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Early outcomes and complications following cardiac surgery in patients testing positive for coronavirus disease 2019: An international cohort study

The Cardiothoracic Interdisciplinary Research Network and COVIDSurg Collaborative

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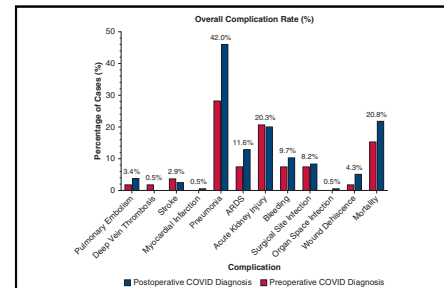
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The outbreak of severe acute respiratory syndrome-coronavirus-2, the cause of coronavirus disease 2019 (COVID-19) in December 2019 represented a global emergency accounting for more than 2.5 million deaths worldwide.¹ It has had an unprecedented influence on cardiac surgery internationally, resulting in cautious delivery of surgery and restructuring of services.² Understanding the influence of COVID-19 on patients after cardiac surgery is based on assumptions from other surgical specialties and single-center studies.

The COVIDSurg Collaborative conducted a multicenter cohort study, including 1128 patients, across 235 hospitals, from 24 countries demonstrating perioperative COVID-19 infection was associated with an overall mortality of 24% and postoperative pulmonary complications in half of all patients.³ Cardiac surgery arguably represents a higher risk population than general or orthopedic surgery due to the high American Society of Anesthesiologists grades and multiple comorbidities usually seen. We present a subgroup analysis of COVIDSurg data, including patients who underwent cardiac surgery between March 1, 2020, and July 31, 2020, across 13 countries, with a confirmed perioperative (7 days preoperative up to 30 days postoperative) diagnosis of COVID-19 infection. This is presented in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology statement for cohort studies.⁴ Categorical variables were expressed as frequency and percentages and χ^2 or Fisher



Outcomes following cardiac surgery in patients with perioperative COVID-19 infection.

CENTRAL MESSAGE

Postoperative COVID-19 infection is associated with increased mortality and respiratory complications highlighting the importance of shielding of patients, caregivers, and relatives.

See Commentary on page XXX.

exact test was used to compare categorical variables. Only anonymized data were collected. Patient consent was obtained unless it was waived by local research committees. In the United Kingdom, the study was registered at each site as either a clinical audit or service evaluation and consent was waived. In other countries, local investigators were responsible for contacting research ethics committees to obtain local or national approvals in line with applicable regulations.

RESULTS

Demographic data for 207 patients are shown in [Table 1](#). COVID-19 was diagnosed in 155 (75%) patients preoperatively and 52 (25%) postoperatively. Elective procedures accounted for 35.3% (n = 73) of cases, with 6 cases (2.9%) performed for malignancy or trauma. Isolated coronary artery bypass grafting was the most commonly performed procedure (44.4%; n = 91). Seventy patients (33.8%) had perioperative computed tomography imaging, with consolidation, pulmonary infiltrates, and ground glass opacification in

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5.3% (n = 11), 2.9% (n = 6), and 11.6% (n = 24) of cases, respectively.

Postoperative respiratory failure occurred in 56.0% (n = 116) of patients, 111 (53.6%) of whom required invasive ventilation and 24 (11.6%) developed acute respiratory distress syndrome. Postoperative bleeding (9.7%; n = 20), stroke (2.9%; n = 6), myocardial infarction (0.5%; n = 1), surgical site (8.2%; n = 17) or organ space infection were similar to those expected in a non-COVID-19 population. The rate of pulmonary embolism (3.4%; n = 7) was higher than would usually be expected; a previous meta-analysis reported a median incidence of 0.6% (interquartile range, 0.3%-2.9%)⁵ although the increased rate maybe due to ascertainment

bias because computed tomography scans are not routine in a non-COVID-19 era.

Survivors Versus Nonsurvivors

Overall mortality was 20.8% (n = 43). Subanalysis demonstrated the already widely accepted unadjusted preoperative risk factors of age >60 years (odds ratio, 3.26; 95% confidence interval, 1.42-7.46; *P* = .01), male sex (odds ratio, 4.05; 95% confidence interval, 1.5-10.9; *P* = .01), and procedural urgency (odds ratio, 3.5; 95% confidence interval, 1.45-8.25; *P* = .01). A summary of characteristics between survivors and nonsurvivors is presented in Table 1. There were more patients with a Cardiac Risk Index ≥ 3 in the nonsurvivor's group (26.8% vs

TABLE 1. Demographic data of coronavirus disease 2019 (COVID-19)-positive patients undergoing cardiac surgery

