



2021

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Recommended Citation

Kulkarni, Prashanth and Mahadevappa, Manjappa (2021) "The COVID-19 pandemic surge and impact on Rheumatic valvular heart disease patient care," *Journal of the Saudi Heart Association*: Vol. 33 : Iss. 4 , Article 9.

Available at: <https://doi.org/10.37616/2212-5043.1271>

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The COVID-19 Pandemic Surge and Impact on Rheumatic Valvular Heart Disease Patient Care

Prashanth Kulkarni ^{a,*}, Manjappa Mahadevappa ^b

^a Department of Cardiology, Heart Care Center, Bidar, 585401, India

^b Department of Cardiology, JSS Medical College and Hospital, JSSAHER, Mysuru, 570004, India

Abstract

The COVID-19 crisis has surged worldwide, putting immense stress on the health care services, leading to institutions deferring elective procedures and struggling to triage the emergency care of cardiac patients. This has affected the management of the rheumatic valvular heart disease patients especially, in developing countries, potentially placing these patients at enormous risk for complications like congestive cardiac failure, stroke and death. This article explores the COVID-19 pandemic and its impact on rheumatic valvular heart disease patient care. We try to provide a framework that addresses the procedural considerations of interventions like percutaneous transluminal mitral commissurotomy (PTMC), mitral and aortic valve surgeries. This article also highlights the implications for the outpatient valve clinic, and safety issues of the patient and health care workers during this ongoing pandemic.

Keywords: COVID-19, Cardiovascular, RHD, Mitral stenosis, PTMC

1. Introduction

The COVID-19 infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) first identified in Wuhan, China in December 2019, was declared a global pandemic of concern by the WHO on March 11th 2020 [1]. Most nations have imposed lockdowns and social distancing to stem the spread of the virus during the multiple surges, affecting daily life, leading to hardships and economic slowdown.

The COVID-19 infection presentation can range from mild symptoms like a common cold to severe ARDS leading to difficulty in breathing, fatigue, fever, and dry cough. Studies done in Wuhan, China, from January 1 to February 3, 2020, reveal that the majority of patients, i.e., around 80% have a mild form of COVID-19 viral infection, and the remaining 20% have severe to an acute disease requiring intensive care unit (ICU) admission and

invasive ventilation, and the fatality rate is about 4.3% [2].

The cardiovascular involvement and manifestations of COVID-19 infection may range from viral myocarditis to myocardial ischemic injury, which results from hypoxia and hemodynamic instability caused by severe pneumonia. Acute cardiac injury is present in 7% of the virus infection with an elevation of troponins, arrhythmias, and shock was seen in 16.7% and 8.7% of the patients, respectively [2]. Since the risk factors for COVID-19 infection are similar to that of myocardial ischemia, namely age more than 60 years with co-morbidities like hypertension and diabetes mellitus, there is a potential for Type 1 myocardial ischemia due to atherosclerotic plaque rupture caused by the stress of pneumonia and resultant inflammation and shock. The thromboembolic risk increases in this viral infection due to the resultant inflammation and immobilization in severe cases [3]. A retrospective analysis done in

Received 8 June 2021; revised 26 July 2021; accepted 8 September 2021.
Available online 3 November 2021.

* Corresponding author at: Department of Cardiology, Heart Care Center, SVP Nagar, Bidar, 585401, India.
E-mail address: docpk77@gmail.com (P. Kulkarni).



China showed that cardiovascular disease incidence in patients admitted to ICU with COVID-19 infection was higher than those who were not admitted to the ICU, i.e., 23% vs. 11% [4].

