Cardiovascular Conundrums of COVID-19 Pandemic

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Abstract
The current COVID-19 pandemic is an enormous and unique challenge to the mankind. Its unprecedented global health impact has exposed the vulnerability of existing healthcare systems and infrastructure of all the countries, rich or poor. Devastating effects of COVID-19 have challenged all aspects of patient care, be it emergency or elective. One of the worst affected population is those with underlying cardiovascular disease. In addition to effects on healthcare workers, it has serious consequences for the education and training of fellows. With currently worsening COVID-19 crisis in the country, one wonders the extent of its impact on various aspects of human health and the healthcare systems.

Keywords: Acute coronary syndrome, Cardiology services, COVID-19, Fellows training, Impact, Telemedicine.

Introduction
The SARS-CoV-2 causing coronavirus disease (COVID-19), first reported on December 8, 2019, in Hubei province in China, spread exponentially across the globe and was declared a pandemic by the World Health Organization (WHO) on March 11, 2020. Until vaccine or curative medical treatments becomes available, COVID-19 poses an unprecedented impact on public health globally. In addition to physical, there are multiple psychological, socioeconomic, and even political consequences of this pandemic. Arguably it is the greatest threat of 21st century to the mankind.

COVID-19 pandemic has burdened the healthcare system all over the world, even in nations with state-of-the-art healthcare facilities. Owing to the abrupt, urgent, and huge need for intensive care units (ICU), temporary redistribution and reorganization of existing resources within hospitals have become mandatory with relevant consequences for all medical specialties. Cardiology, being at the fore front of emergency care, has been deeply affected in multiple ways. In dealing with the challenge of serious cardiac conundrums of COVID-19, it has caused immense collateral damage to every aspects of cardiac care, both elective and emergency, all over the world. Reallocation of resources has led to dramatic reduction in routine cardiac cases globally. Worse affected countries such as Italy were among the first to indefinitely postpone all elective cardiac interventions. Similarly, India too has seen a sharp decline in elective cardiac procedures. Mysteriously, however, there is an unexplained dramatic global reduction in the number of emergency admissions, such as heart attack, stroke, etc., that otherwise keep the emergency rooms busy. At par with international figures, emergency cardiac admissions in India too have substantially reduced. At our institute too, it has reduced at least by one-third of the pre-COVID level. Various factors that might contribute to this observation include patients avoiding hospitals for the fear of contracting COVID-19 infection (Covidphobia), availability of telemedicine services, better adherence to drug therapy, lockdowns leading to unavailability of alcoholic and tobacco products, reduced stress levels especially job-related stress, improvement in air quality, financial constraints of lockdown, and patients with comorbidities already being hospitalized with COVID-related illness.

Effect of COVID-19 on Cardiovascular System
SARS-CoV-2, besides causing viral pneumonia, has major implications for the cardiovascular (CV) system. Elderly males, especially those with comorbidities like diabetes mellitus, hypertension, or established, cardiovascular and cerebrovascular disease, are considered to be at the highest risk of morbidity and mortality when infected with COVID-19. Cardiovascular presentations of COVID-19 pose a serious challenge not only in the diagnosis but also in the management and prognosis of various cardiovascular conditions.

A large proportion of these COVID-19-infected patients show raised cardiac biomarkers such as troponins and brain natriuretic peptide (BNP), suggestive of myocardial injury and increased hospital mortality. Apart from increased risk of acute coronary syndromes (ACS), its mimics like myocarditis and takotsubo cardiomyopathy are commonly seen, and differentiation from true ACS may be rather difficult, given the similar electrocardiogram (ECG) and cardiac biomarker elevation, adding to the diagnostic conundrum. Various arrhythmias have also been linked to COVID-19 per se, in addition to contribution from the drugs aimed at COVID-19, which are often proarrhythmic. Further, some patients may suffer venous thromboembolism, incipiently causing sudden hemodynamic deterioration. Additionally, although management of COVID-19 cardiovascular problems is similar to the non-COVID patients, COVID-19 presentation poses unique challenges.
**CHALLENGES IN THE CONTINUITY OF CARE AND OUTPATIENT MANAGEMENT**

