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ABSTRACT

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Background: Concern has risen on whether COVID-19 infection increases complications and mortality of surgical patients. Besides, overwhelmed hospitals could have decreased ability to rescue patients from postoperative complications. This cohort's study aims to determine whether postoperative outcomes of emergency digestive surgery worsened during the COVID-19 pandemic both for COVID-19-infected and uninfected patients.

Methods: Patients undergoing emergency general and digestive surgery from March to June, 2020, and from March to June, 2019 in 25 Spanish hospitals were included. Main outcome: 30-day mortality. Secondary outcomes: postoperative complications, severe complications (Clavien-Dindo score ≥ IIIA) and failure-to-rescue (death rate among complicated patients). Propensity-score matching was done between intra-pandemic COVID-19-positive and -negative patients (1:3); and between COVID-19-negative intra- and pre-pandemic patients (1:1). A logistic regression model was done in matched cohorts.

Results: 5 307 patients were included (183 COVID-19-positive, 2 132 intra-pandemic COVID-19-negative, 2 992 pre-pandemic). COVID-19-positive patients presented higher analytical markers of inflammatory response and tissular damage and had more complications (1.8-fold risk), severe complications (1.7-fold), and mortality (2.1-fold) than intra-pandemic COVID-19-negative patients. Intra-pandemic COVID-19-negative patients, in comparison to pre-pandemic controls, had similar analytical markers, complication and severe complication rates, but higher failure-to-rescue (1.6-fold risk).

Conclusions: COVID-19-infected patients submitted to emergency surgeries are at increased risk of postoperative complications and mortality; therefore, non-surgical management should be prioritized in these patients. Moreover, COVID-19-negative patients operated on during the pandemic presented higher-than-expected failure-to-rescue; an effort to invest on and better organize public health system should be made to minimize avoidable deaths in future sanitary crisis.

INTRODUCTION

Since the beginning of 2020, the rapid spread of the COronaVIrus-19 Disease (COVID-19) has stressed many health-care systems worldwide, forcing cancellation of most programmed surgeries[1–5]. However, non-delayable surgeries continued to be performed, sometimes in patients infected by COVID-19[6,7]. Patients undergoing emergency surgery are at higher risk of postoperative complications and mortality than those submitted to elective interventions[8,9]. In addition, COVID-19-positive patients could be susceptible of poor postoperative outcomes due to the immunological dysregulation and hyperinflammatory response to surgery, and need of mechanical ventilation[10–15]. Therefore, COVID-19-positive patients with potentially urgent surgical diseases put clinicians in the dilemma of forcing an uncertain conservative management[12–14,16,17]. Most guidelines and recommendations are based on expert opinion[18–21]. Studies describing the risk of performing surgery in COVID-19-infected patients are needed to help evidence-based decision making.

Cohort studies of COVID-19-infected patients submitted to surgery show poor postoperative outcomes[11-14]. However, these findings should be benchmarked with caution, as during the pandemic, all patients were at risk of worse-than-expected outcomes: fear or difficulty of visiting hospitals could make surgical pathologies reach a more advanced stage at consultation[21-23]; and hospitals' work overload may difficult rescue from postoperative complications[9,23]. Spanish public health system could be especially vulnerable to the pandemic resilience test, as austerity following the 2008 financial crisis left it understaffed, under-resourced and under stain[24]. Reliable data on the consequences of hospital collapse are needed in order to draw lessons for the future[25,26].

Our hypothesis was that, from March to June 2020, 30-day mortality following emergency general and digestive surgery increased for COVID-19-infected patients, compared to contemporary COVID-19-uninfected ones; and also, for COVID-19-uninfected patients, compared with patients operated on before the pandemic.

METHODS

Study design

This is a multicentre retrospective cohorts' study in patients undergoing emergency general and digestive surgery at 25 Spanish hospitals. The study protocol (COVID-CIR) was approved by the Institutional Review Board at the leading and participating hospitals and has been previously published[27]. Informed patients' consent was waived given the retrospective nature of the study. It was conducted in accordance with STROBE guidelines and the principles of the Declaration of Helsinki[28]. A high degree of confidentiality, in compliance with the provisions of personal data protection as required by Spanish Law (LOPD 3/2018), was ensured. Protocol registration identifier: ClinicalTrials.gov NCT04479150, July 21st, 2020.

Three cohorts of patients submitted to emergency general or gastrointestinal surgery were defined:

Cohort 1: COVID-19-infected operated on between March 1st and June 30th, 2020;

Cohort 2: COVID-19-non-infected operated on between March 1st and June 30th, 2020; and

Cohort 3: patients operated on between March 1st and June 30th, 2019.

Participants

Participant hospitals and investigators are detailed in the *Supplementary material (Table S1)*. All patients aged 18 or more undergoing emergency digestive or general surgery during the pandemic and pre-pandemic periods were included. Programmed procedures were excluded, but urgent reinterventions to treat complications of elective surgeries were included. If patients had multiple emergency operations, the first one was

considered as the index procedure. Patients were considered as COVID-19-positive if confirmed by quantitative RT-PCR (reverse transcription-polymerase chain reaction) detection of viral RNA in nasopharyngeal sample within 15 days before or 30 days after surgery or in case of clinical suspicion sustained by chest CT-scan findings. Otherwise, patients were COVID-19-negative.

Variables

Anonymized data were gathered in an eCRF based on REDCap® (Research Electronic Data Capture) software.

Demographic data included: age, sex, Body Mass Index (BMI), American Society of Anaesthesiologists (ASA) surgical risk score, functional status, and previous comorbidities: smoking habit, respiratory function, Chronic Obstructive Pulmonary Disease (COPD), cardiac function, ischemic heart disease, cerebrovascular accident, peripheral arterial disease, arterial hypertension, and diabetes.

Index surgery day data included: physiological variables (temperature, blood pressure, heart rate, and Glasgow coma score); electrocardiogram findings; analytical parameters (sodium, potassium, urea, alanine aminotransferase [ALT], haemoglobin, leucocytes, neutrophils, lymphocytes, platelets, C-reactive protein, D-dimer, ferritin, procalcitonin, troponin, and prothrombin time); neutrophil / lymphocyte ratio (NLR), platelet / lymphocyte ratio (PLR) and Systemic Immune-inflammation Index (SII, neutrophil x platelet / lymphocyte counts). Operative variables included: clinical priority (urgent or emergency surgery), surgical access, malignancy, type and extension of peritoneal exudates, estimate blood loss, surgical procedure(s), and complexity of primary intervention, as defined by the Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity (POSSUM) scale[29]. Prognostic surgical scales

POSSUM (mortality and morbidity), Portsmouth-POSSUM (P-POSSUM, mortality), and aLicante sUrgical Community Emergencies New Tool for the enUmeration of Morbidities (LUCENTUM, morbidity) were calculated *(Table S2)*[29-30].

Besides, in COVID-19-positive patients, we detailed pre- or postoperative diagnosis and PCR confirmation.

Outcomes

Main outcome was 30-day mortality for any cause, being day 0 the index surgery. Secondary outcomes were: 90-day mortality; 30-day overall postoperative complications; pulmonary complications (pneumonia, respiratory infection, respiratory failure, pleural effusion, or pulmonary atelectasis); thromboembolic complications (deep venous thrombosis, pulmonary embolism, acute myocardial infarction, stroke, acute limb ischemia, or acute mesenteric ischemia); severe complications (graded ≥ IIIA Clavien-Dindo classification); Failure-To-Rescue (FTR), defined as percentage of patients dying as a consequence of any postoperative complication[31,32]; ICU stay ≥24 hours after surgery; ≤30-day hospital readmission; ≤30-day surgical reintervention; and length of stay, defined as number of days from admission to hospital discharge or death.

Statistical analysis

Data quality

Before analysis, the principal investigators (JO, ZM and SV) confirmed completeness and accuracy of data with senior surgeons from each centre. Hospitals failing to include at least 90% of eligible patients were excluded to avoid selection bias. Patients with relevant missing information (age, sex, functional status, previous comorbidities, malignancy, COVID-19 infection status, date of surgery, urgency, type and complexity of surgery, and 30-day postoperative follow-up) were excluded.

Sample size

Due to the design of the study and the nature of our aim, no formal calculation of sample size was performed, being defined as the number of patients fulfilling inclusion criteria.

Statistical Procedures

Patients' baseline characteristics were summarized by cohort using standard descriptive statistics. A raw and adjusted cumulative incidence (and its 95% confident interval) comparison was performed between cohort 1 and cohort 2, and between cohort 2 and cohort 3. A mixed effects logistic regression model was used to estimate odds ratio to quantify the effect on each outcome. Mixed effects were used to account for centre-effects. The adjustment factors used in the model were sex, age (linear and quadratic term), functional status, COPD, hypertension, malignancy, clinical priority, and surgical complexity.