RHD is characterized by immune-mediated destruction of cardiac valves in the setting of episodes of ARF after exposure to strains of group A streptococcus bacteria. Most episodes of ARF occur in children between age 5 and 14 years, but they may well occur in adulthood, and an Indian study revealed that RHD was prevalent even in the elderly population aged more than 60 years [5,6]. RF and RHD are global problems but are most prevalent in developing countries. In these countries, RF accounts for up to 60% of all cardiovascular disease in children and young adults in their most productive years, and it has the potential to undermine national productivity and puts an additional burden on the economy [7,8]. A large proportion of individuals with chronic rheumatic fever required cardiac valve surgery within 5–10 years [9]. The reported prevalence of RHD in the world varies between 0.2 and 77.8 per 1000 population, and the estimated annual mortality from RHD was 332000 in the year 2000 [10]. The Mitral valve is the most commonly affected in RHD (60%) followed by combined mitral and aortic involvement (29%), tricuspid (10.7%), and pulmonary valve (0.04%) [6]. PTMC is done for mitral stenosis with favourable anatomy, and the risk of restenosis is 40% after seven years [11]. Surgical procedures performed are closed mitral commissurotomy, valve repair, and valve replacement surgeries with a mechanical and bio-prosthesis in mitral, aortic, tricuspid and pulmonary positions. The patient with atrial fibrillation and with mechanical valve needs anticoagulation, which is an independent determinant of long-term survival [12].

Abbreviations

WHO	World Health Organization
ARDS	Acute respiratory distress syndrome
RHD	Rheumatic heart disease
ARF	Acute rheumatic fever
PTMC	Percutaneous transluminal mitral commissurotomy
TAVR	Transcatheter aortic valve replacement
TEE	Trans-oesophageal echocardiography
NYHA	New York Heart Association
MS	Mitral stenosis
MVR	Mitral valve replacement
PPE	Personal protective equipment

Percutaneous mitral valve repair with a Mitraclip system for rheumatic mitral regurgitation is feasible in appropriately selected patients with suitable mitral valve anatomy and no co-existing mitral stenosis or severe valve calcification [13]. Transcatheter mitral valve repair and replacement are yet to be a proven effective treatment modality for primary rheumatic mitral regurgitation. On-going trials should reveal the future directions and usefulness of these technologies in RHD patients [14]. A single-centre TAVR study done in the United Kingdom for rheumatic aortic valve disease showed similar procedural and clinical outcomes as the conventional TAVR patients. The results reveal that for high-risk patients with severe rheumatic aortic valve disease TAVR could be a viable alternative [15]. Transcatheter tricuspid interventions are currently in infancy, and further studies are needed to recommend the use of these procedures in rheumatic tricuspid valve disease.

During an outbreak like COVID-19, delivery of cardiovascular services becomes a challenge,

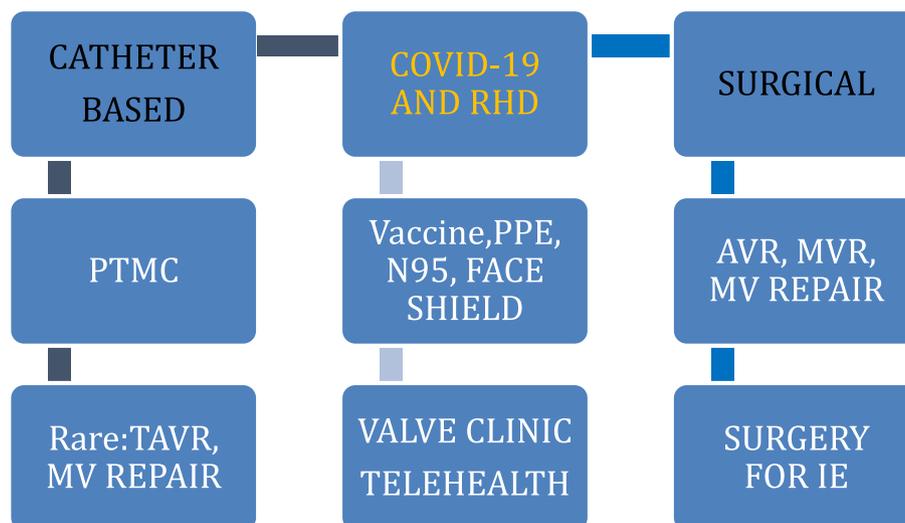


Fig. 1. Implications for RHD patients during COVID-19 pandemic.

especially for those suffering from valvular heart disease, and elective cardiac procedures are invariably postponed. Due to the vast number of coronavirus patients presenting to the hospital and beds in hospital preferentially earmarked for them, other clinical services are bound to suffer. According to a multicentre registry, four in ten patients of valvular heart disease who contract COVID-19 die within 30 days of hospital admission. Thus, conventional valve interventions like PTMC, surgical valve repair, and replacement could be continued to be offered for symptomatic patients even in the context of Covid-19 pandemic [16]. Patients with underlying cardiovascular conditions have a high risk of adverse outcomes, and strategies have to be put in place to prioritize those who require critical cardiac interventions and at the same time reduce the chances of virus infection to them and the health care professionals.

