

# Prioritizing cardiovascular surgical care in COVID-19 pandemic: Shall we operate or defer?

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## Abstract

**Background:** The coronavirus disease (COVID-19) has affected a large population across the world. Patients with cardiovascular disease have increased morbidity and mortality due to coronavirus disease. The burden over the health care system has to be reduced in this global pandemic to provide optimal care of patients with COVID-19, as well not compromising those who are in need of emergent cardiovascular care.

**Methods:** There is a very limited data published defining which cardiovascular procedures are to be performed or to be deferred in the COVID-19 pandemic. In this article, we have reviewed a few published guidelines regarding cardiovascular surgery in COVID-19 pandemics.

**Conclusion:** After reviewing a few available guidelines regarding cardiovascular surgery in COVID-19, we conclude to perform only those surgeries which cannot be deferred to a certain period of time, to reduce the burden of the health care system of the country, provide optimal care to patients with COVID-19, and to protect health care workers and cardiovascular patients from COVID-19.

## KEYWORDS

cardiac surgery, coronavirus disease, COVID-19 pandemic, elective cardiovascular procedures, emergency cardiovascular procedures, vascular surgery

## 1 | INTRODUCTION

Severe acute respiratory syndrome due to coronavirus is also known as SARS-CoV-2 or coronavirus disease 2019 (COVID-19), has been first reported from Wuhan, China in December 2019.<sup>1</sup> The cases of COVID-19 increased rapidly across the world and affects almost all countries. On 11th March 2020, the World Health Organization has declared the COVID-19 as global pandemic.

Approximately 80% of the patients infected with COVID-19 are asymptomatic or mildly symptomatic and 20% of the patients are symptomatic requires the use of health care facility. The case fatality rate although variable is estimated at around 0.5% to 3%.<sup>2</sup> In this situation of the pandemic, the aim of all the health care systems across the world is to provide optimum care and treatment to suspected or confirmed case of COVID-19. Moreover there is lack of sufficient data regarding impact of COVID-19 on post operative

outcomes in patients who were infected with novel coronavirus and underwent cardiac and thoracic procedures. Peng et al<sup>3</sup> reported that patient who underwent thoracic surgery at the time of pandemic and later found to be affected with the novel coronavirus had greater than anticipated incidence of severe illness as well as case fatality rate, thus emphasizing the importance of correct triage and prioritizing cases to be considered for cardiac and thoracic surgery.

The pandemic since its outbreak has increased in global number of cases with only few countries have controlled its impact on health and economic resources while most of the countries are still facing an unprecedented challenge in terms of containing its spread and proper allocation of health care resources to those who are affected. To provide adequate and guideline-directed treatment to those requiring cardiovascular interventions and surgeries becomes challenging when the capacity tends to get overwhelmed in such situations, hence for the fair allocation of the medical resources, guidelines have

to be made and prioritization should be done.<sup>4</sup> There is a very limited data published defining which cardiovascular procedures are to be performed or to be deferred in the COVID-19 pandemic. In this article, we have reviewed guidelines of few centers regarding cardiovascular surgery in COVID-19 pandemic to effectively triage and plan these surgeries and allocating resources to those who are in utmost need.

## 2 | CORONAVIRUS DISEASE AND CARDIOVASCULAR PATIENTS

Cardiovascular patients have a greater risk of acquiring COVID-19 infection, with morbidity and mortality much more in these patients in comparison to healthy individuals.<sup>5</sup> Madjid et al<sup>5</sup> reported that approximately 35% of patients with COVID-19 have underlying cardiovascular diseases (hypertension, coronary artery disease [CAD] and cardiomyopathy), and 28% of patients may have an acute myocardial injury, which can be diagnosed with the elevation of cardiac biomarkers like troponin, brain natriuretic peptide, myoglobin, etc. However, COVID-19 can affect the cardiovascular system of those individuals who are relatively free of any coexisting comorbidities. Recently Zhou et al<sup>6</sup> reported a retrospective study of 191 patients with COVID-19, showed that around 48% of the patients had comorbidities, out of this hypertension was most common (30%), followed by diabetes mellitus (19%) and CAD (8%). Acute heart failure was present in 23% of patients, the major precipitating factors were acute myocarditis, acute coronary events and cardiac arrhythmias.