A propensity matching score analysis was done using a logistic regression model, in which COVID-19 status or year was regressed on observed baseline characteristics. Variables taken into account were: age, sex, functional status, smoking status, hypertension, COPD, diabetes, cardiovascular diseases, malignancy, clinical priority, surgical complexity, and centre. Participants with similar value of propensity score were matched 3:1 when comparing cohort 1 and cohort 2, and 1:1 when comparing cohort 2 and cohort 3. In matched cohorts, to identify imbalance between groups, standardized mean difference on observed baseline characteristics was estimated and plotted. A mixed effects logistic regression model was used to estimate odds ratio to quantify the effect on each outcome. Mixed effects were used to account for centre-effects. Variables remaining imbalanced between groups after matching were added to the logistic model with an adjusting purpose. With a sensitivity purpose, a stratified analysis by centre was

predefined in the statistical analysis plan. Analysis was performed using R version 3.5.3 [R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/].

RESULTS

Twenty-five surgical teams participated in the study *(Supplementary material, Table S1)*, registering 5 599 patients, of whom 5 307 (183 COVID-19-positive, 2 132 intra-pandemic COVID-19-negative and 2 992 pre-pandemic patients) fulfilled inclusion and data quality criteria *(Fig. 1)*. COVID-19 infection diagnosis was confirmed before surgery in 112 patients (61.2%) and after in 71 (38.8%), by RT-PCR in 164 patients (89.6%), and by clinical and radiological findings in 19 (10.4%).

Patients' characteristics

Table 1 shows patients' basal characteristics. Surgical procedures are detailed in the *Supplementary material (Table S3)*.

Intra-pandemic patients: COVID-19-positive versus negative. COVID-19-positive patients were older (+7.0 years difference), more overweight (+7.1%), had higher ASA scores (+15.4% ≥3), worse functional status (+5.8% dependence), more respiratory pathology (+3.3%), COPD (+2.0%), heart failure (+4.0%), arterial hypertension (+9.9%), diabetes (+9.3%) and cardiovascular disease (+5.4%). They were more often hospitalized in ICU before surgery (+11.5%), with lower preoperative Glasgow coma score, submitted to emergency surgery (+5.6%), of higher surgical complexity (+12.7% with major or major+ surgeries), affected of malignant pathology (+5.7%) and with diffuse peritonitis (+5.3%). Besides, COVID-19-positive patients presented lower lymphocyte count (-0.4x10^9/L), higher C-reactive protein values (+42 mg/L), higher urea and ALT values (+1.9 mmol/L and +9.3 U/L), and higher inflammatory indexes: +1.8 difference NLR; +44 PLR; and +329x10^9/L SII. They also had higher surgical prognostic scores: +10.3% POSSUM morbidity; +6.4% POSSUM mortality; +4.8 P-

POSSUM (mortality); +5.4% LUCENTUM-logistic regression (morbidity); and +4.5 LUCENTUM-CHAID (morbidity).

COVID-19-negative patients: intra- versus pre-pandemic. COVID-19-negative patients from both periods had similar age, BMI, ASA score, functional status, and basal comorbidities. There were no relevant differences either in ICU before surgery, priority and complexity of surgeries, malignancy, peritonitis extent, analytical variables nor surgical prognostic scores.

Outcomes

Table 2 shows raw postoperative outcomes of study population. Complications are detailed in *Supplementary material (Table S4)*.

Intra-pandemic patients: COVID-19-positive versus negative. COVID-19-positive patients presented higher mortality (+8.0% at 30 days and +11.2 at 90 days); more complications (+17.6%), of pulmonary, thromboembolic, other medical and surgical types; more severe complications (+11.6%); more postoperative ICU hospitalization (+18.8%); longer hospital stay (+3 days); and higher re-hospitalization and re-intervention taxes (+3.5% and +1.5%). FTR was also higher in raw comparison (+11.0%). Propensity-score selection matched 179 COVID-19-positive with 503 COVID-19-negative patients *(Fig. 1)*. Distribution of matched cohorts is presented in the *Supplementary material (Fig. S1 and Fig. S2)*. In propensity-score analysis, COVID-19-positive patients maintained higher mortality at 30 and 90 days (odds ratio [OR], 2.05 [95% CI, 1.17-3.60]; $P = 0.012$); more complications (OR, 1.83 [95% CI, 1.27-2.62]; $P < 0.001$); more severe complications (OR, 1.70 [95% CI, 1.12-2.58]; $P = 0.012$); higher need of postoperative intensive care assistance ($P = 0.001$); and longer hospital stay ($P < 0.001$) *(Fig. 2 and Table S5)*. Postoperative complications affecting

more frequently COVID-19-infected patients were of pulmonary type ($P = 0.001$), with thromboembolic and surgical complications nearly reaching significant difference ($P = 0.07$). There were no significant differences in re-hospitalization, re-intervention, nor FTR taxes between matched intra-pandemic cohorts.

COVID-19-negative patients: intra- versus pre-pandemic. Raw outcomes of COVID-19-negative patients are shown in *Table 2*. Intra-pandemic patients had higher mortality (+1.4% at 30 days and +1.5% at 90 days) and FTR (+6.4%), with no significant differences in complication, length of stay, re-hospitalization and re-intervention taxes. For propensity-score analysis, 2 033 COVID-19-negative intra-pandemic and 2 033 pre-pandemic control patients were matched *(Fig. 1 and Fig. S3 and Fig. S4)*. COVID-19-negative intra-pandemic patients had significantly higher 30 day-mortality (OR, 1.41 [95% CI, 1.02-1.95]; $P = 0.04$) and FTR (OR, 1.59 [95% CI, 1.12-2.24]; $P = 0.009$) *(Fig. 3 and Table S6)*. Complication rate, type and severity, postoperative ICU admission, hospital stay, re-hospitalization and re-intervention taxes were similar.

DISCUSION

This large multicentre propensity-score matched study (COVID-CIR) demonstrates that COVID-19 infection worsened postoperative complication and mortality rates in patients submitted to emergency general and digestive surgery. Moreover, COVID-19-negative patients operated on during the first wave of the pandemic in Spain had similar complication rates than pre-pandemic ones, but worse mortality deriving from them. To our knowledge, this is the first study providing adjusted comparison of postoperative outcomes of surgical intra-pandemic COVID-19-positive and -negative patients, together with pre-pandemic controls. This benchmarking allows control of the principal factors potentially explaining worse postoperative outcomes observed during the COVID-19 pandemic: first, the influence of COVID-19 infection; second, the possible advanced stage of pathologies at consultation, due to patients' fear or difficulty of visiting the hospital ("lockdown effect"); and third, the collapse of hospital services needed to rescue patients from complications in the pandemic context.

The effect of COVID-19-infection on postoperative outcomes

Great concern has risen on to which degree COVID-19 infection can worsen postoperative outcomes of surgical patients, in order to recommend delaying or avoiding surgery[11,20,33]. In this study, 90-day mortality rate in the matched COVID-19-positive cohort was 17.8%, higher than the 8.9% of matched COVID-19-negative patients and also higher than the 10.6% overall mortality of non-surgical patients of the same age range hospitalized for COVID-19 infection in Spain[34]. This finding reinforces the hypothesis of a synergistic effect of COVID-19 infection and surgery: mechanical ventilation, anaesthesia and tissue damage associated to surgical interventions provoke a proinflammatory cytokine and immunosuppressive response, potentially worsening the

evolution of COVID-19 infection[10,11,14]. It has been probed that upregulation of the systemic inflammatory response is a primary contributor to postoperative death in emergency surgical patients[8]. Interestingly, COVID-19-positive patients in this study presented higher preoperative values of analytical markers of inflammatory and immunological response (CRP, neutrophil count, NLR, PLR, and SII), higher parameters of tissular damage (ALT and urea) and lower values in lymphocyte count than COVID-19-negative patients; all these findings have been probed as bad prognostic factors both for COVID-19 infection and for emergency surgery[10,35-38].

In this study, COVID-19-positive patients had high pulmonary and thromboembolic complication rates (17.5% and 6.0% respectively), in accordance with previous reports but with lower raw incidences[11,12,14]. In addition to this, 30-day mortality rate of non-matched COVID-19-infected surgical patients was 12.6%, close to the lower range described to date (4.3%-42.8%).[7,11–13,21,32,39,40]. This heterogeneity may be partially attributed to differences in national health systems, but also to a potential selection bias of studies including patients from many surgical specialties, especially in large hospitals under significant stress. As far as we are aware, this study is based in the largest cohort of COVID-19-infected patients submitted to emergency surgery of a single surgical speciality published to date.

Raw postoperative outcomes associated to COVID-19 infection should be evaluated with caution, as COVID-19-positive patients had higher risk baseline characteristics: more advanced age, more overweight, higher ASA scores, lower functional status, and more basal comorbidities. Accordingly, previous studies reported that surgical COVID-positive patients were mostly aged 70 years or older (50%-66%), staged as ASA score 3 to 5 (60%-91%), and having two comorbidities or more (61%-67%)[11,12,14]. This underlines the need of meticulous benchmarking. Three previous studies comparing

outcomes of surgical COVID-positive with contemporary COVID-negative patients reached contradictory conclusions: in two of them, COVID-19 infection was associated to poorer postoperative outcomes[13,14], while in another one it was not[41]. The findings of the present study, based on a large homogeneous cohort with propensity-score matched analysis, confirm the higher risk of emergency surgery in COVID-19-infected patients. This fact should be taken in consideration when balancing individual risks and benefits of submitting a COVID-19-positive patient to an emergency surgical intervention. An effort should be made to promote conservative non-surgical treatments in these patients whenever possible.

