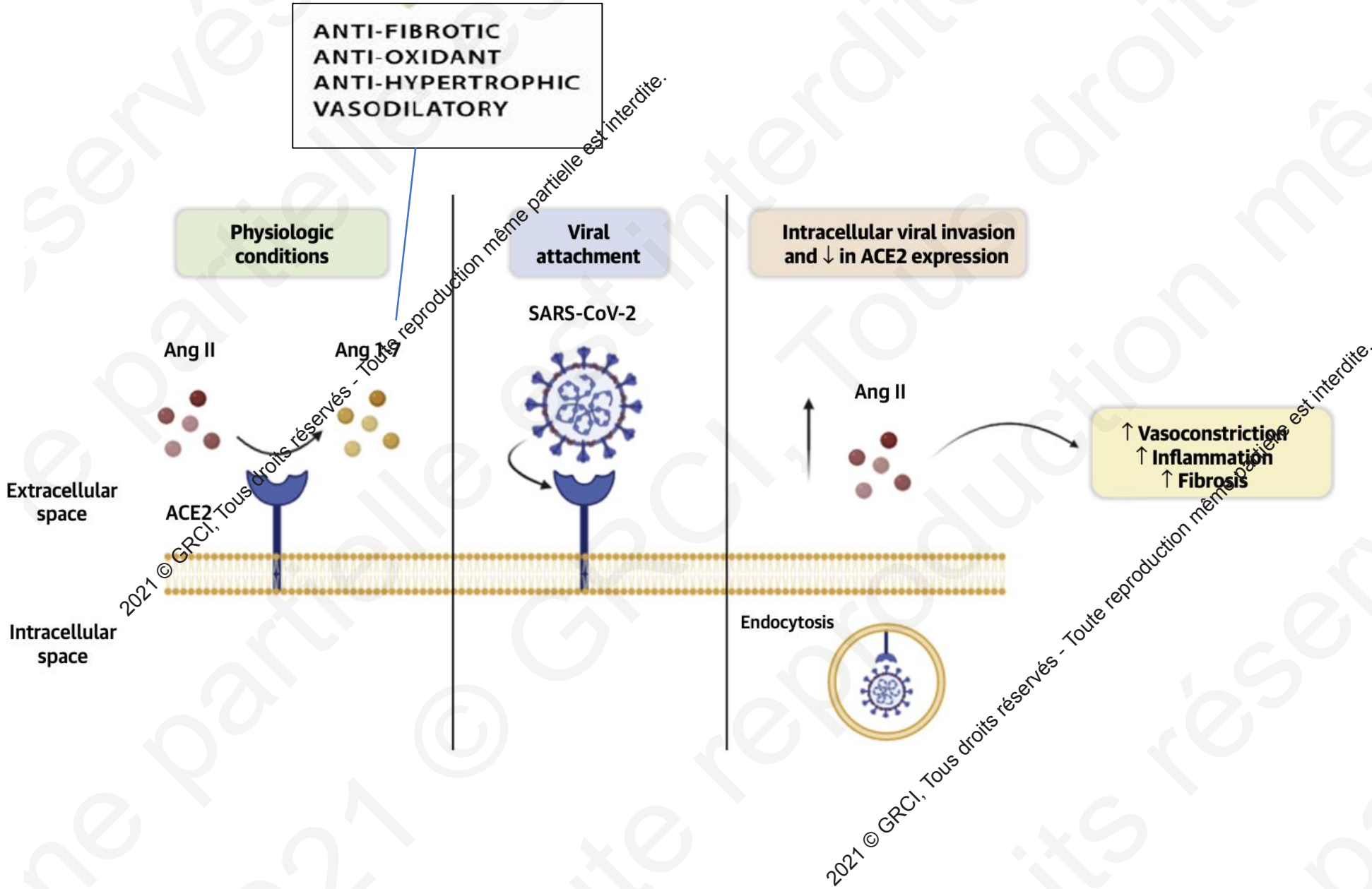
Data are n (%) or mean (SD) except where otherwise stated. Percentages are calculated as a proportion of the included study population; individuals with a previous acute myocardial infarction or stroke were excluded from the study. Day 0 is excluded from the study period due to risk of selection bias. OR=odds ratio. wCCI=weighted Charlson Comorbidity Index. *Quintile 1 is the highest income, quintile 5 is the lowest income.

