Přehledový článek | Review article

Cardiac surgery and the coronavirus disease 2019 pandemic

Morad Yaser Al Mostafa[a], Hashim Talib Hashim[b], Yazeed Fawwaz Abu Ruman[c], Irfan Ullah[d], Ali Talib Hashim[e]

[a] *Princess Basma Teaching hospital, Amman, Jordan*
[b] *University of Baghdad, College of Medicine, Baghdad, Iraq*
[c] *Al-Hussein Hospital – Salt Hospital, Jordan*
[d] *Kabir Medical College, Gandhara University, Peshawar, Pakistan*
[e] *Golestan University of Medical Sciences, Gorgan, Iran*

ARTICLE INFO

Article history:
Submitted: 16. 8. 2022
Accepted: 24. 8. 2022
Available online: 29. 5. 2023

Klíčová slova:
Covid-19
Důsledky
Kardiochirurgické výkony
Operace
Pacienti
Pandemie

SOUHRN

Onemocnění covid-19 má neblahé důsledky jak pro infikované, tak neinfikované jedince. V době pandemie se snížily počty pacientů podstupujících kardiochirurgické výkony. Tito pacienti vykazovali více symptomů, výkony trvaly déle a byla vyšší nemocniční mortalita. Zatímco všechny důsledky pandemie dosud nejsou plně známy, jedna věc je jistá, musíme se připravit na možnou další vlnu tohoto onemocnění.
V současnosti je budoucnost kardiochirurgie po pandemii nejasná, protože neustále přibývají nové důkazy a poznatky v tomto směru. Nicméně se lze z těchto nebývalých událostí v novodobé historii poučit a mít je na paměti při plánování zdravotnických služeb do budoucna. Při vyhledávání asymptomatických nebo subklinických forem infekce bude bezpochyby klíčovou úlohu hrát rutinní screening pacientů na přítomnost infekce virem SARS-CoV-2. Rovněž bude nutno uvádět do praxe i jednoznačná doporučení, aby bylo možno znovu bezpečně provádět chirurgické výkony a současně uklidnit pacienty strachující se o svoji bezpečnost. I když další průběh pandemie není vůbec jistý, poznatky z důsledků onemocnění covid-19 pro kardiochirurgii jako takovou nepochybně ovlivní strategii rozvoje tohoto oboru v budoucnu.

© 2023, ČKS.

ABSTRACT

COVID-19 is having an impact on both infected and non-infected patients. During the outbreak period, a smaller number of patients underwent cardiac surgery. These patients experienced more symptoms, had longer procedures, and had a higher in-hospital mortality rate. While the consequences of the pandemic are not fully understood, one thing is certain; we must prepare for a possible new outbreak.
Currently, the future of cardiac surgery after the pandemic is unclear as the evidence is still emerging. However, the lessons learned from these unprecedented times can be taken forward to inform future service planning. Moving forward, routine screening of patients for SARS-CoV-2 infection will undoubtedly play a key role in identifying asymptomatic or subclinical infections. Ultimately, clear guidelines should be implemented to ensure the safe resumption of surgical services, while also reassuring patients concerned about safety. Although the future trajectory of this pandemic is uncertain, the insights from the impact of COVID-19 on cardiac surgery will undoubtedly shape the future delivery of cardiac surgery.

Keywords:
Cardiovascular surgery
COVID-19
Impact
Pandemic
Patients
Surgery

Address: Hashim Talib Hashim, Thi Qar – Nassiryah – 400 street – 64001, Iraq, e-mail: hashim.h.t.h@gmail.com
DOI: 10.33678/cor.2022.098

Please cite this article as: Al Mostafa MY, Hashim HT, Abu Ruman YF, et al. Cardiac surgery and the coronavirus disease 2019 pandemic. Cor Vasa 2023;65:529–532.

Background

Towards the end of 2019 a new disease emerged in Wuhan, China, now known as coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Approximately 3 months later, on March 11, 2020, COVID-19 was announced by the World Health Organization as a global pandemic. As of May 20, 2020, more than five million people worldwide were affected by the virus with about 325,000 deaths. Since the beginning of COVID-19 the world has changed drastically, and various measures have been taken in an attempt to "flatten the curve", some of them having an unprecedented effect on world health systems.[1]

The developed world is currently facing what seems to be a watershed, and no doubt one of the significant landmarks in the history of medicine. One of the greatest challenges of the medical community is the scarcity of knowledge and experience in facing this virus.