The lockdown effect

Some studies described significant delay of patients with potentially surgical pathologies to attend at Emergency Departments during the COVID-19 pandemic, due to fear of contagion and home confinement, resulting in more evolved acute diseases (for example, more extended peritonitis) and worse postoperative prognosis[7,23,41]. In contrast, in the present study, COVID-19-negative patients showed similar inflammatory parameters and indices, peritonitis extent, intraoperative blood loss and surgical prognostic score values to those of patients operated on during the same period of the previous year. Moreover, their complication and severe complication taxes did not increase. Therefore, the higher mortality of COVID-19-negative patients operated on from March to June 2020 in Spain cannot be attributed to the effect of lockdown.

The effect of hospital collapse

In this study, COVID-19-negative patients submitted to emergency digestive surgery during the pandemic had a significantly higher risk of death as a consequence of

postoperative complications (FTR) than pre-pandemic patients. High quality literature has directly related FTR of surgical patients with delay in detection of morbidity and therapeutical scalation[31]. Several hospital-related risk indicators, such as outdated communication technology, nurse understaffing, hierarchy barriers, and communication errors have been identified as root causes of incapability of surgical services in stopping transition from an initial complication to a progressive cascade of adverse occurrences leading to death[31]. All these factors are likely to have been altered in Spanish hospitals during the pandemic. Spanish health system was systematically under-resourced and understaffed in the last decade, and was therefore overwhelmed by the resilience test of the COVID-19 pandemic[24]. Excess deaths attributed to causes other than COVID-19 during the pandemic could reflect disruptions produced by hospital collapse, such as the one found in this study[5,42]. Diminishing avoidable deaths during present and future sanitary crisis will require increasing resources for overwhelmed health care workers and hospitals and a better coordination among Health Care leaders[25,43]. We also suggest it could be recommendable to coordinate deriving non-delayable surgeries to non-collapsed hospitals in the same area.

This study has some limitations. It only involves one country, Spain, a fact that could limit generalizability of the results. However, it also grants the homogeneity of the cohorts and limits selection bias. The retrospective design is a further limitation, which was intended to be minimized by the thorough data quality control and the exclusion of patients with relevant missing variables. In 10% of COVID-19-positive patients, diagnosis was not based in nasopharyngeal RT-PCR, but in clinical and radiological findings, especially at the initial phase of the pandemic, when COVID-19 diagnostic protocols were not yet standardized. Other studies have similar proportion of COVID-19 diagnosis based on clinical and radiological findings, having them comparable

outcomes to the laboratory-confirmed COVID-19-positive patients[11]. Finally, it must be reminded that the propensity score adjustment cannot balance for unknown or known unmeasured confounding variables; but it is plausible that matching would appropriately correct the impact of baseline variables into the model.

In conclusion, this large multicentre propensity-score matched study probed that COVID-19-infected patients submitted to emergency general and digestive surgeries are at increased risk of postoperative complications and mortality; therefore, non-surgical management should be prioritized in these patients. Moreover, COVID-19-negative patients operated on during the pandemic presented higher-than-expected failure-to-rescue; an effort to invest on and better organize public health system should be made to minimize avoidable deaths in future sanitary resilience tests.

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This study, including its analysis plan, was registered in ClinicalTrials.gov with Identifier NCT04479150 before data collection and analysis were performed. The preregistration adheres to the disclosure requirements of the institutional registry.

The datasets generated and analysed during the current study are not publicly available but are available from the corresponding author on reasonable request.

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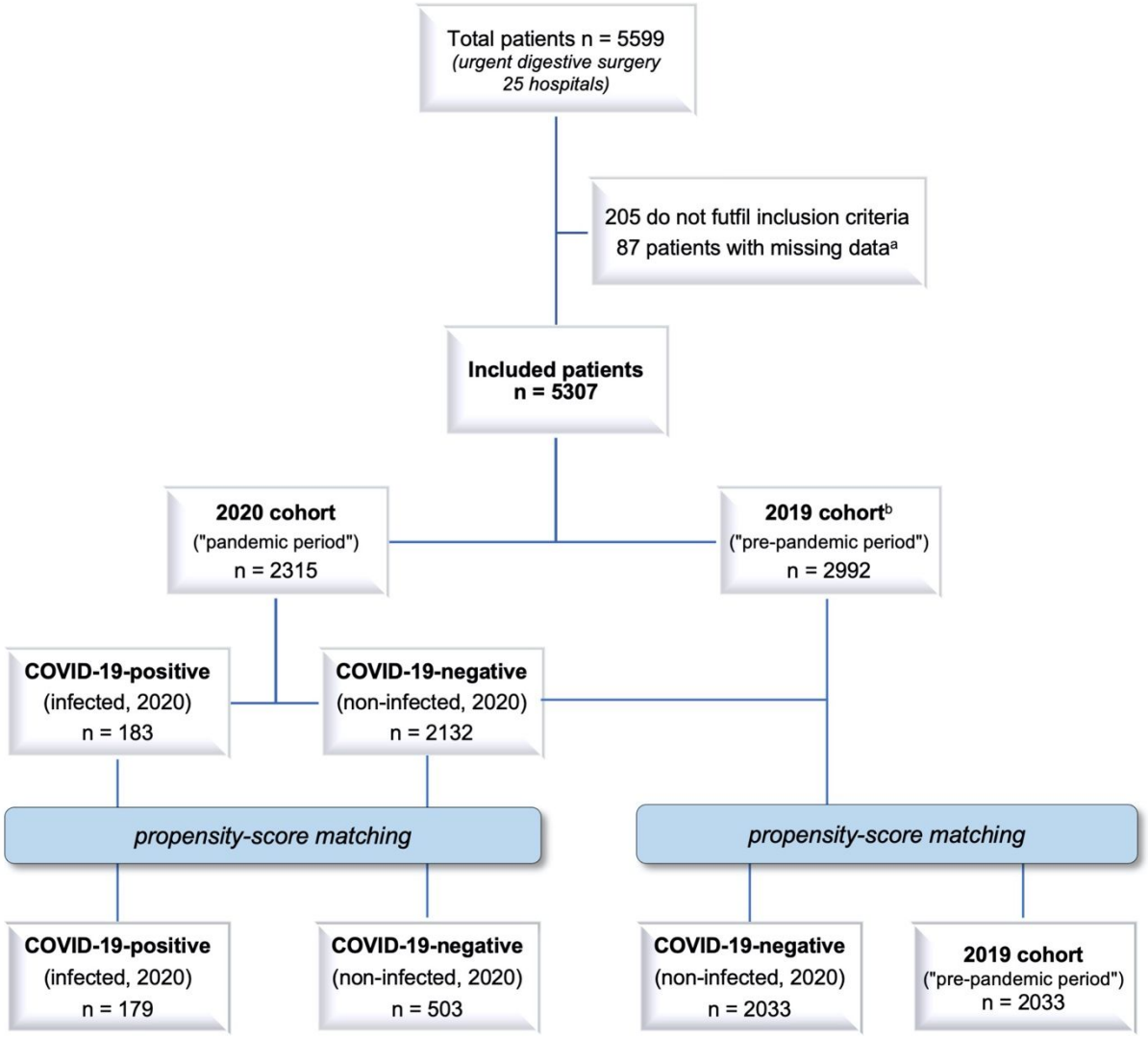
FIGURES AND TABLES

Figure 1. Flow diagram of included patients



[a] Excluded patients: those lacking any of the following data: date of surgery, age, gender, functional status, previous pathologies, malignancy, urgency, complexity of surgery, 30-day and 90-day outcomes.

[b] Three hospitals did not provide all consecutive patients from control cohort (2019).

Table 1. Demographics, comorbidities, clinical, analytical and surgical variables in the study population

