





Cardiac surgery services during COVID-19—what did we learn?

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1 | INTRODUCTION

Since the start of the global coronavirus disease 2019 (COVID-19) pandemic in December 2019, over 170 million confirmed cases of COVID-19, including 3.5 million deaths, have been recorded.¹ In an attempt to manage this extraordinary burden on healthcare systems worldwide, unprecedented changes have been seen in healthcare services. Cardiothoracic surgery is no exception to the rule, seeing considerable changes in response to the COVID-19 pandemic. Cardiac surgical services have had to undergo centralisation through structural changes to allow emergency surgery to take place alongside hospital management of COVID-19 patients, while the re-allocation of ventilators and other intensive care unit (ICU) resources has led to a delay in elective cardiac surgeries.² These patients' conditions are therefore likely to progress, with unknown long-term impacts on their morbidity and mortality rates.³ As well as patients, cardiac surgery trainees have also suffered the effects of the pandemic, due to redeployment to COVID-19 wards and the need for consultant management of high-risk patients.⁴

2 | THE IMPACT OF COVID-19 ON CARDIAC SURGERY SERVICES

The study by Shah et al.⁵ explored the impact of COVID-19 on cardiac surgical service provisions including pre- and postoperative care, surgical training, and the use of telemedicine for cardiac surgery. The study identified that COVID-19 put a significant burden both on patients with cardiovascular disease and surgical units, whose resources required

redistribution to COVID-19 patients; lack of equipment, therefore, meant that only urgent surgeries could be performed, leading to a significant drop in major cardiac surgical procedures.⁶ This, coupled with staffing shortages due to redeployment, isolation, illness or even death, amounted to a backlog of 1–8 months of procedures, depending on hospital capacity, with delays potentially affecting patient morbidity and mortality at a later stage.⁷

The review also demonstrated the poor prognosis of patients with complex postoperative courses, as their subsequent hospitalisation put them at an increased risk of contracting COVID-19, and this has been further elaborated by other studies.⁸ Increased fear of contracting COVID-19 also led to reduced hospital presentations with myocardial infarction or stroke, affecting accessibility to essential treatments.⁹ Intraoperatively, risks associated with aerosol-generating procedures meant that modifications in surgical practices were necessary, possibly compromising the quality of surgical treatments.⁹ Outpatient services were affected by the need for social distancing, with telemedicine being used to allow remote patient assessment and triage during the pandemic, despite a lack of physical examinations.⁵

Cardiac surgical training has also suffered major disruptions, secondary to redeployment of trainees to the frontline in areas that were affected by COVID-19, while less affected areas that lacked critical care beds had decreased training opportunities.¹⁰ As COVID-19 patients with cardiac issues are high-risk, consultants tend to operate on these patients, leaving fewer opportunities for surgical trainees.⁴ The pandemic did, however, allow trainees time to work on research or local management ventures.¹⁰

The review also explored several recommendations to reduce the impact of COVID-19 on cardiac surgery services; these included

preoperative COVID-19 testing, reducing aerosolisation of COVID-19, and implementing structural changes in the operating theatre, such as utilising negative pressure rooms, to reduce the risk of COVID-19 transmission.¹¹ Recommendations also included the centralisation of cardiac surgical units, triage to prioritise urgent cases and minimise the backlog of cases, and patient follow-up using telephone calls or virtual appointments.^{2,11}

While it is important to emphasize on the speed of implementation of such significant changes in healthcare systems by many developed countries in Europe and North America, it should be noted that such implementations may perhaps have taken longer in many developing countries, causing a potential for further compromise in providing adequate and safe care during the COVID-19 pandemic.

3 | POSTOPERATIVE AND LONG-TERM OUTCOMES IN CARDIAC SURGERY

A recent international multicentre cohort study demonstrated that 30-day mortality in COVID-19 patients undergoing a range of surgical procedures was reported as 23.8%, and was found to be associated with male sex, age of 70 years or greater, and poor pre-morbid physical health.¹² This illustrates the importance of balancing the risks and benefits of surgery with the risk of mortality, and the need to consider alternative interventions which might minimise the risk of COVID-19 infection. 51.2% of patients in this study also had postoperative respiratory complications, and an increased mortality rate of 38.0%.¹² Other studies have also described the harmful effects of COVID-19 on the myocardium, and the increased risk of thromboembolism in COVID-19 patients,¹³ which would be further exacerbated in a post-operative patient. All the aforementioned complications make cardiac surgery patients a high-risk cohort requiring intensive monitoring in the context of the pandemic.

Due to the delays seen in elective cardiac surgeries, long-term outcomes for cardiovascular patients who were not operated on could be substantial.³ Reports demonstrate mortality rates as high as 3.7% at one month and 11.6% at 6 months for patients waiting for surgical or transcatheter aortic valve replacement.¹⁴ Patients awaiting coronary surgery are faced with median waiting list mortality rates of 2.6% per month, with risk increasing by 11% every month.¹⁵

To evaluate the impact of COVID-19 on cardiovascular patients' experiences of their surgical care and treatment, a survey conducted through Aortic Dissection Awareness UK and Ireland revealed that only 3% of patients were currently being considered for, or awaiting, surgery.¹⁶ Over 80% of patients were more concerned about their delayed aortic surgeries than the risk of contracting COVID-19 in hospital; 72% of patients would have preferred to have surgery without delay despite the risk of contracting COVID-19. Although this study was a cross-sectional study, requiring larger qualitative studies to validate its findings, it demonstrated greater patient worries about their underlying aortic pathology compared to the risk of contracting COVID-19.

