



## Original Article

## Cardiological society of India document on safety measure during echo evaluation of cardiovascular disease in the time of COVID-19



Rakesh Gupta <sup>a, b, \*</sup>, Mrinal Kanti Das <sup>c</sup>, P.P. Mohanan <sup>d</sup>, Pradip K. Deb <sup>e</sup>, S.K. Parashar <sup>f</sup>, H.K. Chopra <sup>g</sup>, Sameer Shrivastava <sup>h</sup>, Santanu Guha <sup>i</sup>, Kewal C. Goswami <sup>j</sup>, Rakesh Yadav <sup>j</sup>, R. Alagesan <sup>k</sup>, V. Amuthan <sup>l</sup>, M. Bansal <sup>m</sup>, R.N. Chakraborty <sup>n</sup>, N. Chakraborti <sup>n</sup>, S. Chandra <sup>o</sup>, A. Chatterjee <sup>p</sup>, D. Chatterjee <sup>q</sup>, S.S. Chatterjee <sup>r</sup>, A.L. Dutta <sup>s</sup>, A. De <sup>t</sup>, A. Garg <sup>u</sup>, V.K. Garg <sup>v</sup>, A. Goyal <sup>w</sup>, N.K. Goyal <sup>x</sup>, S.C. Govind <sup>y</sup>, V.K. Gupta <sup>z</sup>, Pradeep K. Hasija <sup>aa</sup>, A. Jabir <sup>ab</sup>, P. Jain <sup>ac</sup>, V. Jain <sup>ad</sup>, P.B. Jayagopal <sup>ae</sup>, R.R. Kasliwal <sup>af</sup>, V.K. Katyal <sup>ag</sup>, P.G. Kerkar <sup>ah</sup>, Amal Kumar Khan <sup>ai</sup>, N.N. Khanna <sup>aj</sup>, M. Mandal <sup>ak</sup>, B. Majumder <sup>al</sup>, S.S. Mishra <sup>am</sup>, C.B. Meena <sup>an</sup>, N. Naik <sup>ao</sup>, V.S. Narain <sup>o</sup>, A.K. Pancholia <sup>ap</sup>, L.A. Pathak <sup>aq</sup>, C.K. Ponde <sup>ar</sup>, K. Raghu <sup>as</sup>, S. Ray <sup>at</sup>, D. Roy <sup>q</sup>, D. Sarma <sup>au</sup>, S. Shanmugasundaram <sup>av</sup>, B.P. Singh <sup>aw</sup>, S. Tyagi <sup>ax</sup>, G. Vijayaraghavan <sup>ay</sup>, G.S. Wander <sup>az</sup>, Harsh Wardhan <sup>ba</sup>, N.C. Nanda <sup>bb</sup>

<sup>a</sup> JROP Institute of Echocardiography, Ultrasound & Vascular Doppler, JROP Healthcare Pvt. Ltd., C-1/16, Ashok Vihar-II, Delhi, 110052, India

<sup>b</sup> JROP Charak Heart City, MD City Hospital, Model Town Northex, Delhi, 110009, India

<sup>c</sup> C K Birla Group of Hospitals (BMB and CMRI), Kolkata, West Bengal, India

<sup>d</sup> Westfort Hi-Tech Hospital, Thrissur, Kerala, India

<sup>e</sup> Daffodil Hospital, Kolkata, West Bengal, India

<sup>f</sup> Metro Heart Hospital, Lajpat Nagar, New Delhi, India

<sup>g</sup> Moolchand Medcity, New Delhi, India

<sup>h</sup> Fortis Escort Heart Institute, Okhla, New Delhi, India

<sup>i</sup> Calcutta Medical College Hospital, Kolkata, West Bengal, India

<sup>j</sup> All India Institute of Medical Sciences, New Delhi, India

<sup>k</sup> K M Speciality Hospital, Chennai, India

<sup>l</sup> Jeyalakshmi Heart Center, Madurai, Tamilnadu, India

<sup>m</sup> Medanta, The Medicity, New Delhi, India

<sup>n</sup> Medica Group of Superspeciality Hospitals, Kolkata, West Bengal, India

