

COVID-19 Adult Patients Undergoing Cardiac Surgery: Early Outcomes

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ABSTRACT

Background: COVID-19 illness is a major problem that has the possibility of resulting in morbidity and death. Research on harmful outcomes of SARS-CoV-2 on the cardiovascular and circulatory systems have been documented, complicating the therapy of these patients even more. **Objective:** The purpose of this research was to evaluate the safety and consequences of heart surgery in COVID-19 previously infected patients. **Patients and Methods:** A retrospective observational study on patients receiving open heart surgery was carried out at Elkasr Elaini Medical Center, Cardiothoracic Surgery Department, Cairo University. Patients who tested positive for COVID-19 before surgery were detected and included. Data from patient files were examined and evaluated in real time, complemented by telephone following discharge. **Results:** Nineteen positive cases of COVID-19 underwent open heart surgery; June 2020-September 2021 in our center. Mean age of patients was 58±9 years old. Mean time from confirmed COVID-19 with positive swab using PCR to surgery was 45±15 days. The vast majority of patients (94.7%) were extubated within 24 hours following operation. Acute renal failure developed in 10.5% of the patients, and one patient suffered severe heart failure, seven patients (63.8%) required less than or equal to seven days in the hospital, whereas 11 patients (57.9%) required between eight and fourteen days, one patient required more than 14 days. There were 2 mortalities one was covid related while the other died from severe heart failure refractory to treatment. **Conclusion:** After a period of convalescence, cardiac operation might be conducted successfully in individuals who suffered from COVID-19 illness before undergoing surgery.

Keywords: Cardiopulmonary bypass, Heart surgery, CABG, COVID 19 mortality.

INTRODUCTION

The extraordinary coronavirus (COVID-19) pandemic, driven by SARS-CoV-2, has had a significant impact on the global population ⁽¹⁾. With the introduction of vaccines in late 2020, numerous government initiatives encouraged, and in some cases mandated, immunizations for certain segments of the population. Increased immunization among the aged, immunocompromised, and fragile patients resulted in fewer viral infections, hospitalizations, and deaths. Governments that had adopted physical separation laws to minimize transmission lifted these limits in part or whole ⁽²⁾. Due to their increased transmissibility and capacity to elude vaccination protection, new strains of concern have recently posed a fresh danger ⁽³⁻⁵⁾.

Cardiac surgery is not without danger. The determination to undergo the surgery is dependent on the patient and surgeon's risk assessment. Patient demographic data, as well as clinical urgency, surgical distresses and expected post-surgical recovery, are considered ⁽⁶⁾.

Ongoing COVID-19 illness is a major problem that has the possibility of causing morbidity and death. Several studies have been published showing that SARS-CoV-2 has negative effects on the heart and circulatory system ⁽⁷⁾. Open heart surgery in COVID-19 patients causes coagulopathy, difficulties, weaning, hypoxia, and vulnerability to subsequent bacterial infections. Beside operational damage, reduced extracorporeal circulation (ECC) and poor cardiac and chest reserve might result in weakened immune system and coagulopathy, complicating these patients' care ⁽⁸⁾.

COVID-19 infection can cause severe cardiovascular outcomes such as direct myocardial

damage, coronary thrombosis, significant systemic inflammatory response, coronary plaque damage and hypoxia. In a patient who has previously been infected with COVID-19, there is an increased risk of surgical complications such as pulmonary dysfunction, arterial and venous embolism, difficulties weaning from ventilators and residual neuromuscular weakness ⁽⁹⁾.

AIM OF THE STUDY

The aim of our research is to assess the safety and consequences of heart surgery after a recovery period following COVID-19 infection.

PATIENTS AND METHODS

A retrospective observational study was conducted on nineteen patients --- undergoing open heart surgery in Elkasr Elaini Medical Center, Cardiothoracic Surgery Department in Cairo University, Egypt, from June 2020 to September 2021.

Inclusion and exclusion criteria:

Adult patients undergoing elective, emergency and urgent open heart surgery, who were screened and confirmedly diagnosed pre-operatively with COVID-19 infection via Polymerase Chain Reaction (PCR) as positive swab test, were included in our study. Vaccinated patients against COVID-19 were excluded.

Data collection: Patients were determined using the hospital's heart surgery database. Data from medical computerized patient records and records from patients were evaluated retrospectively. To augment the data, phone calls and interviews were conducted.

Ethical consent:

The approval of our study was attained from Cairo University Academic and Ethical Committee. Written informed consent was taken from all participants. The study was conducted according to the Declaration of Helsinki.

Statistical analysis

The Statistical Package for Social Science (SPSS) software version 17.0 was used for results statistical analysis. The mean ± SD was used as a measure for clinical data. Also, the Kaplan–Meier test was done for analyzing the expected duration of time of death in our sample size.