2. Cardiac interventional procedure considerations

Most elective structural heart interventions should ideally be postponed until the COVID-19 waves recede. In the hospital triage systems favour COVID-19 patients, intensive care unit (ICU) beds would be needed to treat these patients. Scheduling a non-urgent interventional procedure at this stage will put more strain on the institutional resources and also potentially expose the patient and the caregivers to the viral infection in the hospital environment. Some structural heart interventions need an anaesthetist back-up for intubation and TEE, thus exposing the healthcare professionals to a high-risk situation of the virus contagion. In symptomatic rheumatic valvular heart disease, patients requiring emergent interventional procedures would be at high risk for complications like cardiac failure, and postponing interventions in them due to SARS-CoV-2 wave could be fatal (see Fig. 1).

2.1. Percutaneous transluminal mitral commissurotomy

PTMC with Inoue balloon is the preferred intervention for patients with NYHA class III-IV symptoms with moderate to severe MS (Mitral valve area $<1.5 \text{ cm}^2$ and or valve area index $<0.6 \text{ cm}^2/\text{m}^2$) and suitable anatomy based on Wilkins scoring system [17]. PTMC has excellent hemodynamic and long-term results with a low rate of complications [18].

During COVID-19 wave, patients with mild symptoms of NYHA class I-II and moderate to severe MS should be optimized on medications and

closely followed up by a telehealth clinic for any deterioration in symptoms that warrant emergency PTMC. In the symptomatic individuals, PTMC should be performed conventionally with secure pathways earmarked in hospital for these patients to minimize exposure to SARS-CoV-2. It is not uncommon, especially in Asia and Africa, to encounter patients with overt or silent MS during the second or third trimester of pregnancy. The combination of physiological changes of pregnancy and the pathological impact of MS over pregnancy and labour can lead to cardiac decompensation and pulmonary oedema, and if untreated, carry significant maternal and foetal mortality [19]. In symptomatic MS with pregnancy, the second trimester is the preferred period for PTMC, reducing symptoms and having a reasonable success rate [20,21]. A pregnant patient with symptomatic MS requiring conventional PTMC should not be denied the intervention during this pandemic, and a secure institutional triage system should be created to manage such patients. Also, adequate hospital infection prevention protocols should be followed to negate the risk of contagion to the patient and the healthcare professionals.

2.2. Other structural interventions

In RHD patient, procedures like TAVR, transcatheter mitral valve repair, and replacement are not the standard therapeutic options, and instead, surgical valve repair and replacements are the first choices. Nonetheless, when these emergency procedures are considered in rare selective symptomatic patients, appropriate national heart society guidelines of infection prevention protocols should be followed, minimising the risk to patient and the heart care team [22].

3. Cardiac surgery considerations

After the heart team discussion, the symptomatic RHD patient not amenable for cardiac catheter intervention should be considered for cardiac surgery on a case-to-case basis. To sustain hospital services, elective surgeries should be deferred, and the patients followed up closely via telehealth for any escalation of symptoms. Each service providing centre should develop a case triage protocol for emergency cardiac surgeries and minimize the risk of SARS-CoV-2 infection to the patient and healthcare staff. Before considering an emergency surgery, the availability of hospital resources like ICU beds, ventilators, cardiopulmonary bypass (CBP) machine, extracorporeal membrane oxygenator

(ECMO), and operating room supplies like valves, blood products, and sutures should be taken into account [23].