<sup>o</sup> King George's Medical University, Lucknow, India

<sup>p</sup> NH-Imperial, Chittagong, Bangladesh

<sup>q</sup> Rabindranath Tagore International Institute of Cardiac Sciences, Kolkata, India

<sup>r</sup> Cardiology Clinic, Kolkata, India

<sup>s</sup> Peerless Hospital, Kolkata, India

<sup>t</sup> Apollo Gleneagles Hospital, Kolkata, India

<sup>u</sup> Jaipur Heart Institute, Jaipur, India

<sup>v</sup> R D Gardi Medical College, Ujjain, India

<sup>w</sup> Bani Park Hospital, Jaipur, India

<sup>x</sup> BLK Superspeciality Hospital, New Delhi, India

<sup>y</sup> Narayana Healthcity, Bengaluru, India

<sup>z</sup> Kishori Ram Hospital & Diabetes Care Centre, Bhatinda, India

<sup>aa</sup> Military Hospital, Chennai, India

<sup>ab</sup> Lisie Hospital Kochi, Kerala, India

<sup>ac</sup> Lifeline Superspeciality Hospital, Jhansi, India

<sup>ad</sup> Choithram Hospital & R.C., Indore, India

<sup>ae</sup> Laxmi Hospital, Palakkad, Kerala, India

<sup>af</sup> Medanta Medicity, Gurgaon, India

<sup>ag</sup> PGIMS, ROHTAK, India

<sup>ah</sup> KEM Hospital, Mumbai, India

<sup>ai</sup> AMRI Hospital, Salt Lake, Kolkata, India

<sup>aj</sup> Apollo Hospital, New Delhi, India

<sup>ak</sup> NRS Medical College, Kolkata, India

<sup>al</sup> R.G. Kar Medical College & Hospital, Kolkata, India

<sup>am</sup> Hi-Tech Medical College and Hospital, Bhubaneswar, India

\* Corresponding author. JROP Institute of Echocardiography, Ultrasound & Vascular Doppler, JROP Healthcare Pvt. Ltd., C-1/16, Ashok Vihar-II, Delhi, 110052, India.  
E-mail addresses: [rakeshecho@gmail.com](mailto:rakeshecho@gmail.com), [jrop2001@yahoo.com](mailto:jrop2001@yahoo.com) (R. Gupta).

<sup>an</sup> SMS Medical College, Jaipur, Rajasthan

<sup>ao</sup> AIIMS, New Delhi, India

<sup>ap</sup> Arihant Hospital & Research Center, Indore, India

<sup>aq</sup> Nanavati Heart Institute, Nanavati Superspeciality Hospital, Mumbai, India

<sup>ar</sup> PD Hinduja National Hospital & RC, Mumbai, India

<sup>as</sup> Care Hospital, Hyderabad, India

<sup>at</sup> Vivekananda Institute of Medical Sciences, Kolkata, India

<sup>au</sup> Jorhat Christian Medical Centre Hospital, Jorhat, Assam, India

<sup>av</sup> Billroth Hospital, Chennai, India

<sup>aw</sup> IGIMS, Patna, India

<sup>ax</sup> GB Pant Institute of Post Graduate Medical Education and Research, New Delhi, India