The angiotensin-converting enzyme 2 (ACE-2) receptor has been identified as a receptor for SARS-CoV-2 invasion into the cells, and myocytes have abundant ACE-2 receptors that increase the risk of injury to myocytes and precipitating myocarditis, acute coronary events, arrhythmias, and acute heart failure.<sup>7</sup>

## 3 | AMERICAN COLLEGE OF SURGEONS GUIDELINES FOR CARDIAC SURGERY DURING COVID-19

We as cardiovascular surgeons have to protect the cardiovascular patients from acquiring COVID-19 infection, and simultaneously have to treat the patients as well. To allocate timely and proper care to those requiring cardiovascular surgery, American college of surgeons defined the surgical procedures in two categories. First, emergent and urgent procedures, in which delay can harm the patients. Second, elective and nonurgent procedures, which can be rescheduled to a future appropriate date without causing a significant difference in the outcome. All the elective and nonurgent procedures postponed and only emergent and urgent procedures were performed. The rationale for this was, protection of health care workers from exposure of COVID-19, minimizing cardiovascular patients from exposure of COVID-19, use of resources for the appropriate care of patients with COVID-19 and blood conservation.<sup>8</sup>

## 4 | TRIAGE BASED CLASSIFICATION SYSTEM IN PROVIDING SURGICAL CARE FOR CARDIAC PATIENTS

Patel et al, considering the limited resources in the rising phase of a pandemic, gave recommendations for perioperative management and prioritizing patients to receive cardiac surgical care. Identifying the patients on the basis of a pre test probability for acquiring COVID-19 based upon presence of symptoms, travel, and exposure history, and the community prevalence of the disease and may be accordingly categorized into low, intermediate, and high. The decision to perform a cardiac surgery is to be defined by acuity of the clinical situation, with tier 3 being those with high acuity, tier 2 being intermediate, and tier 1 being of low acuity. It was recommended not to defer tier 3 cases and proceed to surgery with COVID-19 precautions on the basis of the clinical indication, and not delaying the case for testing for COVID, as delay would likely result in patient harm. Intermediate, that is, tier 2 cases could be deferred for 4 to 12 weeks, whereas tier one case with low acuity could be deferred up to 12 weeks. It was recommended to consult a surgical case committee in intermediate tier cases when controversy arises regarding tier category. For patients who have recently recovered from COVID-19, delaying cardiac surgery for at least 2 to 4 weeks after the positive COVID test was recommended.<sup>9</sup>

## 5 | A GUIDANCE STATEMENT FROM THE CANADIAN SOCIETY OF CARDIAC SURGEONS

Canadian Society of Cardiac Surgeons released a guidance statement in which they defined three stages of triage of cardiac surgical procedures, to be modified on the local context, infrastructure and capacity of the hospital.<sup>10</sup> Stage 1 reduces services to 0% to 30%, stage 2 to 30% to 50%, and stage 3 to more than 50%. Each stage is further subdivided into two, essential services, and deferred cases. Essential services include symptomatic critical severe aortic stenosis, symptomatic severe triple vessel disease (TVD) with left main, three-vessel CAD with reduced ejection fraction, cardiac tumors at risk of obstruction or embolization, and aortic aneurysms at risk based on size or symptoms. The deferred list includes asymptomatic severe mitral regurgitation, atrial septal defect closure surgery, asymptomatic aneurysm and all patients judged to stable and capable of waiting. All patients on the waitlist should be contacted and informed about the current situation of COVID-19 and screened the patients regarding their present status. All patients on the waitlist, who have worsening of symptoms can contact and can receive additional screening. These strategies are similar to those recently adopted by the Canadian Association of Interventional Cardiology<sup>11</sup> and are encouraged to share their experiences related to the COVID-19 pandemic in a timely manner to improve overall outcomes of the cardiac patients.

## 6 | THE UNITED KINGDOM CARDIAC SURGEONS' VIEW

In absence of clear recommendations and guidelines at the time when pandemic was still rising Benedetto et al<sup>12</sup> concluded through a webmail based nationwide survey in the United Kingdom and Ireland to reach a common view point in handling patients requiring cardiac surgeries. A strong consensus (more than 60%) was reached for the following questions regarding management of patients undergoing cardiac surgery:

- (1) Before hospital admission every patient should receive nasopharyngeal swab, polymerase chain reaction, and computed tomography of the chest.
- (2) Use of full personal protective equipment should to be adopted in every case by the theater team regardless of the patient's COVID-19 status.
- (3) Risk of COVID-19 exposure for patients undergoing heart surgery should be considered moderate to high and likely to increase mortality if it occurs.
- (4) Cardiac procedures should be decided based on ad-hoc multi disciplinary team for every patient.