Table 4: **Unadjusted and adjusted conditional logistic regression models for ischaemic stroke within 14 days following COVID-19 onset in the matched cohort study**

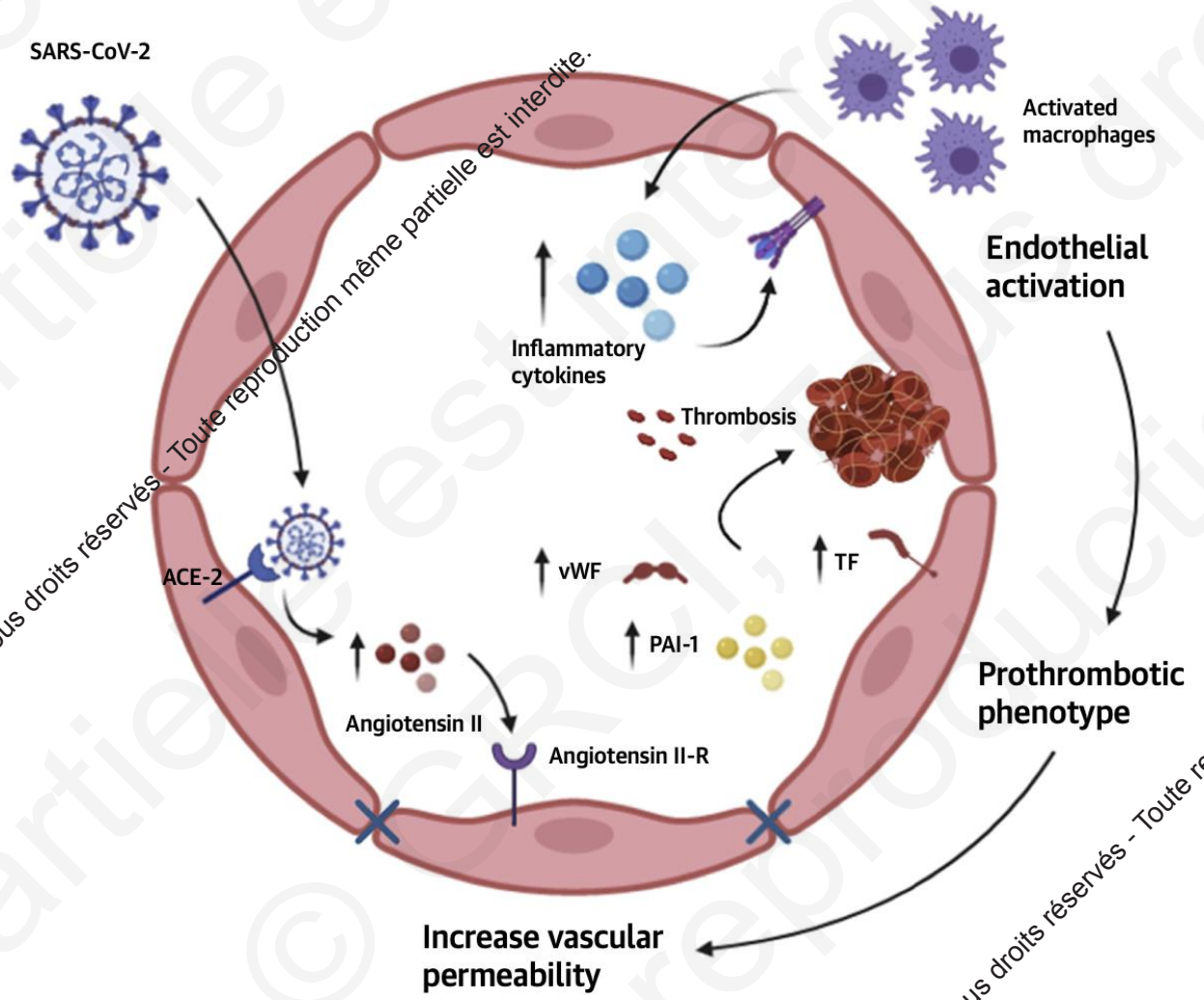
Katsoularis *Lancet* oct 2021



Baigent et al. *Eur H J* sept 2021



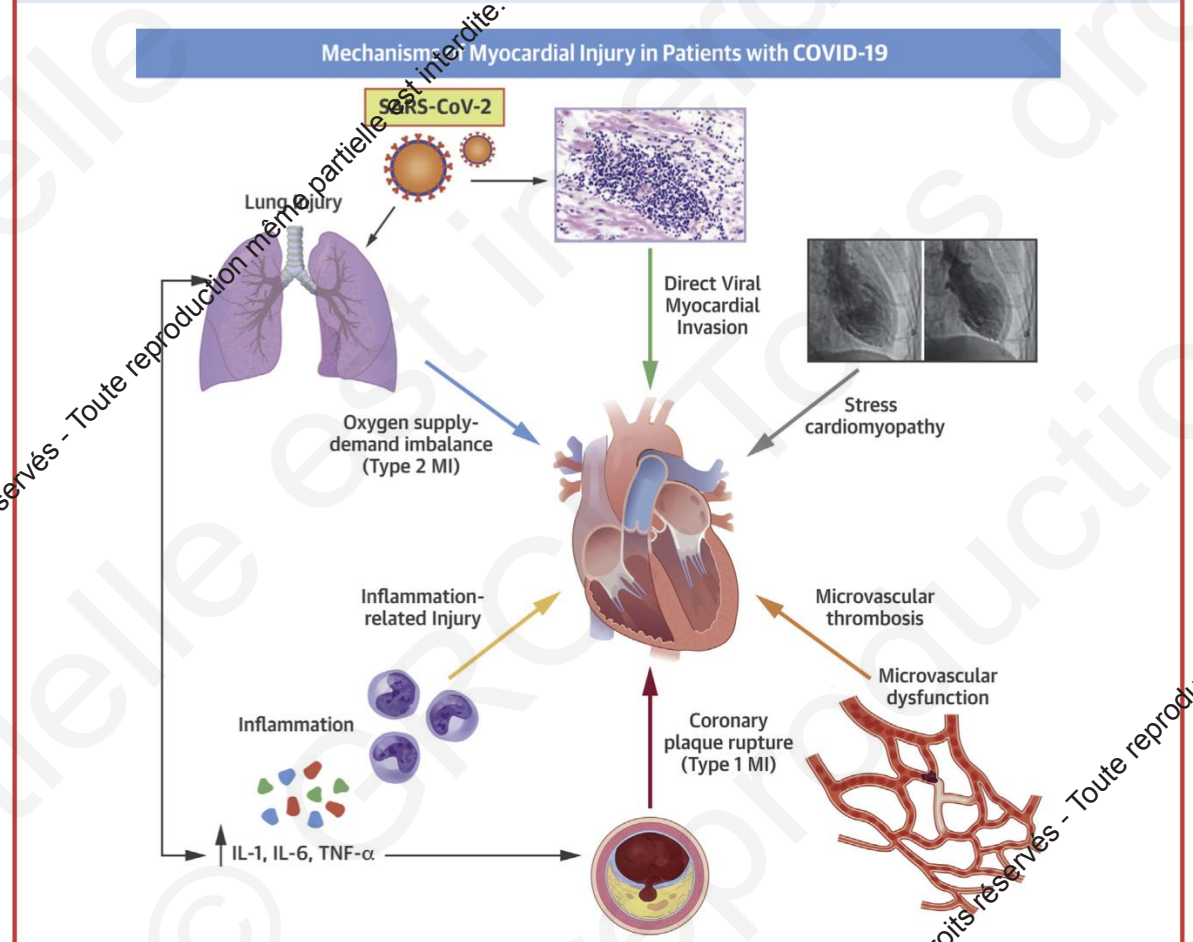
Giustino et al. *J Am Coll Cardiol* 2020



Inflammatory cytokines and excessive Ang II activity lead to endothelial activation, which is associated with a prothrombotic phenotype and increased endothelial permeability. In addition, SARS-CoV-2 has been shown to directly invade endothelial cells and cause endotheliitis. Image created with BioRender.com. PAI = plasminogen activator inhibitor; TF = tissue factor; vWF = von Willebrand factor; other abbreviations as in Figure 1.

Giustino et al. *J Am Coll Cardiol* 2020

CENTRAL ILLUSTRATION **Overview of the Mechanisms of Myocardial Injury in Patients With Coronavirus Disease 2019**



Giustino, G. et al. J Am Coll Cardiol. 2020;76(17):2011-23.