While COVID-19 has indiscriminately affected developed and developing countries around the world, it is important to consider the repercussions on the comparatively weaker surgical services in low- and middle-income countries (LMICs), where patients already face barriers to surgical care and increased disease burden.^{17,18} Reduced accessibility, border closures, disruptions to surgical donations and supply chains, and the redistribution of resources to cope with the burden of COVID-19 has forced some LMICs to rely on a single surgical centre, leading to drastic reductions in cardiac surgical services.¹⁸ The resultant backlog of surgical procedures places a strain on healthcare systems where surgical delivery is already constrained, where deficiencies in personal protective equipment, ventilators and hospital staff exist, and where surgical triage using telemedicine to reduce this burden is not always possible.^{17,19} Pre-COVID-19, LMICs had only met half of the Lancet Commission on Global Surgery's recommendation for 20 surgeons, anaesthetists and obstetricians per 100,000 population to fulfil the surgical disease burden in LMICs²⁰; this statistic is likely to have been further exacerbated by COVID-19 pulling the surgical workforce out of operating theatres and onto the frontline, further reducing the already limited surgical workforce and placing a strain on emergency surgical services.¹⁷

While LMICs might still have the capacity to introduce measures, such as social distancing and preoperative isolation, measures such as polymerase chain reaction (PCR) testing are more resource-dependent.⁶ Limited PCR testing in hospitals in Trinidad and Tobago meant that only symptomatic cardiac surgical patients received preoperative testing¹⁹; this has implications for minimising viral transmission, as many patients with COVID-19 tend to be asymptomatic. Patients may therefore have asymptomatic infections which could adversely impact their perioperative courses; this highlights the importance of prioritising testing to high-risk groups, including cardiac surgery patients,¹⁹ and employing preoperative testing algorithms, which utilise each patient's exposure and travel history and community prevalence to highlight those in need of testing.¹¹

In addition to shortages in PCR testing, LMICs are also likely to be affected by the global scarcity in blood transfusions seen during the pandemic, due to lockdowns restricting the number of people able to donate blood,¹⁹ and by a shortage of ICU beds compared to their high-income counterparts.¹⁷ Additionally, there is as few as one ventilator per 100,000 population in some LMICs; this is likely to give rise to ethical dilemmas involving the rationing of ICU resources based on likely clinical outcomes and would mean that respiratory failure in the context of multiple comorbidities could prove fatal.¹⁷

4 | TECHNOLOGY AND CARDIAC SURGERY DURING AND BEYOND COVID-19

In developed countries, the digitalisation of healthcare has helped to minimise in-person appointments during the COVID-19 pandemic, with the aim of reducing viral transmission and providing high-quality patient care. Remote consultations, diagnostic interventions and

monitoring of clinical parameters have been used to support the care of cardiovascular patients.²¹ For patients requiring surgery, pre-operative assessment using digital tools, such as echocardiograms or smartwatches, has been used to assist with patient triage, as well as helping diagnose and refer patients for procedures, as seen with teleconsultations of angiograms used for coronary artery bypass graft surgery.²² Postoperatively, video conferencing and web applications have allowed the remote identification of surgical complications, such as infections, so that patients can receive appropriate clinical care.²³ Telemonitoring using cardiac resynchronisation defibrillators also allows the identification of cardiac complications.²³

Cardiac rehabilitation via video conferencing can also take place remotely, and has shown similar improvements in exercise capacity and quality of life as centre-based approaches.²⁴ Telemedicine is not, however, without its limitations; accessibility may be an issue for certain patient groups, including the elderly, those with learning difficulties, and those from under-resourced areas.²¹ It is also not always a viable alternative to physical examination, especially in patients of whom there is no prior knowledge, those who have no support at home, or complex or unstable patients who require in-hospital care²³; it, therefore, needs to be tailored to each patient's individual needs.²¹

Overall, the future of cardiac surgery during the ongoing COVID-19 pandemic remains uncertain. The backlog of elective surgeries will need to be managed; early planning and prioritisation of the most vulnerable patients will help maintain the success of these services.³ Long-term cohort studies into the outcomes of high-risk patients whose surgeries were delayed by the pandemic will provide valuable insight into how this patient group can be best supported. All patients requiring cardiac surgery should undergo preoperative PCR screening, to minimise the risks associated with COVID-19 in the postoperative patient.³ Telemedicine will likely retain its place in cardiac surgery service delivery beyond the COVID-19 era due to its benefits in maintaining patient safety and reducing barriers to care, although collaborative research is necessary into its effectiveness.² The lessons learned from the pandemic should be used to implement clear clinical care guidelines to shape the delivery of safe cardiac surgery services moving forward.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

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