<sup>ay</sup> Kerala Institute of Medical Sciences, Trivandrum, India

<sup>az</sup> Hero DMC Heart Institute, Ludhiana, India

<sup>ba</sup> Mahatma Gandhi Medical College and Hospital, Jaipur, India

<sup>bb</sup> University of Alabama at Birmingham, Birmingham, AL, USA

## ARTICLE INFO

### Article history:

Received 8 May 2020

Accepted 19 May 2020

Available online 26 May 2020

### Keywords:

COVID -19

Cardiovascular evaluation

Safety measures

Echocardiography

Cardiological Society of India

## ABSTRACT

An echocardiographic investigation is one of the key modalities of diagnosis in cardiology. There has been a rising presence of cardiological comorbidities in patients positive for COVID-19. Hence, it is becoming extremely essential to look into the correct safety precautions, healthcare professionals must take while conducting an echo investigation. The decision matrix formulated for conducting an echocardiographic evaluation is based on presence or absence of cardiological comorbidity vis-à-vis positive, suspected or negative for COVID-19. The safety measures have been constructed keeping in mind the current safety precautions by WHO, CDC and MoHFW, India.

© 2020 Published by Elsevier B.V. on behalf of Cardiological Society of India. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

The global Coronavirus Disease-19 (COVID-19) pandemic is an unprecedented, rapidly spreading public health emergency spread over 200 countries with 44,29,235 cases with 2,98,165 deaths and 13,59,291 recovered patients as on 14th May 2020. Of the remaining 24,72,075 cases, the major challenge is with 45,921 (2%), who are hospitalized in serious and critical condition.<sup>1</sup> With the so many 'don't knows' about the disease, it is difficult to come out with recommendations that can find appropriate scientific backing. Least of them is to have an evidence based guidelines. Though no significant data is available on the preventive role of non-invasive cardiologist, the guidance provided in this statement is based mainly on opinion of experts and the best currently available published information. The purpose of this position paper is to provide valuable guidance regarding various protective measures to be utilized during any echo evaluation in the current scenario.

Based on the international experience and various national advisories, social distancing, personal hygiene, using appropriate personal protection equipment (PPE), and isolating the highest risk are most important in containing and mitigating COVID-19 infection. Despite all these preventive measures and precautions, many people still suffer from denovo cardiovascular ailments or exacerbation of existing one, leading to cardiac consultation and hospitalization. It becomes imperative for them to have echocardiography (Echo) for correct diagnosis and managements and hence these guidelines has an impact in current scenario.

The Cardiological Society of India acknowledges the sincere efforts of all the various bodies (viz. your institute or hospital, local and state health authorities, Ministry of Health and Family Welfare and Indian Council of Medical Research (ICMR)) in devising this paper. The purpose of this position paper is to supplement, not to override, valuable guidance from any of these bodies.

## 2. Cardiovascular manifestations of COVID:19

1. Although the virus predominantly affects the respiratory system producing a typical influenza like illness, it also shows affinity for the cardiovascular system. COVID-19 patients with pre-existing cardiovascular disease (CVD) have an increased risk of severe disease and death (case fatality rates of 6% among hypertensive, 7.3% among diabetics and 10.5% with CVD).<sup>2</sup> Depending upon the population studied, the prevalence of cardiovascular disease ranges from 5 to 15%.<sup>2-5</sup>
2. Majority of cardiovascular events in patients with COVID -19 infection are the result of severe inflammatory and hemodynamic changes in patients with extensive respiratory involvement. This produces supply-demand mismatch myocardial ischemia due to hypoxia/hemodynamic instability. These are generally seen in the second week of the illness and may manifest with electrocardiogram (ECG) changes and troponin elevation.<sup>2-6</sup>
3. Some patients can present as myocarditis including a severe fulminant myocarditis due to cytokine storm with regional ST-segment elevation, marked troponin release and ventricular dysfunction.<sup>7</sup>
4. Type I myocardial ischemia due to atherosclerotic plaque instability resulting from direct vascular infection is uncommon.
5. Many patients can present with chest pain, shortness of breath and palpitations secondary to pulmonary involvement.
6. Some patients can manifest with acute cardiogenic shock with respiratory distress.

ThustherangeofcardiovascularmanifestationsofCOVID-19include:

- a. Acute cardiac injury (defined as "troponin elevations") is common. Type I (spontaneous myocardial infarction) acute coronary syndrome is uncommon.