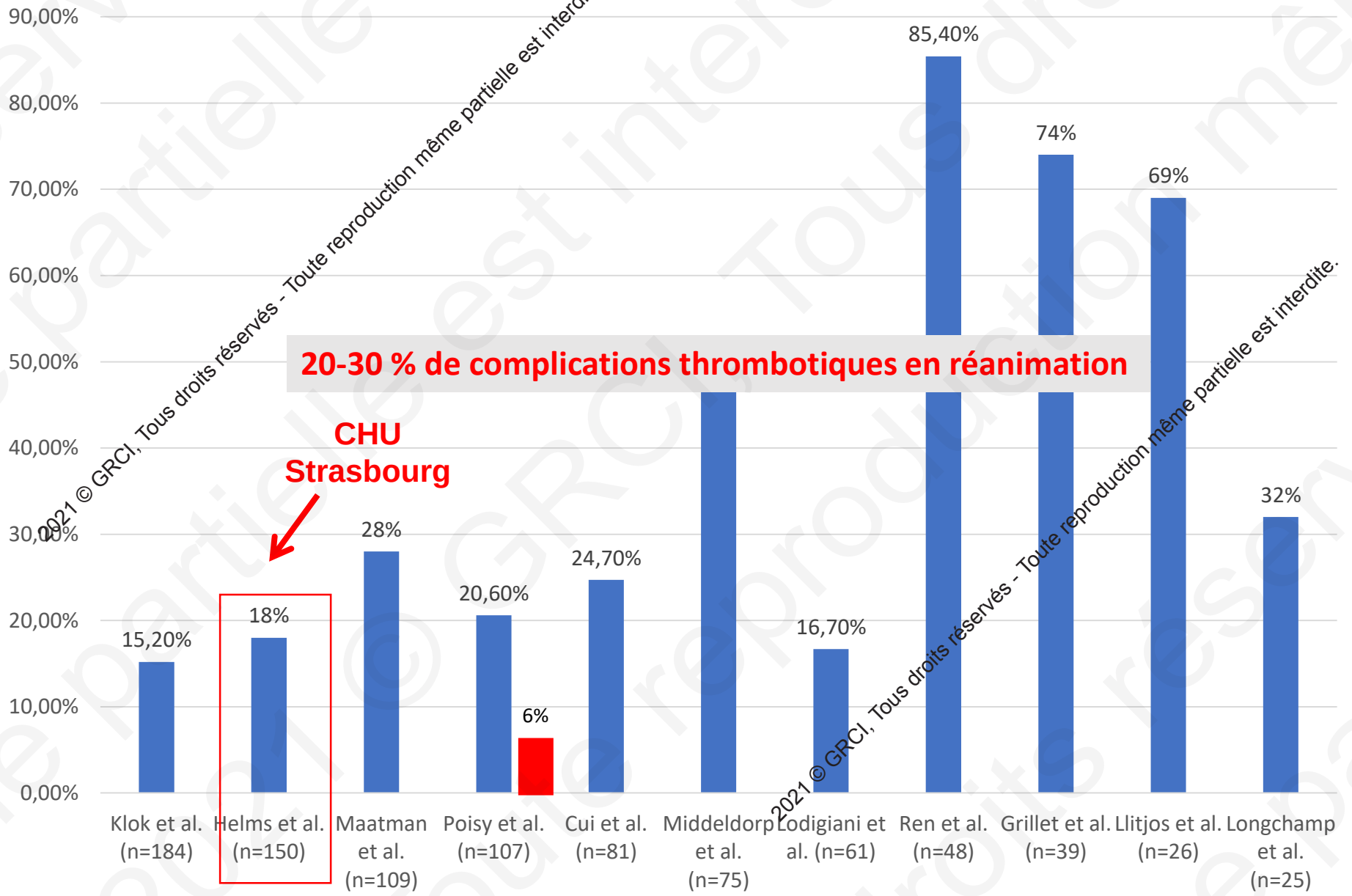
Myocardial injury in the setting of COVID-19 is frequent and associated with poor prognosis. The mechanisms through which COVID-19 can cause myocardial injury are heterogeneous and include oxygen supply-demand imbalance, microvascular and macrovascular thrombosis, inflammation-related injury, stress-induced cardiomyopathy, and direct viral invasion of the myocardium. COVID-19 = coronavirus disease 2019; IL = interleukin; MI = myocardial infarction; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2; TNF = tumor necrosis factor.