In addition to the typical common viral symptoms or, in more severe cases, pneumonia and acute respiratory distress syndrome, COVID-19 also has some important implications for the cardiovascular system and the management of patients with cardiovascular disease. The mechanisms of cardiovascular disruption from COVID-19 are likely multifactorial and have not been fully elucidated.[2,3] It is known that severe infection, especially respiratory infection, can cause systemic changes (e.g., sepsis, shock, hypoxemia, stress) that affect the cardiovascular system. One proposed mechanism is an interaction between the virus, angiotensin-converting enzyme 2 (ACE2) expression, and the renin-angiotensin-aldosterone system (RAAS). The first association between COVID-19 and the cardiovascular system is the increased risk in patients with pre-existing cardiovascular disease to develop severe disease and death.[4,5] Second, complications such as myocarditis, acute myocardial infarction, arrhythmias, thromboembolic events, and heart failure have been linked to COVID-19 infection.[2]

Cardiovascular surgery and COVID-19

Ever since the COVID-19 has become a pandemic, worldwide efforts are being made to "flatten the curve". As a result, cardiac surgeons have been required to scale down their routine practice, resulting in a significant reduction in the number of cardiac surgeries. While the number of patients undergoing cardiac surgery declined during the outbreak period, the rate of surgical mortality increased. One explanation for this might be delayed hospital arrival.

The COVID-19 pandemic has transformed cardiac surgical practices. Limitations in intensive care resources and personal protective equipment have required many practices throughout the globe to pause elective operations and now slowly resume operations. However, much of cardiac surgery is not elective and patients continue to require surgery on an urgent or emergent basis during the pandemic.

Additionally, the COVID-19 pandemic has required a careful analysis of how best to carry out heart transplantation, extra-corporeal membrane oxygenation, and congenital heart surgery. Surgeons were forced to balance the ongoing need of providing urgent and emergent surgical care with the new realities of limited resources. However, cardiac surgery is a resource-intensive specialty where excellence requires multidisciplinary coordination between cardiology, surgery, anesthesia, critical care, perfusionists, and nursing. Moreover, cardiac surgery patients transition through different phases of care (preoperative, operative, intensive care, step-down, and cardiac rehabilitation), which creates unique challenges for preventing disease transmission for patients and their care teams.[3] This continued as the need for providing surgical services has introduced several unique considerations ranging from how to prioritize surgery, how to ensure safety for cardiac surgical teams, and how best to resume elective operations to ensure the safety of patients. In this regard the American College of Surgeons (ACS) released recommendations for surgical management of elective operations during the COVID-19 pandemic. The ACS scale categorized elective procedures into three tiers: Tier 1 (low acuity), Tier 2 (intermediate acuity), and Tier 3 (high acuity) with subcategories A and B in each tier differentiated as a healthy or nonhealthy patient, respectively. The scale was developed for multiple subspecialties, but was less pertinent to cardiac surgery because the scale was limited to elective cases and did not account for urgent and emergency cases.[4]

At the beginning of the outbreak, Légaré et al., on behalf of the Canadian Society of Cardiac Surgeons (CSCS), released a guidance statement to cardiac surgeons.[5] They suggested a template for triaging patients based on the percentage in reduction of services. According to their suggestion, upon a mild reduction in services (0–30%), only symptomatic outpatients or those at greater risk for developing adverse events, should undergo surgery alongside the urgent cases. Under a >50% reduction in services, they suggested operating on urgent cases only.[5]

Challenges of surgeries

Cardiopulmonary bypass might have a deleterious effect on COVID-19 patients undergoing cardiac surgery. This is explained by an increased inflammatory response triggered by the non-endothelial surfaces of the pump. COVID-19 infection after cardiac surgery, regardless of the time of the onset, is a serious condition. The systemic inflammatory state that follows extracorporeal circulation may mask the typical COVID-19 laboratory findings, making the diagnosis more difficult. A strict reorganization of the hospital resources is necessary to safely resume the cardiac surgical activity.[6]