Until vaccine becomes available, social distancing and avoiding unnecessary travel remain the major means to curb spread of COVID-19 infection. To ensure this, a number of countries, including India, imposed prolonged lockdown. With outpatient services being halted across the nation, care of patients with chronic ailments such as heart failure and ischemic heart disease got adversely affected. To overcome this issue, a number of innovative efforts have been made by both public and private sector, including telemedicine applications and use of skype/WhatsApp. To facilitate this, on March 25, 2020, Board of Governors along with NITI Aayog released “Telemedicine Practice Guidelines” as an amendment in the Indian Medical Council Regulation, 2002, making it legal to provide telemedicine consultation and prescription by Registered Medical Practitioners (RMPs) in accordance with the compliance of guidelines. Rather to implement it effectively, as of this writing, Indian Medical Council is making it mandatory for its RMPs to undergo an online certification course in telemedicine if they want to provide medical consultations via telemedicine means in India.

Specifically, the widespread use of telemedicine has been encouraged to minimize the risk of SARS-CoV-2 transmission in both patients and healthcare professionals (HCP). This technology has been utilized to provide medical advice and follow-up, especially for stable patients and to restrict direct contact to sick patients only. This not only provides psychological support and relieves anxiety among patients but also ensures better medicine and dietary adherence and avoids long distance travel to reach hospitals. Additionally, it allows doctors to devote more time to sick patients. As optimal medical therapy remains the corner stone in hospitals. Additionally, it allows doctors to devote more time to sick patients. As optimal medical therapy remains the corner stone in hospitals. Additionally, it allows doctors to devote more time to sick patients. As optimal medical therapy remains the corner stone in hospitals. Additionally, it allows doctors to devote more time to sick patients. As optimal medical therapy remains the corner stone in hospitals. Additionally, it allows doctors to devote more time to sick patients.

Telemedicine cardiology service is successfully benefiting hundreds of patients daily, providing both fresh call and follow-up services. Although telemedicine outpatient management has achieved significant success in patients with stable chronic cardiovascular diseases across the nation, potential limitations do exist, for example, our large population still does not have access/ability to participate in telehealth visits. With lost face-to-face interaction, many patients are apprehensive to start a new medication and are often reluctant to mention serious but embarrassing symptoms on phone.

Optimizing medical therapy through telemedicine practice in the COVID era has significantly reduced the rates of elective cardiac procedures, especially in patients with chronic stable angina, with threshold for revascularization being higher than ever. In our experience, intervention rate for such patients have reduced by more than 80%, which is also supported by an EAPCI survey among interventional cardiologists. To assess ischemia burden for patients with stable coronary artery disease (CAD), all cardiopulmonary exercise stress tests (exercise electrocardiogram and exercise stress echocardiography) are being avoided. Pharmacological stress testing is preferred if stress testing is absolutely necessary. Transesophageal (TEE) and transthoracic echocardiography are best avoided unless they are expected to alter patient management. TEE increases the risk of viral transmission due to aerosol generation and is indicated only if alternative imaging modality does not exist. Similar higher thresholds exist for elective electrophysiology studies, cardiac implantable devices, or structural heart interventions with increased reliance on medical therapy. Possibly, COVID-19 pandemic could scrutinize and trim unnecessary and burdensome interventions to the benefit of patients.

