Initially called pneumonia of unknown cause, coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) now has a global footprint. It has affected healthcare system worldwide, including the surgical procedures. The cardiovascular manifestations of COVID-19 are due to myocarditis, pericarditis, vasoplegia, right ventricular failure and acute coronary syndrome that warrant aggressive medical therapy and mechanical support like extracorporeal membrane oxygenation (ECMO). Proper triage of cardiac surgical cases and tier system should be followed without compromising the safety of healthcare workers. The risk of death due to pneumonia is high even for a low-risk surgery. Delaying elective surgeries has been the dictum during this pandemic. However, cardiovascular procedures are relatively progressive conditions, and elective case triage is tricky in them. So, the cardiac surgical procedures have to be classified into emergent/urgent procedures and elective procedures. The emergent procedures are those procedures that are deemed to be sensitive to time such that a procedural delay would result in harming the patient. The elective procedures include those that are not likely to produce a significant impact on the patient’s health outcome and hence can be refixed on a later date and time; nevertheless, the timing of these cases is flexible. The basic principles are protecting the patient from nosocomial COVID infection; protecting the institution and society by sparing resources and preventing spread of the infection; nevertheless, the health care team has to be optimally utilised so as to protect it.[1,2]

Guidance statements have been issued for patient triage during the COVID-19 pandemic by some societies to help the cardiac surgeons;[1,3]

Tier 1 (0-30% inpatient COVID-19 load, mild reduction in operative capacity)-Continue all cardiac services that are essential; the in-patients waiting for emergency surgery, for example, acute coronary syndrome, ascending dissection of aorta, acute valvular endocarditis and patients in heart failure requiring ventricular assist device or heart transplant; and outpatients with cardiac tumours, aortic aneurysm at risk, correctable anatomic causes of heart failure, end-stage ionotrope dependant heart failure, severe coronary artery disease (CAD), critical aortic stenosis, because these are at the greatest risk of adverse events. The surgical procedures are deferred for asymptomatic outpatients, truly elective interventions, those with asymptomatic or minimally symptomatic severe mitral regurgitation, atrial septal defects, asymptomatic aneurysm and those in need of isolated arrhythmia procedures.

Tier 2 (30–60% inpatient COVID-19 load, moderate reduction in operative capacity)- Cardiac anaesthesia is conducted in all in-patients awaiting emergency surgery; those outpatients with symptomatology that is progressive and who have not responded to medical management [e.g., asymptomatic symptomatic coronary artery disease (CAD) with poor left ventricular function]. The surgical procedures are deferred in the asymptomatic outpatients and in those whose anatomical and physiological features are such that it would be reasonably safe to delay the procedure.

Tier 3 (60–80% inpatient COVID-19 load, severe reduction in operative capacity) – Cardiac anaesthesia is conducted in all in-patients who are in dire need of emergency surgical intervention or corrective procedures and are at a high risk if discharged home. Surgical procedures are deferred for all outpatients.

Tier 4 (>80% inpatient COVID-19 load, minimal operative capacity) – Cardiac anaesthesia is conducted only for emergency services based on resource availability. If in the judgement of the cardiac surgeon, the patient’s condition is stable and can wait, the surgical procedure can be deferred to a later date. The same is applicable to all outpatients.

It is very important to regularly screen patients for identification of those who have a progression of their symptomatology and disease. The recommendations for trans-catheter interventions are same as above. Percutaneous therapies which are usually accompanied by early hospital discharge can be considered as better alternatives. The United Network for Organ Sharing provides guidance for thoracic organ transplant. The preoperative evaluation should mainly emphasise on the patient’s recent epidemiologic history, respiratory history and clinical signs and symptoms.
symptoms. The investigations include estimation of levels of serum immunoglobulin G (IgG), testing for respiratory pathogens, complete blood count, levels of procalcitonin (PCT) and C-reactive protein (CRP), testing for SARS-CoV-2 nucleic acid and computed tomography of the chest. All patients who proceed for surgery must be considered as COVID-19 cases till a test result becomes available. If no investigations are available, the patient is admitted to an airborne isolation room (single room with negative pressure and frequent air exchanges) and necessary investigations are conducted. COVID-19 may manifest as elevated biomarkers of cardiac injury, heart failure (especially in the elderly age group), myocardial injury induced by hypoxia which is very common in cases with previous history of myocardial infarction, those with an unstable angina and those with a history of a percutaneous coronary intervention, stunned myocardium, pneumothorax, renal manifestations including acute kidney injury, electrolyte abnormalities and severe acid-base imbalances and a deranged coagulation profile.[2,4,5] A recent retrospective study concluded that all asymptomatic patients should be tested for COVID-19 using reverse transcriptase polymerase chain reaction (RT-PCR) prior to cardiac surgeries. This can help prevent progress of the disease and also help to prevent the poor perioperative course that can arise due to COVID-19.[6]

The preparations to conduct cardiac anaesthesia include: a dedicated operation room (OR), a team incorporating cardiac surgeons, cardiac anaesthesiologists, chest physicians, infectious disease specialists, nursing personnel and perfusionists; negative pressure room; gas scavenging system; level 3 infection control precautions (disposable hat, medical masks [N95 or above], powered air purifying respirators [PAPR], scrubs, disposable gloves and disposable shoe covers) and two experienced cardiac anaesthesiologists.[4,7] Dedicated surgical equipment including instruments, sutures, prosthetic valves, grafts, anaesthetic equipment for endotracheal intubation, arterial and central venous cannulation and the oxygenator should be kept ready before patient arrival in OR (operating room). If the OR personnel run in search of this equipment after patient arrival, the traffic across the OR can increase and this is not desirable.[4] The other principle of anaesthesia management and techniques are to be followed as per guidelines.[8,9]

Advanced invasive haemodynamic monitoring is frequently required. This includes pulse contour cardiac output (PiCCO), integrated monitoring system to determine fluid status (FloTrac), Swan-Ganz catheter, transoesophageal echocardiography (TEE) guided fluid therapy and use of inotropic or vasoactive medications. In the event of acute myocardial injury, early use of intra-aortic balloon pump, ventricular assist device or ECMO mechanical circulatory support is instituted. Ultrasound guidance for arterial and central venous catheterisation can improve success rates, reduce procedural times, and avoid multiple vessel punctures. All this will reduce blood contamination of assisting personnel.

The basic principles of management are: timely correction of hypoxaemia and electrolyte imbalance; institute cardiopulmonary bypass or ECMO support in case of severe pulmonary dysfunction; provide adequate titrated sedation; administer steroids in case a cytokine storm is present; administer antimicrobial prophylaxis and anti-inflammatory therapy; take adequate precautions during patient transfer and disinfection of operating room, equipment and medical waste management.[4,7]

To conclude, anaesthesia for cardiac surgery in a COVID-19 patient either suspected/confirmed is challenging. It warrants careful perioperative patient management including wisely taken clinical decisions as per guidelines and protection of OR and intensive care unit (ICU) personnel. Though the COVID pandemic is now under control, these principles can be helpful for future preparedness and they need to be kept in mind during the possible future peaks of the pandemic.

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