Efforts and management

Under the unprecedented pressures of the global COVID-19 pandemic, there is an urgent requisite for successful strategies to safely deliver cardiac surgery. Additionally, patients with pre-existing cardiovascular dise-

ase are likely to have comorbidities which are associated with poorer clinical outcomes in confirmed SARS-CoV-2 cases. Despite this, Yandrapalli et al. have reported the first case of a successful coronary artery bypass graft (CABG) operation in a patient with asymptomatic SARS--CoV-2 infection, which offers insights into how cardiac surgery could be adapted to solve the challenges of this pandemic.[7]

Elective cardiac surgeries have been delayed owing to the redistribution of intensive care resources and the unquantifiable risk of acquiring COVID-19. Likewise, cardiac surgery services have undergone structural remodeling into a centralized system in an attempt to continue provisions of emergency surgery alongside hospital management of COVID-19 patients. Two Unsurprisingly, most cardiac surgery units across the globe have seen a sharp decline in surgeries as a result, and one cardiac surgery unit reported an 83% reduction in cardiac index cases between 23rd March to 4th May 2020.[8]

Similar models have been used in Europe to manage healthcare services and increase intensive care capacity. For example, in the Lombardy region of Italy, 16 out of 20 cardiac surgical units discontinued services and all urgent cases have been consequently diverted to the remaining four units for centralized services. Although these measures have been beneficial for supporting the focused management of COVID-19 patients, it is important to reflect upon the future consequences of delayed elective cardiac surgery.[9]

On March 20, 2020, the Royal College of Surgeons (RCS) published its initial, brief guidance for surgeons who were working during the COVID-19 pandemic, emphasizing the safety of the working force as well as the maintenance of emergency surgical workforce and capabilities. The detailed guidance came into force on March 26th, 2020 outlining the scope of patient selection and flow of surgical practice across the United Kingdom. Since then, the guidelines have been updated four times, lastly on June 5th, 2020.[10]

The initial guidance involved the cancellation of all elective operating cases, with a focus on operating on urgent/emergency and otherwise life-saving procedures. Patients were categorized into four levels according to their need for surgery:

- Priority level 1a Emergency – operation needed within 24 h.
- Priority level 1b Urgent – operation needed with 72 h.
- Priority level 2 Surgery that can be deferred for up to 4 weeks.
- Priority level 3 Surgery that can be delayed for up to 3 months.
- Priority level 4 Surgery that can be delayed for more than 3 months.

With the gradual decline in the cases of COVID-19, the service gradually resumed its activities, slowly reintroducing elective surgery on a phased basis. Elective cases were prioritized as Red, Amber, Green (RAG rating) with red been classified as "urgent elective".

As hospitals become increasingly populated with suspected or confirmed COVID-19 patients, exposing cardiac patients to the hospital environment will potentially increase their risk of nosocomial infection.

There is obviously a balance of risk, as patients with significant cardiovascular disease have their definitive treatment delayed vs increasing the likelihood of acquiring a nosocomial COVID-19 infection and its consequences. The factors resulting in delaying a cardiac surgical procedure are multifold. Blood products are in short supply because volunteer donation rates are substantially reduced under the advisory of avoiding close contact. Each cardiac surgical procedure will necessarily consume increasingly scarce resources (inpatient space, human resources, personal protective equipment, etc.) that might delay or prevent treatment of a patient suffering from the sequela of a COVID-19 infection.

Reducing the number of cardiac surgical procedures will result in the preservation of valuable resources that will allow for intensive care unit beds, mechanical ventilators, circuitry for extracorporeal membrane oxygenation, pharmaceuticals, personal protective equipment, and health care workers with advanced skills to be used for the ever-growing numbers of COVID-19 admissions.

Cardiac surgery requires a relatively small dedicated team of uniquely skilled individuals, including cardiac operating room scrub and circulators, perfusionists, cardiac anesthesiologists, and perioperative caregivers. Using these individuals for potentially nonessential operations may increase their chances of COVID-19 exposure, threatening their availability for future more urgent procedures. Given that the duration of COVID-19 burden in our hospitals is presently unknown, it is foreseeable that reduction in cardiac surgery capacity may be impacted for several months or longer. For patients whose cardiac surgical procedures are being delayed and in whom alternative therapies are not deemed appropriate, programs are encouraged to develop an orchestrated follow-up mechanism for regular communication (i.e., 1- to 2-week intervals) to monitor for progression of symptoms by telephone conference or video conference.