RESULTS

According to demographics illustrated in **Table 1**, nineteen patients were undergoing open heart surgery who were confirmed as COVID-19 infected before surgery. Patients’ mean age was 58 ± 9 years including 14 male (73.7%) and 5 female (26.3%) patients.

In terms of pre-operative cardiac diagnostic, 14 patients (73.7%) underwent CABG, three (15.7%) had valvular cardiac illness, one had mitral valve endocarditis, and another suffered from Aortic dissection (5.3% for each). In addition, 3 patients were smokers, Diabetes mellitus (21.1%) was found in four patients, three patients had hypertension (HTN) (15.7%), another three patients had both HTN and DM (15.7%), two patients had Chronic Kidney Disease (CKD) with DM and HTN (10.5%) and last four patients had CKD, COPD, DM with COPD and HTN with COPD where one patient (5.3%) for each.

Table (1): Patients’ demographics

Demographics		N	%
Sex	Female	5	26.3%
	Male	14	73.7%
Age	Mean ± SD (year)	58 ± 9	
Cardiac diagnosis	Valvular heart disease	3	15.7%
	CABG	14	73.7%
	Infective endocarditis	1	5.3%
	Aneurysm dissection(BENTAL)	1	5.3%
Comorbidities	Chronic kidney disease (CKD)	1	5.3
	COPD	1	5.3
	Diabetes	4	21.1
	Diabetes + COPD	1	5.3
	Diabetes + HTN	3	15.7
	Diabetes + Hypertension + Chronic renal disease	2	10.5
	Hypertension	3	15.7
	Hypertension + COPD	1	5.3
	Smokers	3	15.7

The average duration from COVID-19 patients’ confirmation by swab test using PCR to their operation was 45 ± 15 days. Only one patient (5.3%) underwent urgent surgery. Median time of cross clamp was 72 minutes and mean time of cardiopulmonary bypass (CPB) was 105 ± 36 minutes, as showed in **Table 2**.

Table (2): Operation and urgency

Urgent surgery	N=1 (Aortic Dissection)	(5.3%)
Time period from confirmed COVID-19 infection to surgery (per day)	Mean ± SD	45 ± 15
	Median (Q1, Q3)	49 (45, 52)
Cardiopulmonary bypass (CPB) time (min)	Mean ± SD	105 ± 36
Cross clamp time (min)	Median (Q1, Q3)	72 (60, 82)

Post-operatively, the majority of patients were extubated in day 1 operation (94.7%, n= 18), only one patient was extubated after more than two days (5.3%). Besides, only two patients required re-intubation (10.5%) which both died later, two patients (10.5%) required non-invasive ventilation. Acute kidney failure occurred in 10.5% of the patients (n = 2) and one patient developed heart failure post-operatively (5.3%).

Seven patients (36.8%) had less than or equal 7 days hospital stay, 11 patients (57.9%) require from 8 to 14 days hospital stay and only one patient spent more than 14 days in hospital.

Table (3): Post-operative Outcome

	N	%	
Time to extubation	< 24 hrs	18	94.7%
	> 2 days	1	5.3%
Post-operative Complications	Re-intubation	2	10.5%
	Noninvasive ventilation	2	10.5%
	Acute kidney failure	2	10.5%
	Heart failure	1	5.3%
Hospital length of stay	≤ 7 day	7	36.8%
	> 14 day	1	5.3%
	8 - 14 d	11	57.9%
Outcome	Alive	17	89.5%
	Dead	2	10.5%

Our patients’ longer lengths of stay were caused by prolonged respiratory weaning, heart failure medication, and AKI treatment. There were two deaths (10.5%), and the other patients were discharged. The 2 patients who died underwent surgery within 1 and 7 days respectively One patient who underwent urgent surgery (BENTAL) died from ARDS post COVID pneumonia while the other (Mitral valve replacement

for endocarditis) died from severe heart failure not related to COVID-19 deaths.

DISCUSSION

COVID-19 was labelled a pandemic by the World Health Organization (WHO) in March 2020, producing extremely serious health difficulties globally ⁽¹⁾. Numerous infected patients recovered and released for optional and urgent operations in hospitals. Major elective operations accomplished within the first month following a COVID-19 infection were associated with high risk of harmful consequences after surgery ⁽⁹⁾.

The purpose of our investigation was to evaluate the safety and prognosis of individuals having heart surgery after infection with Covid-19. According to our study, the mean age was 58 ± 9 years old for COVID-19 patients, the majority were males (73.7%). The major pre-operative cardiac illness was IHD (ischaemic heart disease) (73.6%).