- b. Myocarditis and cardiomyopathy including a severe fulminant form due to cytokine storm syndrome with elevations in N-terminal pro brain natriuretic peptide, troponin and interleukin- 6 level.
- c. Various form of arrhythmia occurred in 6.7% of patients in a case series from China.<sup>5</sup>
- d. Venous thromboembolism probably due to vascular inflammation and immobilization<sup>4,8</sup>

**3. Why need for categorization of COVID-19 patients with or without pre-existing CVD and other comorbidities?**

CVD was a common comorbidity in patients with COVID-19 predecessors like Severe Acute Respiratory Syndrome (SARS) and Middle-East Respiratory Syndrome (MERS). In SARS, the prevalence of DM and CVD was 11% and 8% respectively, and the presence of either comorbidity increased the risk of death twelve-folds.<sup>9,10</sup> DM and HTN were prevalent in about 50% of cases of MERS, while CVD was present in approximately 30% of patients.<sup>11</sup>

The increased presence of cardiovascular comorbidities holds true for COVID-19 as well, most notably among those with more severe disease. In one cohort of 191 patients from Wuhan, China, any comorbidity was present in 48% (67% of non-survivors), HTN was present in 30% (48% of non-survivors), DM in 19% (31% of non-survivors), and CVD in 8% (13% of non-survivors).<sup>12</sup> In a cohort of 138 hospitalized patients with COVID-19, comorbidities were similarly prevalent (46% overall, 72% in patients requiring admission to intensive care unit (ICU), as were cardiovascular comorbidities: HTN in 31% (58% in patients in to ICU), CVD in 15% (25% in patients requiring an ICU), and DM in 10% (22% in patients requiring an ICU).<sup>5</sup> Analysis of an outpatient and inpatient cohort of 1,099 patients with COVID-19 reported that 24% had any comorbidity (58% among those with intubation or death), with 15% having HTN (36% among those with intubation or death), 7.4% with DM (27% among those with intubation or death), and 2.5% with coronary heart disease (9% among those with intubation or death).<sup>13</sup> Data from the National Health Commission (NHC) of China demonstrated that 35% of the patients diagnosed with COVID-19 had HTN and 17% had coronary heart disease.<sup>14</sup> A recent meta-analysis of eight studies from China including 46,248 infected patients showed the most prevalent comorbidities were HTN ((17 ± 7%, 95% Confidence Interval (CI) 14–22%)) and DM (8 ± 6%, 95% CI 6–11%), followed by CVD (5 ± 4%, 95% CI 4–7%).<sup>15</sup> Early COVID-19 case reports suggest that patients with underlying conditions are at higher risk for complications or mortality—up to 50% of hospitalized patients have a chronic medical illness (40% cardiovascular or cerebrovascular disease). In the largest published clinical cohort of COVID-19 to date, acute cardiac injury, shock, and arrhythmia were present in 7.2%, 8.7%, and 16.7% of patients, respectively, with higher prevalence amongst patients requiring intensive care.<sup>16</sup>

The mechanism of these associations remains unclear at this time. Potential explanations include CVD being more prevalent in those with advancing age, a functionally impaired immune system, elevated levels of angiotensin converting enzyme 2 (ACE2), or a predisposition to COVID-19 for those with CVD. Regardless of the mechanism, the common occurrence of cardiovascular comorbidities in COVID-19 patients makes for the role of non-invasive cardiologist important, who can help in cardiac evaluation (including echo) and management of these individuals facilitating for their complete recovery.

**4. Categorization of COVID 19 patients with CVD**

- a. (Group A) Patients with pre-existing CVD and other comorbidities, presenting in the hospital in one of the three categories mentioned subsequently.