Giustino et al. *J Am Coll Cardiol* 2020

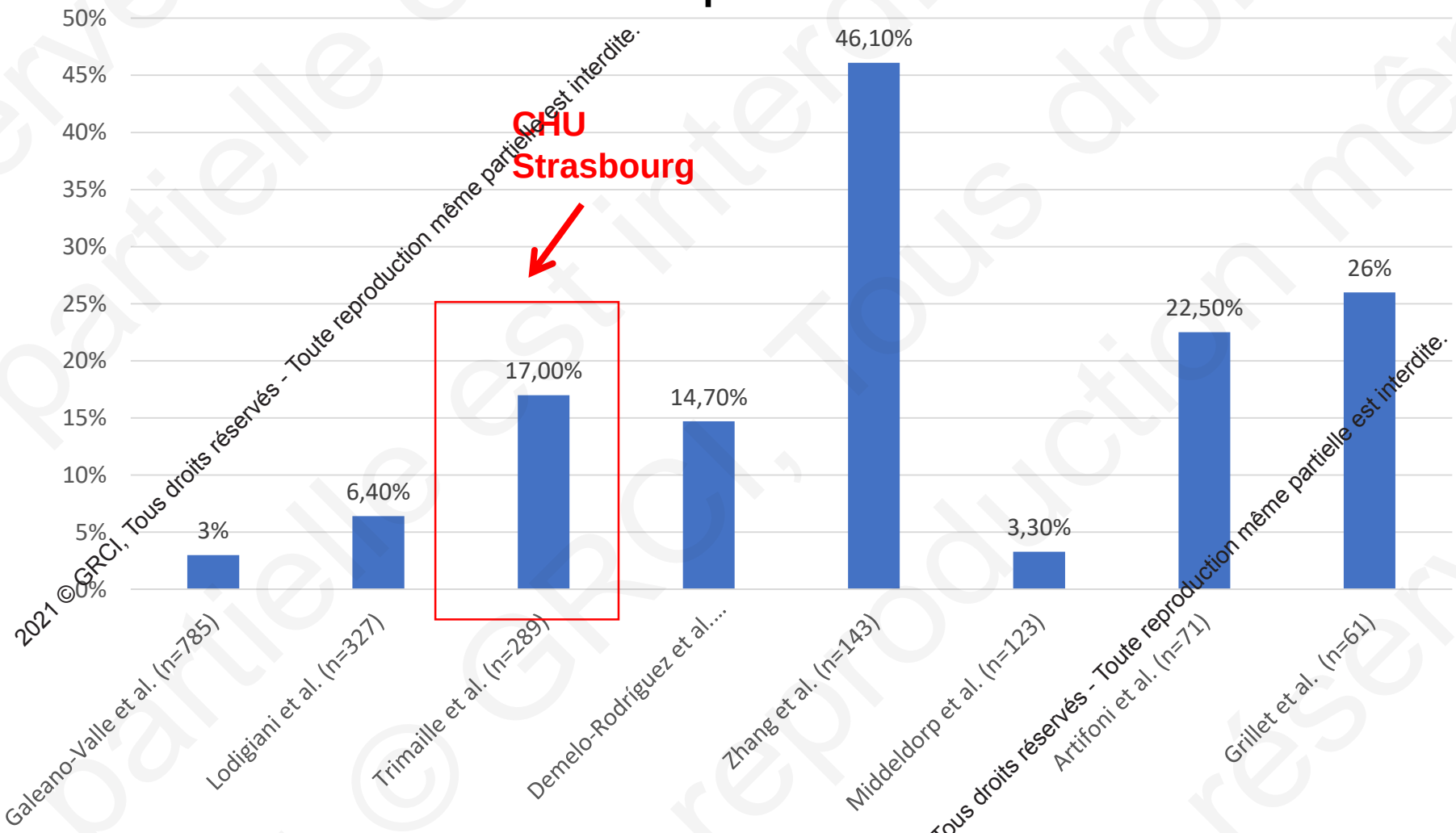
Embolie pulmonaire et Covid

Leonard-Lorant I et al. Radiology 2020

Reported Incidence of Venous Thrombotic Events in COVID-19 Patients Hospitalized in ICU



Reported Incidence of Venous Thrombotic Events in COVID-19 Patients Hospitalized in non-ICU