Variable	No. (%)			
	2020 cohort			
	COVID-19-positive (n = 183)	COVID-19-negative (n = 2 132)	Total 2020 cohort (n = 2 315)	2019 cohort (n = 2 992)
Men	113 (61.7)	1 272 (59.7)	1 385 (59.8)	1 754 (58.6)
Women	70 (38.3)	860 (40.3)	930 (40.2)	1 238 (41.4)
Age, median (IQR), years	63 (48-73)	56 (40-72)	56 (41-72)	57 (40-72)
Body Mass Index,mean (SD), kg/m^2	27.9 (5.6)	27.2 (5.6)	27.3 (5.6)	27.3 (5.9)
Body Mass Index classification				
Underweight	1 (0.7)	35 (2.7)	36 (2.5)	48 (2.7)
Normal weight	43 (30.7)	465 (36.1)	508 (35.6)	604 (33.9)
Overweight	58 (41.4)	442 (34.3)	500 (35.0)	684 (38.4)
Obesity	38 (27.1)	346 (26.9)	384 (26.9)	447 (25.1)
ASA score				
ASA 1	34 (18.7)	612 (28.9)	646 (28.1)	875 (29.4)
ASA 2	66 (36.3)	876 (41.4)	942 (41.0)	1149 (38.7)
ASA 3	59 (32.4)	523 (24.7)	582 (25.3)	784 (26.4)
ASA 4	22 (12.1)	104 (4.9)	126 (5.5)	155 (5.2)
ASA 5	1 (0.6)	3 (0.1)	4 (1.2)	9 (0.3)
Functional status				
Independent	155 (84.7)	1 930 (90.5)	2 085 (90.1)	2 727 (91.1)
Partially dependent	26 (14.2)	187 (8.8)	213 (9.2)	236 (7.9)
Fully dependent	2 (1.1)	15 (0.7)	17 (0.7)	29 (0.9)
Respiratory system[a]				
Normal	158 (86.3)	1 910 (89.6)	2 068 (89.4)	2 737 (91.5)
Dyspnea with exercise	14 (7.7)	161 (7.6)	175 (7.6)	182 (6.1)
Limiting dyspnea	7 (3.8)	53 (2.5)	60 (2.6)	61 (2.0)
Dyspnea at rest	4 (2.2)	7 (0.3)	11 (0.5)	10 (0.3)
Cardiac system				
Normal (no failure)	137 (74.9)	1 681 (79.0)	1 818 (78.6)	2 254 (75.3)
Diuretics, digoxin, antianginal or antihypertensive drugs	38 (20.8)	391 (18.4)	429 (18.6)	630 (21.1)
Peripheric edemas, warfarin, incipient cardiomegaly	5 (2.7)	53 (2.5)	58 (2.5)	97 (3.2)
Elevated jugular venous pressure, cardiomegaly	3 (1.6)	4 (0.2)	7 (0.3)	11 (0.4)
Comorbidities				
Arterial hypertension[b]	79 (43.2)	709 (33.3)	788 (34.0)	1 030 (34.4)
Diabetes[b]	40 (21.9)	268 (12.6)	308 (13.3)	416 (13.9)
Active smoker	27 (14.8)	377 (17.7)	404 (17.5)	523 (17.5)
COPD	19 (10.4)	180 (8.4)	199 (8.6)	196 (6.6)
Cardiovascular disease[c]	31 (16.9)	245 (11.5)	276 (11.9)	397 (13.3)
Preoperative Glasgow coma score ≤8	16 (8.7)	16 (0.8)	32 (1.4)	21 (0.7)
Preoperative analytical data, mean (SD)				
Urea, mmol/L	8.8 (8.4)	6.9 (5.4)	7.1 (5.7)	7.3 (13.5)
ALT, U/L	53.2 (161)	43.9 (142)	44.8 (143)	36.7 (79.4)
Hemoglobin, g/dL	11.7 (3.8)	11.5 (4.7)	11.5 (4.7)	11.7 (4.6)
Leukocytes, x10^9/L	13.4 (6.8)	13.0 (5.9)	13.0 (6.0)	12.6 (5.7)
Neutrophils, x10^9/L	12.6 (12.6)	11.7 (11.3)	11.8 (11.4)	13.0 (15.1)
Lymphocytes, x10^9/L	1.5 (1.3)	1.9 (2.5)	1.9 (2.4)	2.2 (3.6)
Platelets, x10^9/L	254 (112)	252 (96.9)	252 (98.1)	255 (101)
NLR	11.9 (10.5)	10.1 (12.5)	10.3 (12.3)	9.7 (10.1)
PLR	272 (207)	228 (212)	231 (212)	230 (249)
SII, x10^9/L	2 948 (2937)	2 619 (3720)	2 644 (3666)	2 496 (3361)
CRP, mg/L	143 (268)	101 (147)	105 (161)	105 (183)
PT, %	78.6 (23.9)	79.5 (25.4)	79.4 (25.3)	75.5 (29.6)
PT, Quick value	1.2 (0.2)	1.2 (0.3)	1.2 (0.3)	1.3 (1.1)
PT, seconds	13.1 (1.4)	13.9 (4.7)	13.8 (4.4)	13.8 (7.8)
ICU admission before urgent surgery	27 (14.8)	70 (3.3)	97 (4.2)	132 (4.4)
Surgery type[d]				
Urgent	164 (89.6)	2 030 (95.2)	2 194 (94.8)	2 810 (93.9)
Emergency	19 (10.4)	102 (4.8)	121 (5.2)	182 (6.1)
Surgical approach				
Open	108 (60.0)	1 111 (52.4)	1 219 (53.0)	1 655 (55.5)
Laparoscopy	72 (40.0)	1 008 (47.6)	1 080 (47.0)	1 327 (44.5)
Malignancy				
No	160 (87.4)	1 983 (93.0)	2 143 (92.6)	2 789 (93.2)
Localized tumor	15 (8.2)	86 (4.0)	101 (4.4)	126 (4.2)

Table 1. Demographics, comorbidities, clinical, analytical and surgical variables in the study population (continued)

Variable	No. (%)			
	2020 cohort			
	COVID-19-positive (n = 183)	COVID-19-negative (n = 2 132)	Total 2020 cohort (n = 2 315)	2019 cohort (n = 2 992)
Peritoneal exudate (intraoperative)				
None	67 (36.8)	979 (45.9)	1 046 (45.2)	1 513 (50.6)
Serous	47 (25.8)	492 (23.1)	539 (23.3)	615 (20.6)
Localized purulent	39 (21.4)	435 (20.4)	474 (20.5)	551 (18.4)
Diffuse purulent	29 (15.9)	225 (10.6)	254 (11.0)	313 (10.5)
Blood loss (intraoperative)				
≤100 mL	135 (73.8)	1 859 (87.2)	1 994 (86.2)	2 542 (85 .0)
101-500 mL	37 (20.2)	226 (10.6)	263 (11.4)	336 (11.2)
501-1000 mL	8 (4.4)	27 (1.3)	35 (1.5)	47 (1.6)
>1000 mL	3 (1.6)	19 (0.9)	22 (0.9)	65 (2.2)
Surgical complexity[e]				
Minor	35 (19.1)	477 (22.4)	512 (22.1)	773 (25.8)
Moderate	74 (40.4)	1 063 (49.9)	1 137 (49.1)	1 393 (46.6)
Major / Major +	74 (40.4)	592 (27.8)	666 (28.8)	826 (27.6)
Surgical prognostic scores, mean (SD), %				
POSSUM mortality	16.3 (21.6)	9.9 (13.8)	10.4 (14.7)	10.1 (14.3)
P-POSSUM mortality	9.0 (18.5)	4.2 (10.2)	4.6 (11.2)	4.3 (9.9)
POSSUM morbidity	45.3 (28.7)	35.0 (24.7)	35.9 (25.2)	34.9 (25.4)
LUCENTUM-logistic regression morbidity	28.1 (19.5)	22.7 (17.7)	23.1 (17.9)	22.4 (17.8)
LUCENTUM-CHAID morbidity	22.0 (17.3)	17.5 (15.3)	17.8 (15.5)	17.3 (15.7)

Abbreviations: IQR, interquartile range; SD, standard deviation; ASA, American Society of Anesthesiologists; COPD, Obstructive Chronic Pulmonary Disease; ALT, alanine-aminotransferase; NLR, neutrophil-to-lymphocyte ratio; PLR, platelet-to-lymphocyte ratio; SII, systemic immune-inflammation index (neutrophil x platelet/lymphocyte counts); CRP, C-reactive protein; PT, prothrombin time (expressed as %, Quick value or seconds); ICU, Intensive Care Unit; POSSUM, Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity; P-POSSUM, Portsmouth POSSUM score; LUCENTUM, aLicante sUrgical Community Emergencies New Tool for the enUmeration of Morbidities.

[a] Respiratory system: normal: no dyspnea and chest X-ray with no signs of COPD; dyspnea with exercise: dyspnea with exercise and/or chest X-ray with minimal signs of COPD; limiting dyspnea: limiting dyspnea (1 landing) and/or chest X-ray with moderate signs of COPD; dyspnea at rest: dyspnea at rest (≥30 breaths/minute) and/or chest X-ray with fibrosis or consolidation.

[b] Arterial hypertension and diabetes, defined as patient needing specific pharmacological treatment.

[c] Cardiovascular disease: antecedent of ischemic heart disease, cerebrovascular accident (transient ischemic attack, stroke) or peripheral artery disease.

[d] Surgery type: emergency surgery: less than 2 hours since indication; urgent surgery: between 2 and 24 hours since indication.

[e] Surgical complexity: minor: hernia/eventration repair, perineal surgery, pilonidal sinus; moderate: cholecystectomy, appendectomy; major: gastrointestinal perforation suture, intestinal resection, colectomy, main bile duct surgery, gastrectomy, lysis of adhesions, internal hernia repair, enterolithotomy, splenectomy or minor liver trauma, exploratory laparotomy/laparoscopy, surgical control of intra-abdominal bleeding; major+: pancreatectomy or pancreatic necrosectomy, damage control surgery (due to trauma, bleeding, ischemia or peritonitis). Performed surgical procedures are detailed in complementary material .