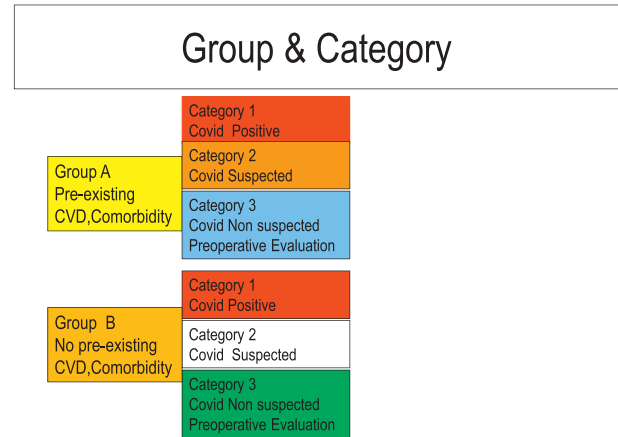


Fig. 1. Group and category of the patients.

- b. (Group B) Patients with no pre-existing CVD and other comorbidities, presenting to the hospital in below mentioned three categories (Fig. 1).

- i. Category 1. Confirmed COVID-19: This would include patients with a positive COVID-19 test result and they are in quarantine or in the hospital.
- ii. Category 2. Suspected COVID-19: At the present stage in the epidemic this would include patients who have a history of international travel or have been in close contacts of a definite COVID-19 patient and have symptoms of fever and/or some respiratory symptoms and majority of these people are in quarantine phase. However there are few cases of suspected community spread (stage III) are reported in this subcontinent at this stage.
- iii. Category 3. Patient with low clinical probability of being a suspected COVID-19 patient/confirmed non-COVID-19 patient: This would include a patient with no symptoms suggestive of influenza and no history of travel/contact with a COVID-19 patient or a patient whose COVID 19 test is negative. This category also includes patients admitted to hospital with emergency non cardiac surgery requiring preoperative evaluation. This is possibly the current stage II of epidemic in India and in this continent.

**5. Echo in whom?**

Echo should be target oriented and should only be ordered when it is helpful in decision making (Fig. 2). The role of stress echo

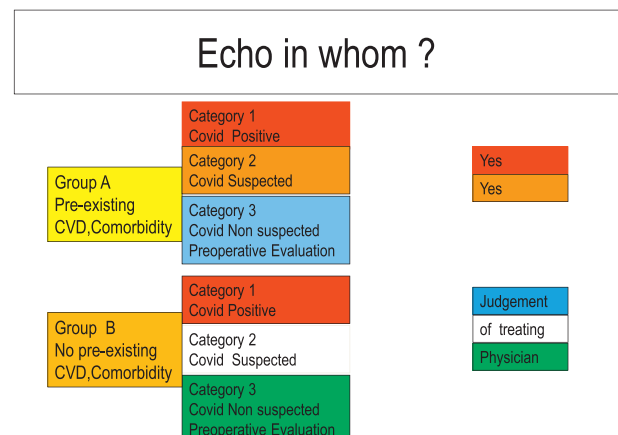


Fig. 2. Echo advised in group and category of patients.

is limited and if done will lead to increased chances of spread of disease. Similarly the role of transesophageal echo (TEE) is also limited, as this too will lead to increased incidence of spread of disease because of aerosol spray, cough and throat secretions in COVID-19. We call for cautious consideration of the benefit of a TEE examination. It should be weighed against the risk of exposure of healthcare personnel to aerosolized virus in a patient with suspected or confirmed COVID-19. These examination also require use of higher level PPE. TEE should be postponed or cancelled, if an alternative imaging modality can be helpful, including off-axis trans thoracic echo views or contrast echo or computed tomography (CT).

All patients in Group A - Category 1 and Category 2 should be subjected to echo. However the choice of doing echo in category 3 patients should be based on judgment of the treating physician. All patients in Group B - Category 1, who are hospitalized should be subjected to echo. However the choice of doing echo in category 2 and 3 patients should be based on the judgment of the treating physician.