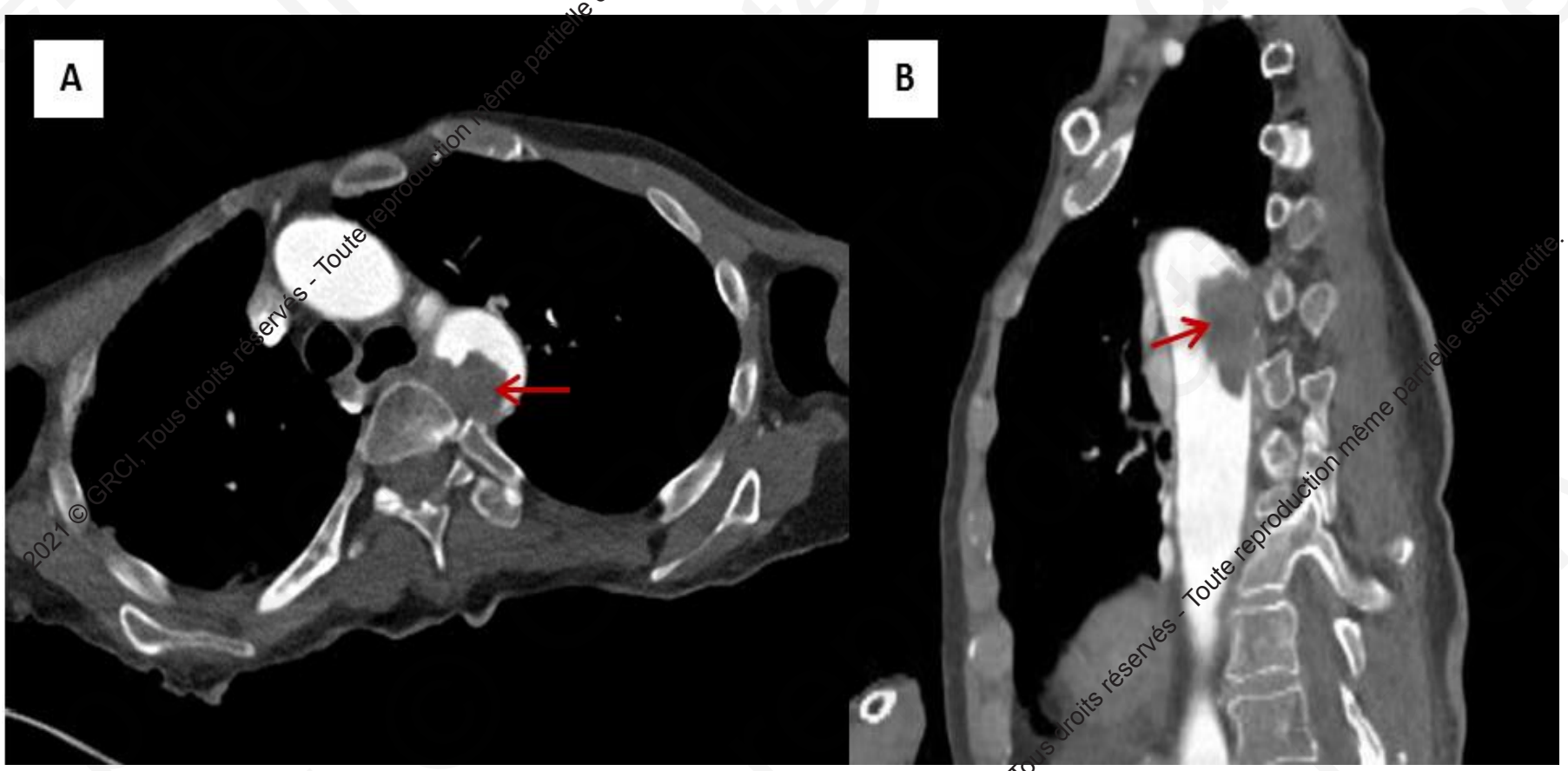


Incidence TVP population générale: 117/100 000/an

Incidence hospitalière 960 /10 000/an

Incidence hospitalière Covid 1695/10 000/2mois

Thrombose artérielle et Covid



Woehl B et al. JACC Case Reports 2020

ESC Guidelines COVID-19 and CV disease

ESC European Society of Cardiology

European Heart Journal (2021) **00**, 1–45
doi:10.1093/eurheartj/ehab697

SPECIAL ARTICLE

ESC guidance for the diagnosis and management of cardiovascular disease during the COVID-19 pandemic: part 2—care pathways, treatment, and follow-up

The Task Force for the management of COVID-19 of the European Society of Cardiology

Received 23 April 2021; revised 8 July 2021; editorial decision 10 September 2021; accepted 13 September 2021