Table 2. Table 2. Study outcomes of the study population

Variable	No. (%) 2020 cohort COVID-19-positive (n = 183)	COVID-19-negative (n = 2 132)	Total 2020 cohort (n = 2 315)	2019 cohort (n = 2 992)
30-day mortality	23 (12.6)	98 (4.6)	121 (5.2)	97 (3.2)
90-day mortality[a]	29 (17.4)	119 (6.2)	148 (7.1)	139 (4.7)
Patientes with 30-day postoperative complications	76 (41.5)	509 (23.9)	585 (25.3)	754 (25.2)
Failure-to-rescue, %[b]	30.3	19.3	20.7	12.9
Type of complication (at least, one of the following)				
Pulmonary[c]	32 (17.5)	119 (5.6)	151 (6.5)	165 (5.5)
Thromboembolic[d]	11 (6.0)	38 (1.8)	49 (2.1)	38 (1.3)
Other medical	33 (18.0)	210 (9.9)	243 (10.5)	304 (10.2)
Surgical	46 (25.1)	328 (15.4)	374 (16.2)	521 (17.4)
Clavien-Dindo system				
I	5 (2.7)	51 (2.4)	56 (2.4)	126 (4.2)
II	27 (14.8)	206 (9.7)	233 (10.1)	263 (8.8)
IIIA	3 (1.6)	40 (1.9)	43 (1.9)	69 (2.3)
IIIB	5 (2.7)	64 (3.0)	69 (2.9)	101 (3.4)
IVA	5 (2.7)	26 (1.2)	31 (1.3)	42 (1.4)
IVB	8 (4.4)	24 (1.1)	32 (1.4)	57 (1.9)
V	23 (12.6)	98 (4.6)	121 (5.2)	97 (3.2)
Patients with severe complications[e]	44 (24.0)	252 (11.8)	296 (12.8)	365 (12.2)
Need of postoperative ICU for ≥24 hours	55 (30.1)	241 (11.3)	296 (12.8)	389 (13.0)
Length of stay, median (IQR), days	7 (3-18)	4 (2-8)	4 (2-8)	4 (2-9)
30-day rehospitalization	16 (10.2)	135 (6.7)	151 (6.9)	190 (6.6)
30-day surgical reintervention	11 (6.9)	110 (5.4)	121 (5.5)	153 (5.3)

Abbreviations: ICU, Intensive Care Unit; IQR, interquartile range.

[a] Only considered for patients with registred 90-day follow-up (91.3%, 90.3%, 90.4% and 98.5% in each group, respectively).

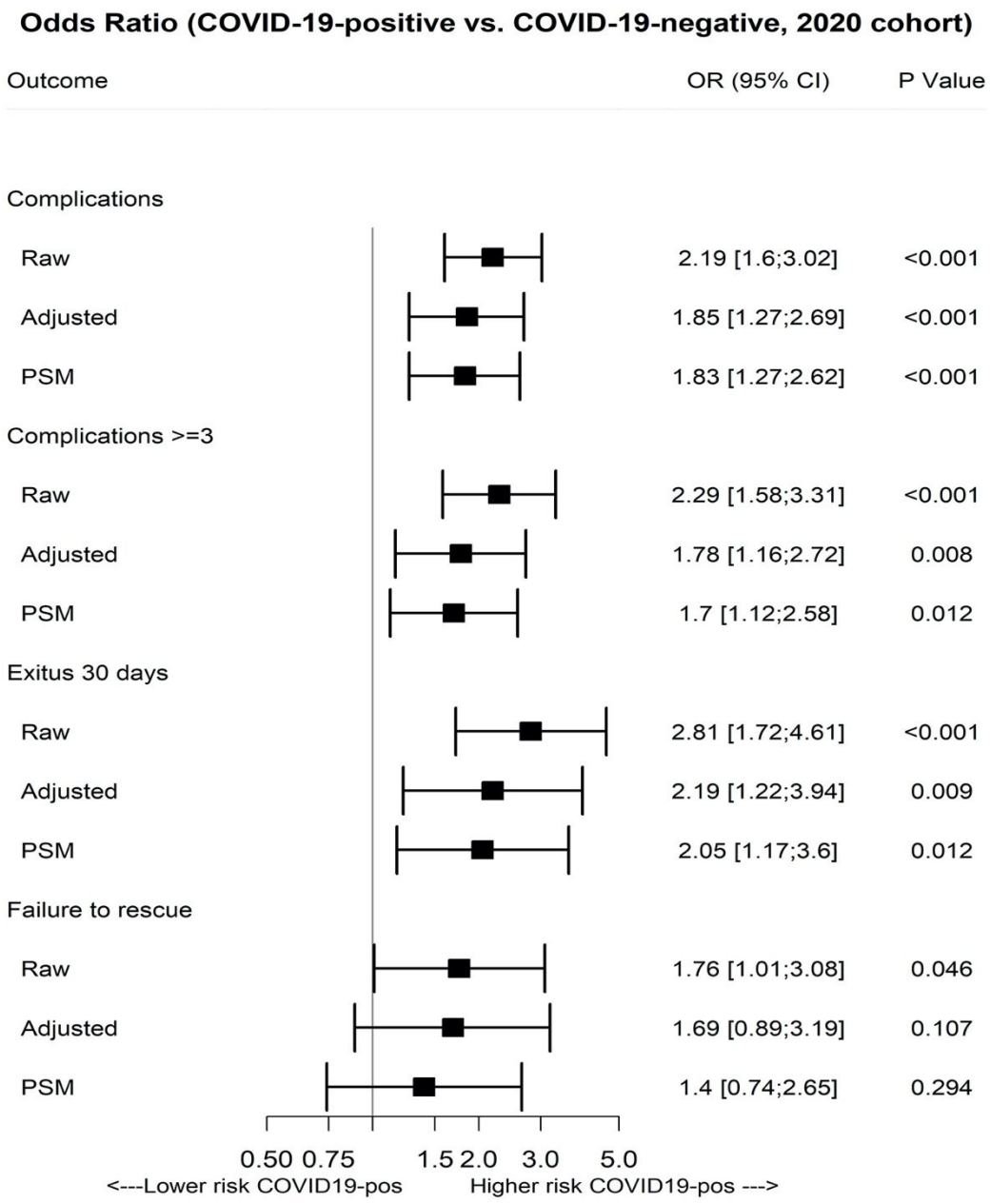
[b] Failure-to-rescue (%): 30-day deaths divided by 30-day complicated patients.

[c] Pulmonary complications: respiratory infection or pneumonia, defined as purulent expectoration with positive bacteriological/virological culture, with or without changes in chest X-ray, or fever associated to pulmonary consolidation in chest X-ray; respiratory failure, defined as dyspnea requiring ventilator urgent support and/or PaO_2<60mmHg and $PaCO_2$>45mmHg without oxygen assistance; and pleural effusion/pulmonary atelectasis.

[d] Thromboembolic complication: deep venous thrombosis and/or pulmonary embolism; acute myocardial infarction, stroke, acute limb ischemia, acute mesenteric ischemia.

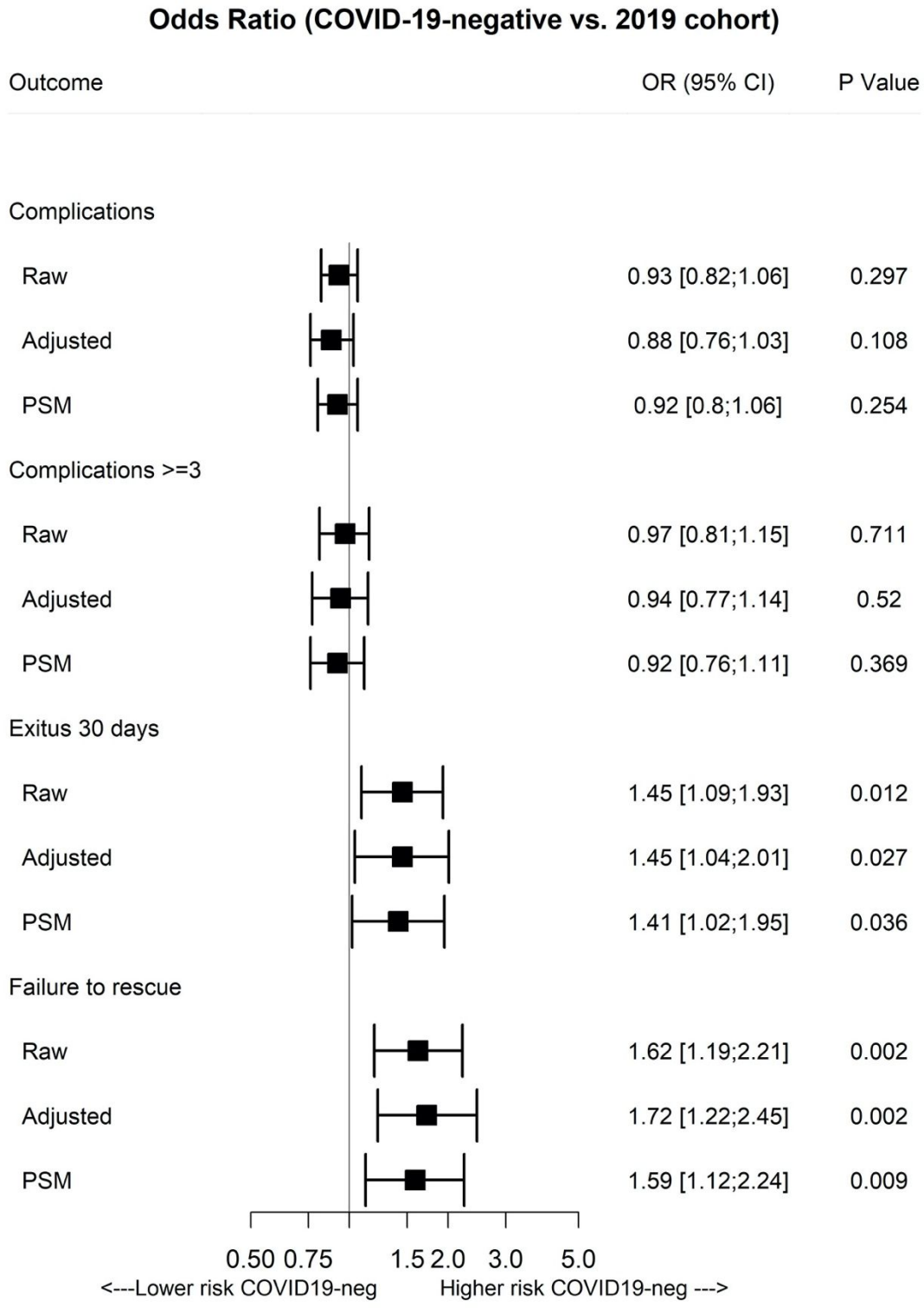
[e] Clavien-Dindo grade ≥IIIA

Figure 2. Forest plot of raw, adjusted and propensity-score-matched (PSM) outcomes of 2020 COVID-19-positive *versus* 2020 COVID-19-negative patients[a]