**CHALLENGES IN MANAGING CARDIOVASCULAR EMERGENCIES**

Common cardiovascular emergencies include ACS, decompensated heart failure, pulmonary embolism, symptomatic heart blocks, etc. While most of these can be managed by electively, acute ST-segment elevation myocardial infarction (STEMI), high-risk non-STEMI (NSTEMI), or heart block may require urgent intervention. However, the ongoing COVID-19 pandemic calls for the unaccustomed changes in protocols in managing these patients. Although primary percutaneous coronary intervention (PCI), if available, is a default strategy for majority of STEMI patients, the COVID-19 pandemic has constrained us to reconsider the role of thrombolysis and pharmacol-interventional approach due to certain COVID-related conundrums. Reduced patient willingness to visit hospitals and decline in means of transportation often leads to delayed presentation beyond the usual timeline for PCI. Even those presenting in time may be unable to drive benefit of early intervention due to delays in emergency department evaluations, such as reverse transcription polymerase chain reaction (RT-PCR) testing to rule out COVID related STEMI, myocarditis, etc. Further, due to high prevalence of false-negative test results for COVID-19, transfers from emergency department are complicated by additional risk of exposure to staff and delays in preparedness associated with personal protective equipment (PPE). Beyond a delay of 120 minutes, the primary PCI loses its survival advantage over fibrinolytic therapy. Hence, fibrinolytic or pharmacol-interventional approach offers a simple, logical, safe, and effective alternative to delayed primary PCI and will help reduce the tremendous burden of COVID-19 exposure to healthcare professionals as well as ease the load on overtaxed healthcare system in the COVID era. Moreover, COVID-19 may present with ST-segment elevation without having other symptoms to suggest COVID-19 infection, and up to 40% of these may not be having any obstructive CAD on angiography. Hence, the default approach of catheterization for all STEMI needs to be scrutinized in the COVID era. Consequently, a significant one-third reduction in number of emergency cardiac interventions, in excess to the reduction in number of hospital admissions, is also seen. Cath lab interventions are being restricted to life-saving procedures such as rescue or primary PCI, pacemaker implantations, or emergency peripheral interventions. While decline in intervention rate has logical explanation, reduction in number of patients presenting with cardiac emergencies, such as acute coronary syndromes, largely remain unexplained, adding to the conundrums. Despite all this, primary or rescue PCI may be indicated in cases of failed thrombolysis, but this provides window of opportunity for COVID-19 testing and catheterization laboratory preparedness. Those ACS patients being managed conservatively should undergo catheterization at a suitable time after the pandemic is over.

To reduce exposure to HCPs, strategies like electronic intensive care unit (e-ICU) monitoring systems, especially in COVID ICU, early hospital discharge, and follow-up via telemedicine should be implemented. For COVID-19 patients, early follow-up visits, if required, should be in separate dedicated COVID-19 clinics and preferably at 4 weeks, if feasible, as virus shedding in some cases may be prolonged.
Post-pandemic, an exacerbation of cardiovascular disease leading to huge wave of inpatient admissions can be expected, but effective use of telemedicine practice may help blunt the same.

**IMPACT ON FELLOWS IN TRAINING AND EARLY CAREER CARDIOVASCULAR PROFESSIONAL COMMUNITY**

The COVID-19 pandemic has multiple adverse effects on the cardiology fellows in training (FIT) as well as cardiovascular professionals who are in the early phase of their career. The social and physical distancing practices has significantly transformed the roles and responsibilities of the fellows. Their lack of patient interaction means failure to acquire essential clinical skills, which form the basis of training program and future treatments prescribed. The peculiar work nature of the fellows places them at a serious risk of infection, and they have to balance their personal protection with their professional and educational responsibilities. Deferring most of the elective procedures has led to the fellows receiving substantially reduced exposure to the essential hands-on and certain supervised interventional procedures. Hence, beyond the obvious lack of clinical experience, there is a serious fear of missing out on target number of procedures performed before securing the accreditation of their respective universities. In a survey of 997 FIT’s, fellows performed approximately 66% fewer echocardiographic examinations, and 66% were involved in providing care through telemedicine. As done in our institute, extending the tenure of FIT may help compensate the same.

Another major challenge would be in securing job placement, given the economic impact of the pandemic and how most institutes have ceased hiring new recruits. Despite these adverse impacts, COVID-19 had offered various new opportunities like experiential learning, online demonstrations, observing virtual interventional procedures, and familiarizing with the concept of telemedicine and remote educational platforms. Additionally, switching various educational activities such as national professional society scientific meetings, departmental seminars, and journal clubs, to remote tele-conferencing platforms has permitted FIT to actively engage in virtual learning. It needs to be seen which of these innovative strategies will endure in the post-COVID-19 era. Overall, FIT are facing a major challenges in their practical training, education, and research activity, and they are rightly concerned about their personal safety and career prospects.

**CONCLUSION**

COVID-19 crisis has led to unique cardiovascular conundrums, adversely affecting not only patient care but also healthcare professionals and fellows in training. Additionally, COVID-19 conundrums have massive impact on the organizational and human resources.

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