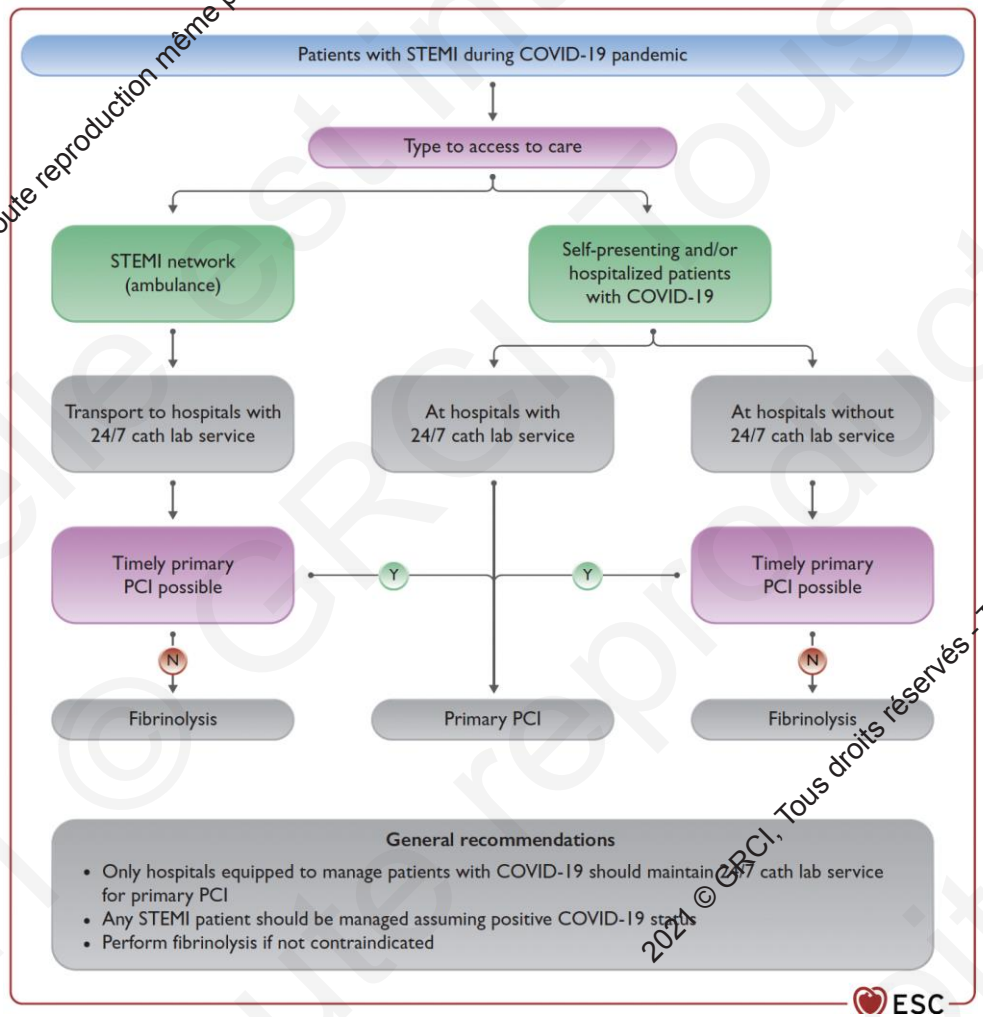
Aims Since its emergence in early 2020, the novel severe acute respiratory syndrome coronavirus 2 causing coronavirus disease 2019 (COVID-19) has reached pandemic levels, and there have been repeated outbreaks across the globe. The aim of this two part series is to provide practical knowledge and guidance to aid clinicians in the diagnosis and management of cardiovascular (CV) disease in association with COVID-19.

Methods and results A narrative literature review of the available evidence has been performed, and the resulting information has been organized into two parts. The first, which was reported previously, focused on the epidemiology, pathophysiology, and diagnosis of CV conditions that may be manifest in patients with COVID-19. This second part addresses the topics of: care pathways and triage systems and management and treatment pathways, both of the most commonly encountered CV conditions and of COVID-19; and information that may be considered useful to help patients with CV disease (CVD) to avoid exposure to COVID-19.

Conclusion This comprehensive review is not a formal guideline but rather a document that provides a summary of current knowledge and guidance to practicing clinicians managing patients with CVD and COVID-19. The recommendations are mainly the result of observations and personal experience from healthcare providers. Therefore, the information provided here may be subject to change with increasing knowledge, evidence from prospective studies, and changes in the pandemic. Likewise, the guidance provided in the document should not interfere with recommendations provided by local and national healthcare authorities.