Similarly, in a study included 34 patients in Wuhan City, the age was 55 years (IQR 43–63) but the majority of patients were women (58.8%). ICU admitted patients were 44.1%, due to the advancement of organ failure or the necessity for artificial breathing. The most prevalent comorbidities were hypertension (38.2%), cancer (26.5%), diabetes (23.5%), and cardiovascular disease (20.6%) ⁽¹⁰⁾.

In this trial, the average time from confirmed COVID-19 to operation time was 45 ± 15 days (around six weeks). This conclusion supported the results of **Sanders et al.** ⁽⁸⁾ who did a retrospective analysis of 9 cardiac surgery centers in the United Kingdom. There were 17 pre-operative COVID-19 confirmed patients underwent surgeries with a similar outcome as non COVID-19 patients.

Although there was Chronic Kidney Disease (CKD) in three patients as comorbidity (15.7%), only two patients developed acute kidney failure as a renal complication in COVID-19 infection (10.5%) one of which needed dialysis.

In terms of pulmonary consequences, one patient had ARDS and required reintubation and mechanical ventilation (BENTAL) (5.3%), while the other was reintubated during trial of resuscitation, and the other two patients who underwent CABG required non-invasive ventilation (10.5%) due to poor respiratory function, as those two patients had pre-operative COPD as a comorbidity.

All of the patients in the Wuhan research most likely got pneumonia following surgery. Among the 34 patients, the most common sequelae were 32.4%, ARDS, 14.7% acute cardiac damage, and 5.9% acute renal injury. ARDS, shock, second infection, and acute cardiac damage were more common in ICU patients than in non-ICU patients ⁽¹⁰⁾.

Recent research reveals that COVID-19 individuals who have operation may be more vulnerable to ARDS and pneumonia thereafter, even if there was no symptoms ⁽¹¹⁾. Individuals who underwent operation within six weeks of confirming COVID-19 diagnosis

had significantly higher increased 30-day pulmonary complication rates after surgery than in non-COVID-19 individuals. After seven weeks, this risk revenues to normal ⁽¹²⁾.

Additionally, there was one patient (5.3%) developed heart failure as a cardiac complication, as he had poor EF pre-operatively but didn't develop pneumonia or ARDS. Similarly, An American study of 21 individuals hospitalized to an intensive care unit (ICU) with COVID-19 found that one-third of them had new-onset cardiomyopathy with impaired left ventricular function and clinical symptoms of cardiogenic shock with increased cardiac enzymes ⁽¹³⁾. In other case series, up to half of COVID-19 patients died from cardiac failure ⁽¹⁴⁾.

As a by-product of severe COVID-19 illness, patients hospitalized to the intensive care unit (ICU) exhibited considerably higher creatine kinase myocardial band (CK-MB) and troponin I levels ⁽¹⁵⁾. In our study, heart failure developed and cardiogenic shock occurred with failure of resuscitation but without evidence of a relationship to COVID-19 infection, as this case didn't develop pneumonia or ARDS.

In addition, we had only 5.3% COVID-19 related mortality post-operatively, this surgery was urgent, while the other patient 5.3%, who underwent mitral valve replacement for endocarditis and died from heart failure not related to COVID-19. Our mean time to extubation period was less than one day in the vast majority of patients. Our hospital stay length post-operatively was less than one week in 36.8% of patients and less than two weeks in 57.9% of patients.

Similarly, in the study of 12 COVID-19 positive patients in Jantung Negara Institute, the mean time to extubation was one day. However, the hospital stay after surgery was 9 days and there was no COVID-19 related mortality ⁽¹⁶⁾. While, in Wuhan study, 20.5% of patients died after admission to the ICU ⁽¹⁰⁾.

Depending on its huge multinational research through all operational specialties including 100,000 patients and more, a Collaborative study including Royal College of Anaesthetists and Royal College of Surgeons of England recommended that optional procedures shouldn't be scheduled within 7 weeks of confirmed COVID-19, except if the risk of delaying surgical procedure exceeds the expected the post-surgical risk of COVID-19 morbidity and deaths ⁽¹²⁾. We found that all patients who underwent surgery after the mentioned recovery period in our study had good outcome and discharged home while the patient who underwent surgery on urgent base suffered ARDS post Covid pneumonia and died on day 14 after surgery.

CONCLUSION

Numerous COVID-19 patients require cardiac surgery, which could be performed safely in patients with pre-operative Covid-19 infection after a period of recovery, especially in the asymptomatic to mild category of infection. Understanding the post-COVID-

19 effects is critical for determining the appropriate time of operation and the morbidity caused by it. In difficult circumstances, a multidisciplinary group method may be active in determining the time of operation.

RECOMMENDATION

Finally, we would want to underline the critical need of developing evidence-based guidelines for the preoperative evaluation and within and after surgical care of COVID-19 infected patients before going to open cardiac operation.

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