Although there was not a strong consensus but most of the surgeons (more than 50%) agreed upon:

- (1) Patients who tested positive for COVID-19 before salvage surgery should be considered for surgery only if they have no symptoms of infection and have best chances of survival.
- (2) Aortic and mitral valve surgery could be considered only in selected cases.
- (3) CABG should be considered only in selective cases.

## 7 | GUIDELINES DEFINING LEVEL OF PRIORITY FOR CARDIOVASCULAR PROCEDURES IN COVID-19

Mavioglu et al<sup>13</sup> reported article on perioperative planning for cardiovascular operations in the COVID-19 pandemic in the *Turkish Journal of Thoracic and Cardiovascular Journal*. They have defined a total four level of priority (LoP) for cardiovascular procedures to be done in COVID-19 pandemic. LoP I is elective cases, LoP II is urgent cases, LoP III is emergent cases, and LoP-IV is salvage cases (Table 1). The LoP I should be postponed as much as possible, and LoP II-IV should be operated with protective measures.

## 8 | GUIDELINES FOR THE MANAGEMENT OF VASCULAR SURGERY PATIENTS IN COVID-19 PANDEMIC

Patients with COVID-19 has increased risk of venous thromboembolism. COVID-19 pneumonia is associated with abnormal coagulation

and there is an increased risk of disseminated intravascular coagulation in critically ill patients and has increased morbidity and mortality.<sup>14</sup> American college of surgeons has defined triage guidelines for vascular surgery patients,<sup>8</sup> and have provided guidelines regarding whether to postpone or not, vascular surgical procedures including, ascending aortic aneurysm, peripheral aneurysms, aortic dissection, mesenteric ischemia, peripheral vascular disease, trauma, venous thromboembolism, and amputation of limbs (Table 2).

Critically ill patients with COVID-19 are at increased risk of both thrombosis and bleeding. In these patients, Pauda predilection score may be more helpful than just clinical assessment for risk of venous thromboembolism.<sup>15</sup> Vascular inflammation and endothelial dysfunction may also contribute to hypercoagulable states in patients

**TABLE 1** Defining level of priority (LoP) for cardiovascular operations in the COVID-19 pandemic (adapted from: Mavioglu HL et al. Perioperative planning for cardiovascular operations in the COVID-19 pandemic. *Turkish J Thorac Cardiovasc Surg.* 2020;28(2):236-43)

|         |  |
|---------|--|
| LoP I   | Elective surgery (routine admission for surgery) <ul style="list-style-type: none"> <li>• Asymptomatic or stable angina</li> <li>• Chronic hemodynamically stable valvular heart disease</li> <li>• Unruptured and hemodynamically stable aneurysms</li> <li>• Patients with chronic limb ischemia</li> </ul>  |
| LoP II  | Urgent surgery (requires surgery in same admission) <ul style="list-style-type: none"> <li>• Severe left main or three vessel CAD involving proximal left anterior descending</li> <li>• Acute coronary syndrome</li> <li>• Acute aortic regurgitation</li> <li>• Acute mitral regurgitation</li> <li>• Obstructive prosthetic valve thrombosis in critically ill patients without serious comorbidity</li> <li>• Active endocarditis</li> <li>• Acute contained, hemodynamically stable, ruptured aneurysm</li> <li>• Acute limb ischemia with preserved neurological functions</li> <li>• Amputations for nonsalvageable limbs</li> <li>• Symptomatic acute mesenteric ischemia</li> <li>• Pericardial tamponade in hemodynamically stable patients</li> </ul> |
| LoP III | Emergency (to operate before next working days) <ul style="list-style-type: none"> <li>• Ongoing ischemia and anatomy not suitable for percutaneous intervention</li> <li>• Ongoing ischemia with hemodynamic instability and ventricular arrhythmia</li> <li>• Mechanical complications of Myocardial infraction</li> <li>• Valvular disorder with acute heart failure</li> <li>• Aneurysm rupture with hemodynamic instability</li> <li>• Acute limb ischemia with neurological deficit</li> <li>• Acute type A and complicated type B aortic dissection</li> <li>• Pericardial tamponade with hemodynamic instability</li> </ul>  |
| LoP IV  | Salvage procedures (requires cardiopulmonary resuscitation on the way to operation theater or before induction of anesthesia)  |

Abbreviations: CAD, coronary artery disease; COVID-19, coronavirus disease 2019.

with COVID-19. Critically ill patients with COVID-19 will be benefited by the use of low molecular weight or unfractionated heparin.<sup>16</sup>