Baigent et al. *Eur H J* sept 2021

ESC Guidelines COVID-19 et STEMI



Baigent et al. *Eur H J* sept 2021

ESC Guidelines COVID-19 et non-STEMI

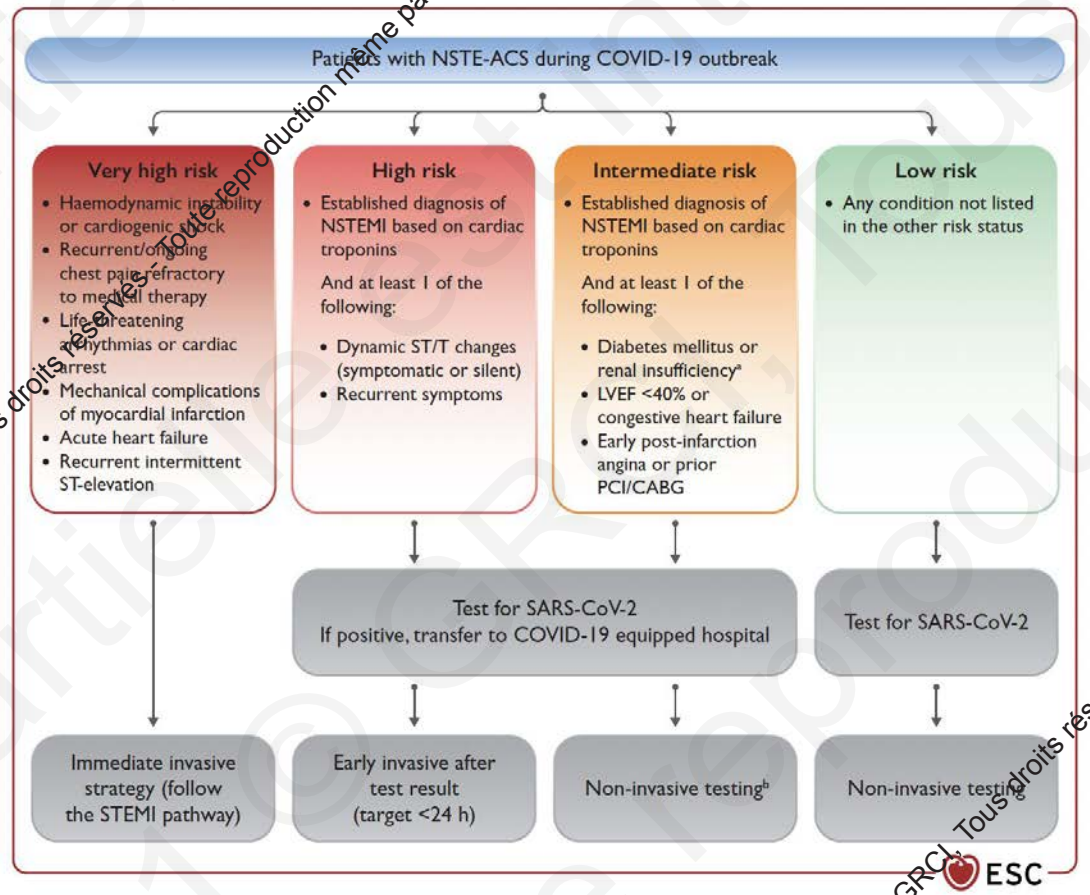


Figure 3 Recommendations for the management of patients with NSTE-ACS in the context of COVID-19 outbreak. CABG, coronary artery bypass graft; COVID-19, coronavirus disease 2019; LVEF, left ventricular ejection fraction; MI, myocardial infarction; NSTEMI, non-ST-segment-elevation MI; PCI, percutaneous coronary intervention; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2. [a]Estimated glomerular filtration rate <60 mL/min/1.73 m^2. [b]Coronary computed tomography angiography should be favoured, if equipment and expertise are available. In low-risk patients, other non-invasive testing might be favoured in order to shorten hospital stay. It is suggested to perform left ventriculography during catheterization if echocardiography not performed before catheterization laboratory admission.

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ESC Guidelines COVID-19 et angor stable

Table 2 Management of chronic coronary syndromes during COVID-19 pandemic

Continuation of medications in CCS patients is recommended during COVID-19 pandemic
Follow-up of CCS patients via tele-health is recommended
Revascularization of CCS patients must be postponed in low- to intermediate-risk patients
Postponing of non-invasive testing of CCS patients should be considered during COVID-19 pandemic
CT angiography should be preferred to non-invasive functional testing during COVID-19 pandemic
Screening for SARS-CoV-2 infection should be considered before cardiac surgery with nasopharyngeal swab and CT scan
Revascularization of high-risk[a] CCS patients may be considered during COVID-19 pandemic
PCI may be considered over CABG in selected patients during COVID-19 pandemic[b]
Identification of COVID-19-free hospitals may be considered as 'Hub' for cardiac surgery
Invasive management of CCS in SARS-CoV-2-positive patients should be deferred until the patient has recovered, whenever possible

CABG, coronary artery bypass graft; CCS, chronic coronary syndrome; COVID-19, coronavirus disease 2019; CT, computed tomography; ICU, intensive care unit; PCI, percutaneous coronary intervention; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

[a]Patients with high-risk symptoms and/or coronary anatomy and/or large ischaemia as assessed by Heart team.

[b]To shorten hospital stay and keep ICU beds available for patients with COVID-19.

Invasive assessment and revascularization

Symptomatic patients with very high clinical likelihood of obstructive CAD are generally referred to ICA without prior non-invasive diagnostic testing.[25] However, medical treatment should be attempted first to reserve ICA with possible ad hoc revascularization only in case of clinical instability, especially in regions where healthcare systems are heavily overloaded by patients with COVID-19.[26] Revascularization, either by PCI or by coronary artery bypass graft (CABG), can be postponed in most CCS patients. Healthcare systems might identify COVID-19-free hospitals serving as hubs for selected CCS patients in whom invasive and surgical procedures cannot be postponed. In selected patients, hybrid revascularization CABG/PCI or even full PCI can be considered by the heart team based on the patient's clinical condition and local situation (see *Table 2*).

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Conclusion: COVID-19

- Dérégulation de la prise en charge des SCA
  - Baisse du recours aux soins
  - Allongement des délais
  - Services surchargés
- Surmortalité extra-hospitalière et hospitalière des SCA
- Facteur de risque de pathologie thrombotique
  - Veineuse
  - Artérielle (IDM, AVC)
- Physiopathologie propre
- Adaptation de nos prises en charge

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