Variable	Survivors (30-d)	Nonsurvivors (30-d)	<i>P</i> value
Total	164 (79.2)	43 (20.8)	
Age group (y)			
> 60	94 (57.31)	35 (81.40)	.004
Body mass index*			
≤ 24.9	42 (28.38)	11 (34.38)	.768
25.0-29.9	52 (35.14)	11 (34.38)	
≥ 30.0	54 (36.49)	10 (31.25)	
Demographic characteristic			
Male gender	107 (65.24)	38 (88.37)	.003
Current smoker	21 (12.80)	3 (6.98)	.423
Comorbidities			
Asthma	15 (9.15)	1 (2.33)	.136
COPD	17 (10.37)	1 (2.33)	.096
Malignancy	11 (6.71)	2 (4.65)	.621
CKD	24 (14.63)	9 (20.93)	.174
CCF	14 (8.54)	7 (16.28)	.146
Diabetes	53 (32.32)	21 (48.84)	.044
PVD	11 (6.71)	4 (9.30)	.559
Hypertension	110 (67.07)	22 (52.16)	.053
Previous CVE	11 (6.71)	8 (18.60)	.016
IHD	73 (44.51)	20 (46.51)	.612
ASA grade†			
1-2	16 (9.88)	2 (4.65)	.240
3-5	146 (90.12)	41 (95.35)	
Emergency procedure	98 (59.76)	36 (83.72)	.004
Procedure type			.519
Isolated CABG	76 (46.34)	15 (34.88)	
Valve procedures: Open	26 (15.85)	7 (16.28)	
CABG + valve	14 (8.54)	5 (11.63)	
Aortic surgery	13 (7.93)	2 (4.65)	
Other major cardiac‡	8 (4.88)	3 (6.98)	
Transcatheter valve procedures			
Trauma	6 (3.66)	1 (2.33)	
Minor procedures§	19 (11.59)	10 (23.26)	

Values are presented as n (%). Statistically significant *P* values (<.05) are in bold. COPD, Chronic obstructive pulmonary disease; CKD, chronic kidney disease; CCF, congestive cardiac failure; PVD, peripheral vascular disease; CVE, cerebrovascular event; IHD, ischemic heart disease; ASA, American Society of Anesthesiologists; CABG, coronary artery bypass graft. *Body mass index data were available only for 180 patients (86.9%). †ASA data were available for 205 patients (99%). ‡Other major cardiac procedures include transplant, congenital, and myxoma. §Minor procedures include permanent pacemaker.

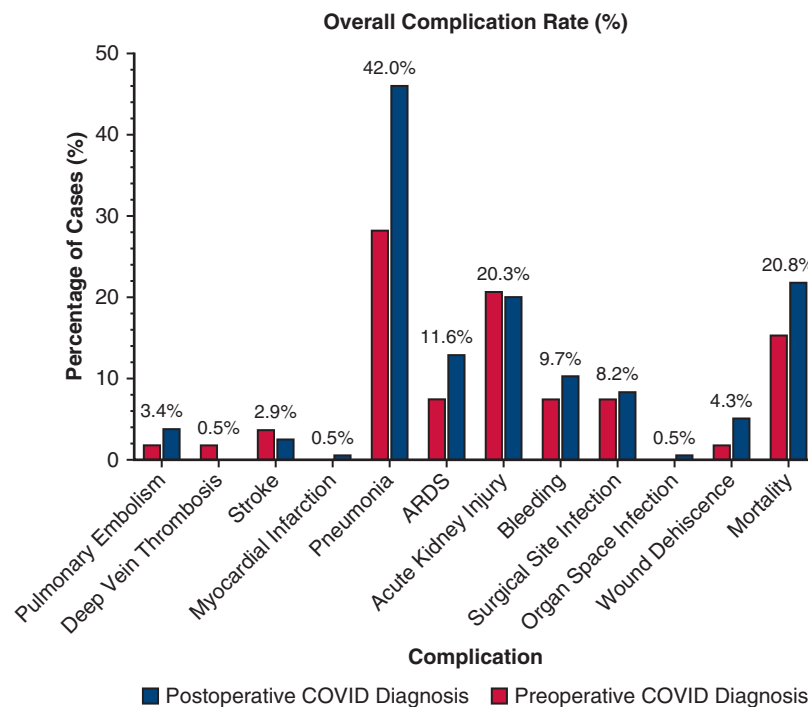


FIGURE 1. Perioperative complication rates in coronavirus disease (COVID) 2019-positive patients undergoing cardiac surgery. Complications have been split between patients with pre-versus postoperative COVID diagnosis. The overall incidence is reported above each paired column. ARDS, Acute respiratory distress syndrome.

44.2%; $P = .04$). There was a high mortality rate (35%) in those who had a minor procedure.

Preoperative COVID-19 Diagnosis Versus Postoperative Diagnosis

The only observable difference noted between those patients diagnosed with COVID-19 infection within 7 days of surgery or those diagnosed up to 30 days after surgery was the incidence of pneumonia 15 (28.8%) versus 72 (46.4%) ($P = .034$). No difference in mortality 15.4% versus 21.9% ($P = .43$) or other complications was illustrated (Figure 1). The timing of diagnosis did not influence mortality or the incidence of major complications. This highlights the importance of ensuring, wherever possible, that patients requiring cardiac surgery are managed postoperatively on so-called COVID clean pathways and wards. In addition, discharge advice to patients should extend to ensure patients and their caregivers/relatives continue to shield for at least a 30-day period alongside the 2-week preoperative shielding many hospitals have already implemented. In our analysis, 83% of cases originated from Great Britain (48%), the United States (14%), Russia (14%), and Spain (6%). A sensitivity analysis using the top-4 countries that contributed data demonstrated no significant difference in preoperative characteristics or postoperative complications. This study has several limitations: as an observational study, no comparison is possible

and generally contains a higher-risk population. A commonly used risk score was not captured and given the relatively small sample size, the risk of selection bias cannot be underestimated. Nevertheless, this remains the largest report to date in this cohort of patients.

CONCLUSIONS

This study confirms increased mortality and respiratory complications associated with perioperative COVID-19 infection highlighting the need for COVID clean pathways and postdischarge shielding of cardiac surgery patients, caregivers, and relatives. Further work is required to ascertain the influence of delays to surgery on those still requiring cardiac surgery.

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