The risk of performing emergency cardiac surgery on symptomatic COVID-19 positive patients is unknown, but mortality would be expected to be higher than under normal circumstances. We also do not know the safe time to operate on a patient who has recovered from the infection or whether there is a risk for COVID-19 reactivation. Although the risk of exposure and infection in health care personnel is well documented, the specific risk to cardiac surgeons is unknown. Obvious sources of exposure include aerosol from ventilators, respiratory treatments, chest tube air leaks, and electrocautery. Insufflation used in endoscopic saphenous vein harvesting also presents an aerosolization risk. Reoperations are particularly risky because of the potential for parenchymal lung injury during sternal re-entry and mediastinal dissection.[10]

A study was done to evaluate the impact of the COVID-19 pandemic on activity at the cardiothoracic surgical care at the National Cardiothoracic Surgery and Transplant Centre. A comparison was performed of cardiac surgery and transplant caseload for the first 4 months of 2019 and 2020 using data collected prospectively on a customized digital database, the study showed that in March and April 2020, the spread of COVID-19 and the

resultant focus on its management resulted in a reduction in cardiothoracic surgery service delivery.[9,10]

Conclusion

COVID-19 is having an impact on both infected and non-infected patients. During the outbreak period, a smaller number of patients underwent cardiac surgery. These patients experienced more symptoms, had longer procedures, and had a higher in-hospital mortality rate. While the consequences of the pandemic are not fully understood, one thing is certain; we must prepare for a possible new outbreak.

Currently, the future of cardiac surgery after the pandemic is unclear as the evidence is still emerging. However, the lessons learned from these unprecedented times can be taken forward to inform future service planning. Moving forward, routine screening of patients for SARS-CoV-2 infection will undoubtedly play a key role in identifying asymptomatic or subclinical infections. Ultimately, clear guidelines should be implemented to ensure the safe resumption of surgical services, while also reassuring patients concerned about safety. Although the future trajectory of this pandemic is uncertain, the insights from the impact of COVID-19 on cardiac surgery will undoubtedly shape the future delivery of cardiac surgery.

References

1. Keizman E, Ram E, Kachel E, et al. The impact of COVID-19 pandemic on cardiac surgery in Israel. J Cardiothorac Surg 2020;15:294.
2. Soumya RS, Unni TG, Raghu KG. Impact of COVID-19 on the Cardiovascular System: A Review of Available Reports. Cardiovasc Drugs Ther 2021;35:411–425.
3. Patel V, Jimenez E, Cornwell L, et al. Cardiac Surgery During the Coronavirus Disease 2019 Pandemic: Perioperative Considerations and Triage Recommendations. J Am Heart Assoc 2020;9:e017042.
4. COVID-19: Elective Case Triage Guidelines for surgical care. American College of Surgeons. https://www.facs.org/covid-19/clinical-guidance/elective-case. Accessed May 4, 2020.
5. Sayre TJ. Cardiovascular Impact of Coronavirus Disease 2019 (COVID-19). US Pharm 2021;46:17–20.
6. Yandrapalli S, Cooper HA, Malekan R. Successful coronary artery bypass operation in a SARS COV-2 infected patient with acute coronary syndrome [published online ahead of print June, 2020]. J Card Surg 2020;35:2361–2363.
7. Mohamed Abdel Shafi A, Hewage S, Harky A. The impact of COVID-19 on the provision of cardiac surgical services. J Card Surg 2020;35:1295–1297.
8. Bonalumi G, di Mauro M, Garatti A, et al. The COVID-19 outbreak and its impact on hospitals in Italy: the model of cardiac surgery. Eur J Cardiothorac Surg 2020;57:1025–1028.
9. Royal College of Surgeons of England. Guidance for surgeons working during the COVID-19 pandemic. https://www.rcseng.ac.uk/coronavirus/joint-guidance-for-surgeons-v1/. Accessed August 22, 2020.
10. Bakaeen FG, Gillinov AM, Roselli EE, et al. Cardiac surgery and the coronavirus disease 2019 pandemic: What we know, what we do not know, and what we need to do. J Thorac Cardiovasc Surg 2020;160:722–726.