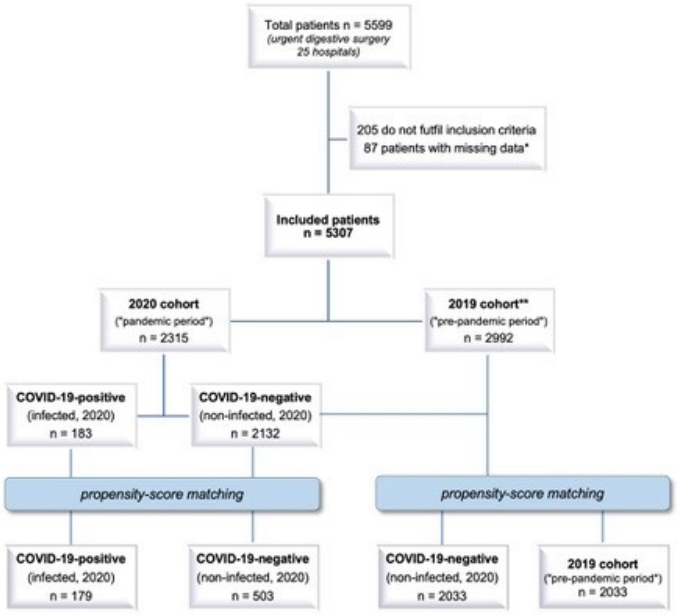


[a] Model adjusted by sex, age (linear and quadratic term), functional status, COPD, cardiovascular pathology, arterial hypertension, diabetes, smoking, surgery type (urgency/emergency), malignancy, and surgical complexity

Figure 3. Forest plot of raw, adjusted and propensity-score-matched (PSM) outcomes of 2019 cohort *versus* 2020 COVID-19-negative patients[a]

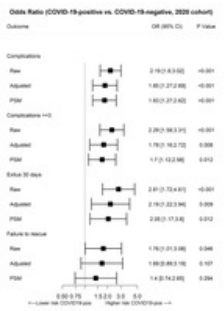


[a] Model adjusted by sex, age (linear and quadratic term), functional status, COPD, cardiovascular pathology, arterial hypertension, diabetes, smoking, surgery type (urgency/emergency), malignancy, and surgical complexity



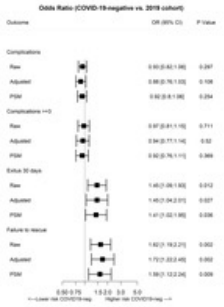
Flow diagram of included patients

54x40mm (300 x 300 DPI)



Forest plot of raw, adjusted and propensity-score-matched (PSM) outcomes of 2020 COVID-19-positive vs 2020 COVID-19-negative patients

225x70mm (72 x 72 DPI)



Forest plot of raw, adjusted and propensity-score-matched (PSM) outcomes of 2019 cohort vs 2020 COVID-19-negative patients

225x70mm (72 x 72 DPI)

Supplementary material

Table S1. List of surgical teams participating in the study (COVID-CIR Collaborative Group)

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Table S1. List of surgical teams participating in the study (COVID-CIR Collaborative Group) (continued)

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Table S1. List of surgical teams participating in the study (COVID-CIR Collaborative Group) (continued)

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Table S1. List of surgical teams participating in the study (COVID-CIR Collaborative Group) (continued)

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082066	Sant Joan Despí Moisès Broggi Hospital, Sant Joan Despí	Camilo Andrés López Arévalo (PI) e-mail: CamiloAndres.LopezArevalo@sanitatintegral.org
081885	Igualada University Hospital, Anoia Health Consortium, Igualada	Sergi Sánchez Cordero (PI) e-mail: ssanchezco@csa.cat David Salazar Terceros (Co-PI) e-mail: dsalazar@csa.cat Carla Galmés Huerta (Co-PI) e-mail: cgalmes@csa.cat Mariano Artigot Pellicena (Co-PI) e-mail: martigot@csa.cat Xavier Guedes de la Puente (Co-PI) e-mail: xguedes@csa.cat Marta Domingo González (Co-PI) e-mail: mdomingo@csa.cat
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[a] National Catalog of Hospitals (CNH) 2019, Ministry of Health, Consumption and Social Welfare, Spain.

Table S2. Surgical prognostic scores

surgical score	equation	prediction
POSSUM[a] (mortality)	Ln [R/(1-R)] = -7.04 + (0.13 x physiological score) + (0.16 x operative severity score)	postoperative mortality
POSSUM[a] (morbidity)	Ln [R/(1-R)] = -5.91 + (0.16 x physiological score) + (0.19 x operative severity score)	postoperative morbidity
P-POSSUM[a]	Ln [R/(1-R)] = -9.065 + (0.1692 x physiological score) + (0.155 x operative severity score)	postoperative mortality
LUCENTUM[b]-logistic regression	Ln [R/(1-R)] = -4.461 + (0.257 x age) + (0.261 x sodium) + (0.167 x Hb) + (0.364 x white cell count) + (0.397 x operative severity)	postoperative morbidity
LUCENTUM[b]-CHAID	Ln [R/(1-R)] = -5.835 + (0.757 x cardiac function) + (0.563 x sodium) + (0.411 x peritoneal soiling) + (0.778 x operative severity)	postoperative morbidity

Abbreviations: R, predicted risk of postoperative mortality/morbidity (≤30 days); Hb, hemoglobin (g/dL).

[a] Units for POSSUM and P-POSSUM scores: total physiological and operative severity score[29].

[b] Units for LUCENTUM scores: age (years); sodium (mmol/L); hemoglobin (g/dL); white cell count (x10^9/L); operative severity *(minor, moderate, major, major+)*; cardiac function (no failure, any abnormality); peritoneal soiling (none/serous, local pus/diffuse peritonitis/hemoperitoneum/free bowel content)[30].

Table S3. Performed emergency surgical procedures in the study population (n=5658 procedures in 5307 patients)

	No. (%)			
	2020 cohort			
Variable	COVID-19-positive (n = 183)	COVID-19-negative (n = 2 132)	Total 2020 cohort (n = 2 315)	2019 cohort (n = 2 992)
Minor surgical complexity				
perianal surgery	22 (11)	309 (13.7)	331 (13.5)	488 (15.3)
hernia/eventration repair	12 (6)	205 (9.1)	217 (8.8)	335 (10.5)
Moderate surgical complexity				
appendectomy	45 (22.5)	735 (32.6)	780 (31.7)	860 (26.9)
cholecystectomy	32 (16)	337 (14.9)	369 (15.0)	523 (16.3)
Major surgical complexity				
colectomy	25 (12.5)	144 (6.4)	169 (6.9)	188 (5.9)
intestinal resection	10 (5)	132 (5.9)	142 (5.8)	188 (5.9)
lysis of adhesions or internal hernia repair or enterolithotomy	12 (6)	107 (4.7)	119 (4.8)	140 (4.4)
gastrointestinal perforation suture	8 (4)	70 (3.1)	78 (3.2)	143 (4.5)
other surgical procedures[a]	16 (8)	82 (3.6)	98 (3.9)	120 (3.8)
surgical control of intra-abdominal bleeding	5 (2.5)	20 (0.9)	25 (1.0)	48 (1.5)
exploratory laparotomy[b]	3 (1.5)	36 (1.6)	39 (1.6)	31 (0.9)
splenectomy or minor liver trauma	1 (0.5)	11 (0.5)	12 (0.5)	25 (0.8)
gastrectomy	1 (0.5)	16 (0.7)	17 (0.7)	14 (0.4)

main bile duct surgery	2 (1)	5 (0.2)	7 (0.3)	11 (0.3)
Major + surgical complexity				
damage control surgery	5 (2.5)	44 (1.9)	49 (1.9)	74 (2.3)
pancreatectomy or pancreatic necrosectomy	1 (0.5)	5 (0.2)	6 (0.2)	12 (0.4)
Total procedures	200	2 258	2 458	3 200

The same patient may have required several surgical procedures during an intervention.