## 9 | AUTHOR'S VIEWPOINT

There are well-defined guidelines available for the management of various cardiovascular diseases in our daily routine practices. In the present context of COVID-19 pandemic when the cases are still rising in most of the countries across the globe and it has become extremely difficult for many health care systems to handle and allocate resources, we must aim to reduce the burden and also to provide appropriate care to both non-COVID-19 and COVID-19 patients, simultaneously protecting the health care workers and cardiovascular patients from COVID-19. For that, we have to prioritize patients by performing those who are emergent/urgently need surgery, while postponing non-emergent surgeries. There is very limited data published which defines which procedures to be deferred or to be performed. After reviewing the few available guidelines, our suggestions are as follows:

- (1) Defer all elective cardiovascular procedures in which outcome will not be significantly altered by deferring the procedure for a certain period of time. This includes
  - Hemodynamically stable CAD
  - Chronic stable angina
  - Hemodynamically stable Valvular heart disease
  - Adult congenital heart diseases like atrial septal defect, ventricular septal defect, and patients not in failure or in cyanotic spell.
  - All patients with stable, non-ruptured aortic aneurysms irrespective of the size of the aneurysm.
  - All patients with chronic limb and mesenteric ischemia.
  - Asymptomatic patients with blocked prosthetic grafts and stents.

- (2) Perform surgeries in which outcomes will be significantly altered if the procedure is deferred for a certain period of time. These procedures should be done using standard universal precautions and prior COVID testing should be done as per individual institutional policy.

- CAD: Perform surgeries for the critical left main disease, severe TVD with hemodynamic instability, and or having a ventricular arrhythmia, mechanical complications of acute myocardial infarction, such as ventricular septal rupture, cardiac free wall rupture and acute ischemic mitral regurgitation. Acute coronary syndrome with anatomy not suitable for percutaneous coronary interventions.
- Valvular heart surgery: Patients with valvular heart disease with heart failure not responding to medical management. Acute mitral regurgitation, acute aortic regurgitation, symptomatic critical aortic stenosis, obstructive prosthetic valve thrombosis, infective endocarditis (native or prosthetic) not responding to maximal medical management.
- Congenital heart disease: Patients with a cyanotic spell, or in heart failure not responding to medical management.
- Vascular surgery: Ruptured aneurysm of aorta, hemodynamically unstable contained rupture of aortic aneurysm, acute type A dissection and complex type B dissection with visceral malperfusion. Acute limb ischemia either due to trauma or due to thromboembolism. Acute mesenteric ischemia should also be operated. Fasciotomy for compartment syndrome and amputation for nonsalvageable limbs should be performed.

## 10 | CONCLUSION

After reviewing a few available guidelines regarding cardiovascular surgery in COVID-19, we conclude to perform only those emergency surgeries which cannot be deferred to a certain period of time, as

**TABLE 2** Guidelines for the management of vascular surgery patients in COVID-19 pandemic (adapted from: American College of Surgeons. COVID-19: Elective case triage guidelines for surgical care. *Am Coll Surg.* 2020;2020)

| Vascular surgical procedures      | Do not postpone   | Postpone/can postpone   |
|-----------------------------------|---|---|
| Ascending aortic aneurysm         | Ruptured, infected, symptomatic and prosthetic graft infection                                    | Asymptomatic, even size more than 6.5 cm                                      |
| Peripheral aneurysms              | Symptomatic, expanding pseudoaneurysm   | Asymptomatic  |
| Aortic dissection                 | Rupture or malperfusion or shock  |   |
| Mesenteric ischemia               | Symptomatic acute mesenteric ischemia   | Chronic mesenteric ischemia   |
| Peripheral vascular disease (PVD) | Acute limb ischemia, fasciotomy for compartment syndrome, progressive tissue loss or wet gangrene | Chronic limb ischemia   |
| Trauma                            | Hemorrhage or acute limb ischemia   |   |
| Venous thromboembolism            | Acute iliofemoral DVT   | IVC filter placement and removal, surgery for varicose veins or venous ulcers |
| Wounds and amputation             | Acute limb ischemia with nonsalvageable limb  | Deep debridement of wounds, wounds requiring skin grafts                      |

Abbreviations: COVID-19, coronavirus disease 2019; DVT, deep vein thrombosis.

this may cause significant alteration in the outcome of the disease. These recommendations should be considered on case to case basis and need regular updates according to individual institutional policy or guidelines released by the national or international society of cardiovascular surgeons.

### CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

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