Surgeries that could be considered during the COVID-19 pandemic are:

1. Mitral valve replacement
 - (a) Symptomatic severe MS when valve anatomy not favourable for PTMC.
 - (b) Symptomatic severe mitral regurgitation [24,25].
2. Aortic valve replacement in symptomatic severe aortic stenosis or severe aortic regurgitation [24,25].
3. Infective endocarditis involving the left-sided valve causing a severe valve defect and/or large mobile vegetation [25].

4. Implications for the healthcare personnel

Healthcare workers are at a heightened risk of getting infected during this pandemic, primarily when operating on a suspected or COVID-19 positive patient [25]. Apart from getting vaccinated against COVID-19 on priority, the staff should be equipped with PPE including a N95 respirator mask, goggles, face shield, and adhere to meticulous hand washing and personal hygiene measures [25]. They should be well versed with the PPE donning and doffing protocols and avoid contaminating or touching the surfaces in the hospital environment, which could harbour the coronavirus [25]. The cardiac catheterization lab and surgical operating theatres should be converted into negative pressure areas to minimize the risk of SARS-CoV-2 infection to the healthcare professionals [26, 27]. The institution stakeholders could devise and constitute multiple units of different cardiac professionals and post them on rotation for emergency services, so that in case of exposure to the virus, quarantine issues can be applied to the individual unit rather than the entire group.

5. Outpatient valve clinic considerations

During the COVID-19 surge waves, outpatient clinic visits for the patient would be adversely affected due to lockdown and sparse transportation availability. In this context, virtual consultation, telehealth, and video counselling are the favoured mode of interaction between the physician and the patient. Many institutions have rapidly ramped up the telehealth facilities to address this sudden transition in the outpatient clinic services. The virtual clinics are essential for the uninterrupted follow-up of the recently operated patients, and this

should help them avoid making multiple trips to the hospital and minimize the risk of virus transmission among the patients and health care personnel. Many RHD patients with atrial fibrillation or those who have undergone valve replacement surgeries and are on anticoagulants like warfarin will require an international normalised ratio (INR) test. This testing may be hampered or unavailable as most of the health services are working with less capacity. Until the time INR tests become easily available, asymptomatic patients should continue to take the anticoagulants especially if the preceding INR values were stable and in the therapeutic range. Some clinics provide home testing of INR to avoid patients needing to visit the hospital [28]. As secondary prophylaxis to prevent recurrent attacks of RF, RHD patients are required to take an intramuscular injection of benzathine benzyl penicillin every three or four weeks [29]. Due to limited stock supplies and curtailed hospital services during this pandemic, the patient might face difficulties taking this injection. Oral penicillin may be used as an alternative in secondary prophylaxis if penicillin injection is not available.

6. COVID-19 vaccine considerations

The COVID-19 vaccine trials included patients with heart ailments and did not reveal any serious adverse effects from the vaccine in such patients [30]. Persons with underlying cardiovascular disease, including RHD, are at an increased risk of morbidity and mortality due to COVID-19 infection, and hence, whenever offered, these patients should take the vaccine. Patients with RHD who are on anticoagulant medications such as warfarin are at high risk of bleeding after trauma, including while receiving the COVID-19 vaccination in the arm with a needle. Patients on anticoagulant medications with their INR maintained in the therapeutic range can receive intramuscular vaccination. Compared to normal individuals, it is expected that the risk of swelling and bruising around the injection site will be slightly increased in these patients. Hence, to minimize the risk of hematoma, a 23- or 25-gauge fine needle should be used for the vaccination, followed by a firm pressure applied for a minimum of two minutes to the site without rubbing [31].

7. Conclusion

The COVID-19 pandemic surge has led to the disruption of hospital systems, impacting cardiac patient management. The heart care team needs to

harness its skills and continue to provide optimal care to the patients. With the hospital triage under increasing strain from the burgeoning number of critically ill COVID-19 patients, institutions should conceive protocols to provide a safe environment for the health care professionals and the patients.

Author contributions

Conception and design of Study, Literature review, Revising and editing the manuscript critically for important intellectual contents: Prashanth Kulkarni, Manjappa Mahadevappa. Drafting of manuscript: Prashanth Kulkarni.

Funding

The authors whose names are listed certify that the manuscript is not funded by any organization.

Conflicts of interest

The authors whose names are listed certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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