[a] The *"other surgical procedures"* category includes: debridement of skin and soft tissue infection, surgical site infection, or necrotizing fasciitis (60 cases); other surgical procedures (43 cases); derivative ostomy or intestinal bypass (39 cases); abdominal washout and drainage (33 cases); postoperative evisceration (12 cases); hemostasis of surgical incision or abdominal wall (11 cases); surgical airway (8 cases); choleperitoneum (7 cases); reconfection of an ostomy or anastomosis (5 cases).

[b] The *"exploratory laparotomy"* category includes: suspected intestinal perforation, dehiscence or peritonitis (22 cases); peritoneal carcinomatosis (14 cases); massive intestinal ischemia (12 cases); suspected intestinal obstruction (9 cases); other surgical procedures (7 cases); suspected intestinal ischemia (6 cases).

Table S4. Type of postoperative complications in the study population

Variable	No. (%)			
	2020 cohort			
	COVID-19-positive (n = 183)	COVID-19-negative (n = 2 132)	Total 2020 cohort (n = 2 315)	2019 cohort (n = 2 992)
Pulmonary				
Pneumonia/respiratory infection	24 (13.1)	61 (2.9)	85 (3.7)	56 (1.9)
Respiratory failure	16 (8.7)	70 (3.3)	86 (3.7)	110 (3.7)
Pleural effusion/pulmonary atelectasis	2 (1.1)	20 (0.9)	22 (0.9)	40 (1.3)
Thromboembolic				
Deep venous thrombosis and/or pulmonary embolism	7 (3.8)	17 (0.8)	24 (1.0)	24 (0.8)
Acute myocardial infarction, stroke, acute limb ischemia	1 (0.6)	9 (0.4)	10 (0.4)	4 (0.1)
Acute mesenteric ischemia	3 (1.6)	12 (0.6)	15 (0.7)	10 (0.3)
Other medical complications				
Heart failure or acute pulmonary edema	5 (2.7)	28 (1.3)	33 (1.4)	50 (1.7)
Fever of unknown origin	5 (2.7)	23 (1.1)	28 (1.2)	23 (0.8)
Hypotension	11 (6.0)	75 (3.5)	86 (3.7)	119 (3.9)
Urinary infection	2 (1.1)	22 (1.0)	24 (1.0)	30 (1.0)
Renal failure	15 (8.2)	84 (3.9)	99 (4.3)	133 (4.5)
Bacteriemia/sepsis	7 (3.8)	60 (2.8)	67 (2.9)	81 (2.7)
Blood glucose disturbances >24 hours	0 (0.0)	7 (0.3)	7 (0.3)	10 (0.3)
Atrial fibrillation	5 (2.7)	18 (0.8)	23 (0.9)	42 (1.4)
Hypertensive crisis	0 (0.0)	7 (0.3)	7 (0.3)	6 (0.2)
Acute confusional syndrome	3 (1.6)	14 (0.7)	17 (0.7)	34 (1.1)
Cardiomyopathy or pericarditis	0 (0.0)	3 (0.1)	3 (0.1)	2 (0.1)
Surgical				
Anastomotic leak/intestinal fistula	5 (2.7)	48 (2.3)	53 (2.3)	81 (2.7)
Superficial wound dehiscence	4 (2.2)	20 (0.9)	24 (1.0)	36 (1.2)
Mild bleeding	6 (3.3)	30 (1.4)	36 (1.6)	42 (1.4)
Severe bleeding	4 (2.2)	28 (1.3)	32 (1.4)	52 (1.7)
Superficial wound infection	13 (7.1)	76 (3.6)	89 (3.8)	146 (4.9)
Deep wound infection	13 (7.1)	96 (4.5)	109 (4.7)	157 (5.3)
Postoperative ileus	20 (10.9)	105 (4.9)	125 (5.4)	149 (4.9)
Intestinal perforation	0 (0.0)	10 (0.5)	10 (0.4)	21 (0.7)
Wound seroma or hematoma	2 (1.1)	23 (1.1)	25 (1.1)	43 (1.4)
Intestinal obstruction	2 (1.1)	10 (0.5)	12 (0.5)	14 (0.5)
Ostomy complication	1 (0.6)	3 (0.1)	4 (0.2)	14 (0.5)
Gastrointestinal bleeding	1 (0.6)	3 (0.1)	4 (0.2)	16 (0.5)
Evisceration	0 (0.0)	7 (0.3)	7 (0.3)	15 (0.5)

Figure S1. Density plot to view the distribution of distance among matched cohorts of COVID-19-positive and intra-pandemic COVID-19-negative patients (nearest neighbor matching)

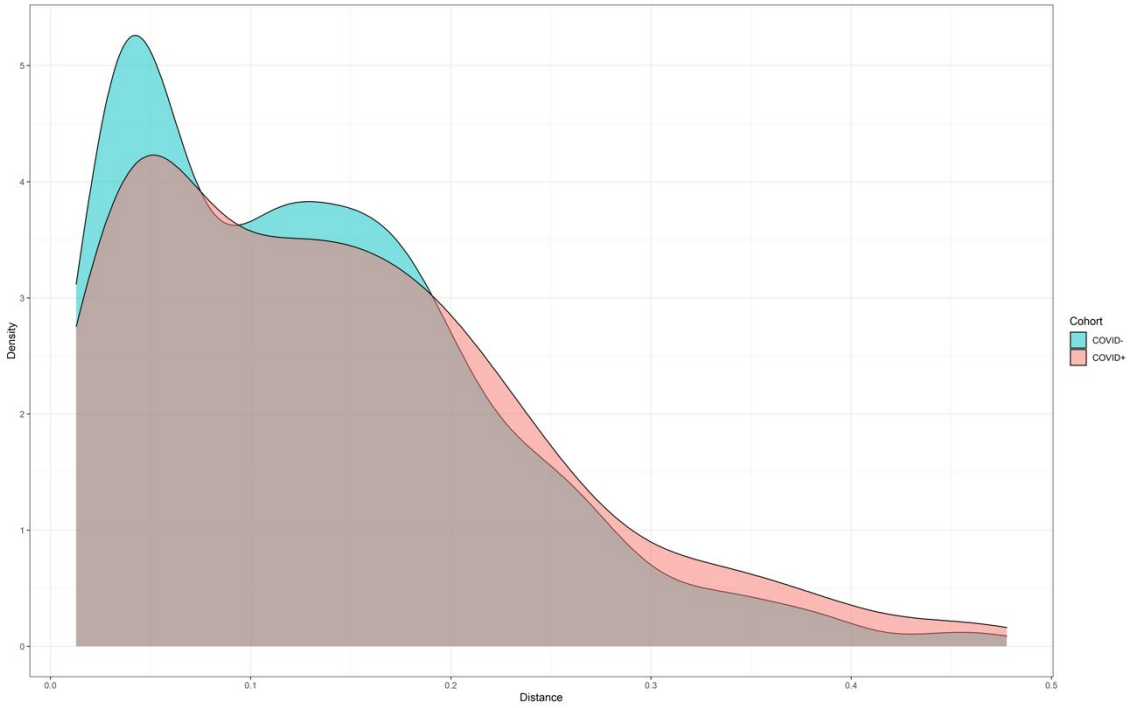
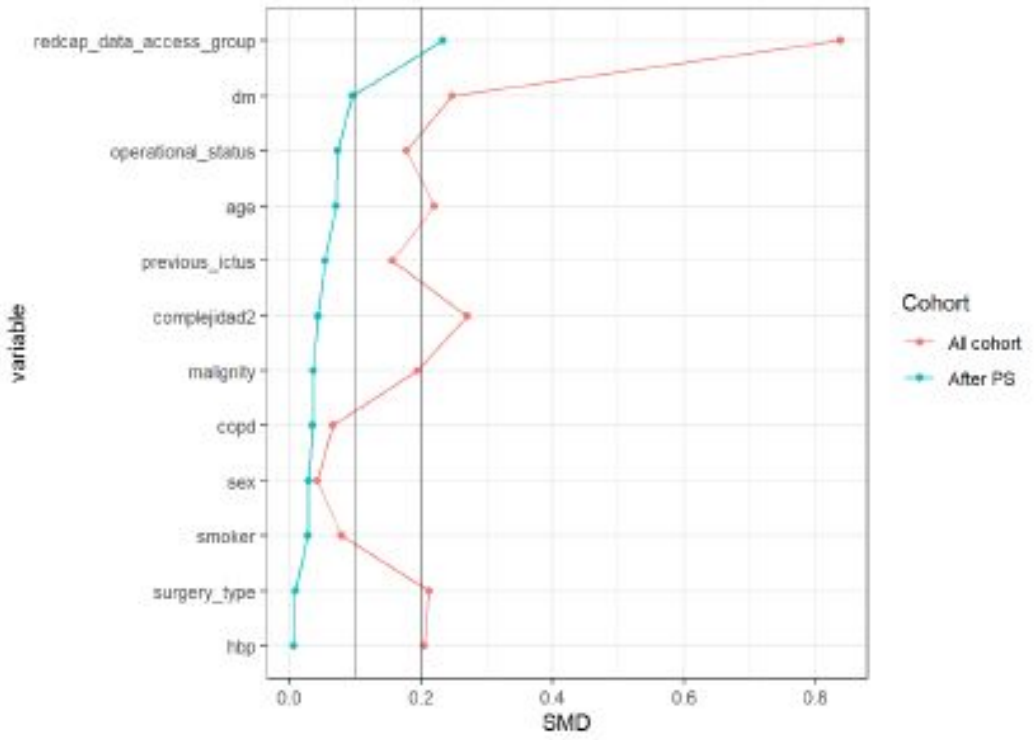


Figure S2. Comparison of means and prevalences of baseline characteristics among matched cohorts of COVID-19-positive and intra-pandemic COVID-19-negative patients



Red dots are standardized differences in the cohort, and green dots are standardized differences in the matched cohort. Vertical lines in 0.1 and 0.2 are standard cut-off to identify negligible differences.

Table S5. Outcomes of the 2020 COVID-19-positive and COVID-19-negative matched cohorts (n=682)

Variable	No. (%)		*P* value
	COVID-19-positive (n = 179)	COVID-19-negative (n = 503)	
30-day mortality	23 (12.9)	34 (6.8)	0.02
90-day mortality[a]	29 (17.8)	41 (8.9)	0.003
Patients with 30-day postoperative complications	76 (42.5)	147 (29.2)	0.002
Failure-to-rescue, %[b]	30.3	23.1	0.31
Type of complication			
Pulmonary[c]	32 (17.9)	44 (8.8)	0.001
Thromboembolic[d]	11 (6.2)	14 (2.8)	0.07
Other medical	33 (18.4)	79 (15.7)	0.46
Surgical	46 (25.7)	95 (18.9)	0.07
Patients with severe complications[e]	44 (24.6)	81 (16.1)	0.005
Need of postoperative ICU for ≥24 hours	52 (29.4)	89 (17.7)	0.001
Length of stay, median (IQR), days	7 (3-18)	5 (2-9)	<0.001
30-day rehospitalization	16 (10.5)	34 (7.3)	0.28
30-day surgical reintervention	11 (7.1)	26 (6.2)	0.83

Abbreviations: ICU, Intensive Care Unit; IQR, interquartile range.

[a] Only considered for patients with registred 90-day follow-up (91.1% in boths groups).

[b] Failure-to-rescue (%): 30-day deaths divided by 30-day complicated patients.

[c] Pulmonary complications: respiratory infection or pneumonia, defined as purulent expectoration with positive bacteriological/virological culture, with or without changes in chest X-ray, or fever associated to pulmonary consolidation in chest X-ray; respiratory failure, defined as dyspnea requiring ventilator urgent support and/or PaO_2<60mmHg and $PaCO_2$>45 mmHg without oxygen assistance; and pleural effusion/pulmonary atelectasis.

[d] Thromboembolic complication: deep venous thrombosis and/or pulmonary embolism; acute myocardial infarction, stroke, acute limb ischemia, acute mesenteric ischemia.

[e] Clavien-Dindo grade ≥IIIA

Figure S3. Density plot to view the distribution of distance among matched cohorts of COVID-19-negative intra- and pre-pandemic patients (nearest neighbor matching)

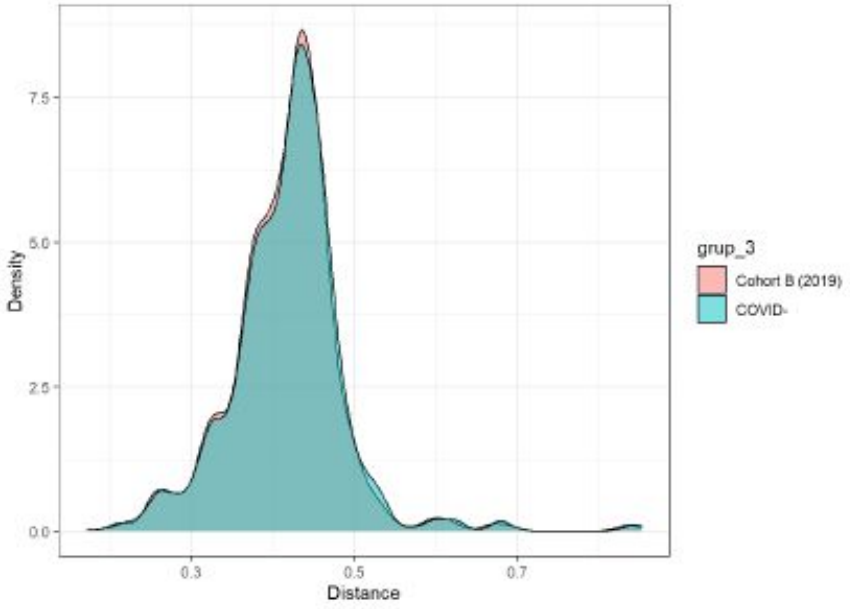
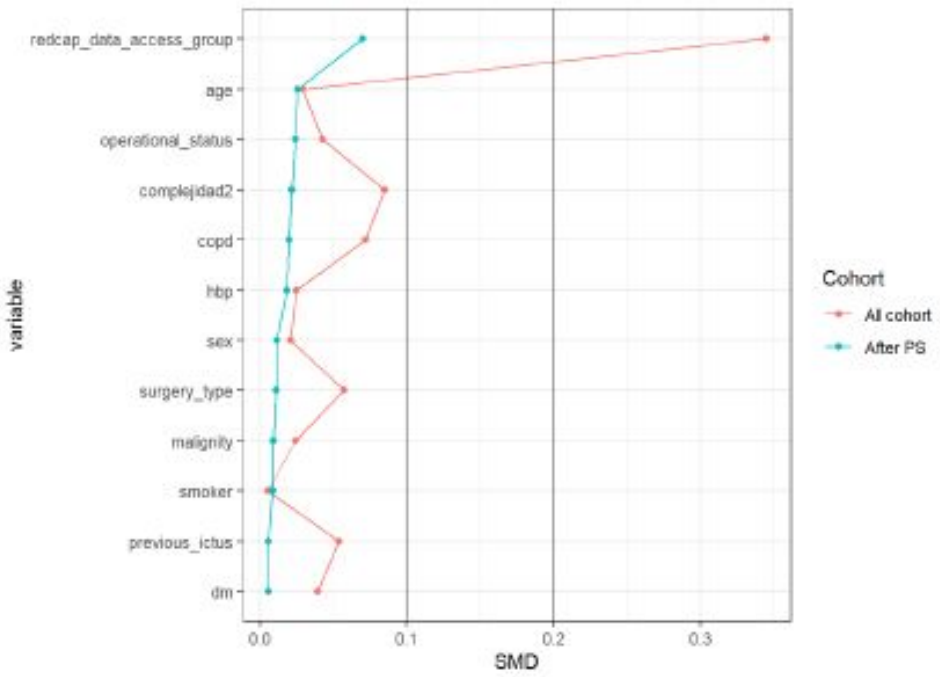


Figure S4. Comparison of means and prevalences of baseline characteristics among matched cohorts of COVID-19-negative intra- and pre-pandemic patients



Red dots are standardized differences in the cohort, and green dots are standardized differences in the matched cohort. Vertical lines in 0.1 and 0.2 are standard cut-off to identify negligible differences.

Table S6. Outcomes of the COVID-19-negative (2020) and 2019 matched cohorts (n= 4 066)

Variable	No. (%)		*P* value
	COVID-19-negative 2020 (n = 2 033)	2019 cohort (n = 2 033)	
30-day mortality	92 (4.5)	66 (3.3)	0.04
90-day mortality[a]	111 (5.9)	93 (4.6)	0.07
Patients with 30-day postoperative complications	485 (23.9)	515 (25.3)	0.29
Failure-to-rescue, %[b]	19.0	12.8	0.01
Type of complication			
Pulmonary[c]	117 (5.8)	109 (5.4)	0.63
Thromboembolic[d]	36 (1.8)	25 (1.2)	0.19
Other medical	196 (9.6)	200 (9.8)	0.87
Surgical	313 (15.4)	359 (17.7)	0.06
Patients with severe complications[e]	240 (11.8)	258 (12.7)	0.54
Need of postoperative ICU for ≥24 hours	224 (11.0)	254 (12.5)	0.16
Length of stay, median (IQR), days	4 (2-8)	4 (2-9)	0.60
30-day rehospitalization	128 (6.6)	133 (6.8)	0.84
30-day surgical reintervention	108 (5.6)	108 (5.5)	>0.99

Abbreviations: ICU, Intensive Care Unit; IQR, interquartile range.

[a] Only considered for patients with registred 90-day follow-up (91.2% and 98.6% in each group, respectively).

[b] Failure-to-rescue (%): 30-day deaths divided by 30-day complicated patients.

[c] Pulmonary complications: respiratory infection or pneumonia, defined as purulent expectoration with positive bacteriological/virological culture, with or without changes in chest X-ray, or fever associated to pulmonary consolidation in chest X-ray; respiratory failure, defined as dyspnea requiring ventilator urgent support and/or PaO_2<60mmHg and $PaCO_2$>45 mmHg without oxygen assistance; and pleural effusion/pulmonary atelectasis.

[d] Thromboembolic complication: deep venous thrombosis and/or pulmonary embolism; acute myocardial infarction, stroke, acute limb ischemia, acute mesenteric ischemia.

[e] Clavien-Dindo grade ≥IIIA