**6. Echo evaluation procedure**

*6.1. Preparations of the reception and escorting patient to the appropriate room*

- The receptionist should wear a complete protection gear (level-1).
- Proper appointment should be given to every patient coming for echo in all category of patients, so that social distancing is maintained. The referral form, discharge papers and previous operation notes may be sent by email or whats app, so as to avoid disease transmission. The requisite fee can be deposited in advance by digital method so as to avoid contamination.
- No attendant is allowed in the reception area except in case of children, pregnant women and elderly patients, where only one attendant is allowed.
- All patients and their attendant should remove their shoes and socks outside the reception area.
- Facilities should be there for having their hands and feet washed and provision of separate hospital / centre slippers (preferably disposable) or plastic shoe covers, which they can wear. Patient should be provided with a face mask, if he/she is not wearing it.
- The patient coming for echo should be properly escorted by the hospital staff wearing appropriate PPE based on the category of the patients and taken to appropriate changing room and to appropriate segregated echo machine for the evaluation.

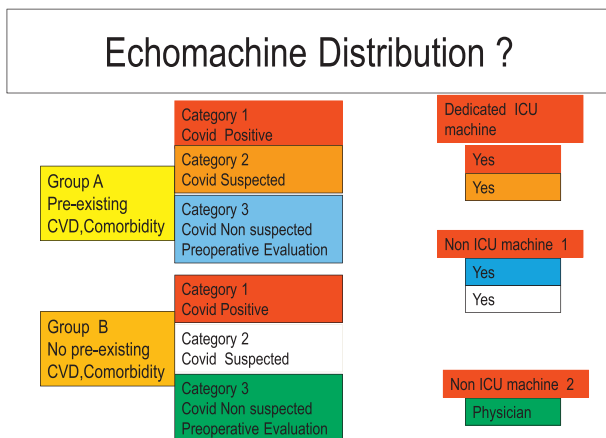


Fig. 3. Distribution of echo machines.

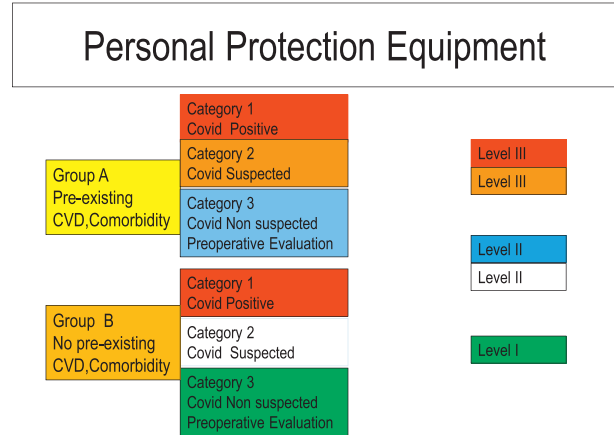


Fig. 4. Group, Category & PPE for examiner.

**Personal Protection Equipment**

Protection Level I	Protection Level II	Protection Level III
Disposable Surgical Cap	Disposable Surgical Cap	Disposable Surgical Cap
Disposable Surgical Mask	N 95 Protection Mask	FF 3 Protection Mask
Work Uniform	Work Uniform	Work Uniform
Disposable Surgical Gloves	Hospital OT Gown	Hospital OT Gown
	Disposable Surgical Gloves	Disposable Surgical Gloves
	Goggles	Full Face Respiratory Protective Device

Fig. 5. Personal protection equipments.

*6.2. Preparation of changing room*

- Separate changing room should be present based on the category of the patients.
- Group A – category 3, Group B – category 2 should have a separate changing room and echo machine
- Group B – category 3 should have a separate changing room and echo machine
- The patient should change all his/her clothes except undergarments and wear a gown kept separately. All patients to continue wear mask as provided by the centre or hospital.
- The changing room should have a good ventilation mechanism like exhaust fan installed in it.

*6.3. Preparation of the echo room*

- The echo machines should be kept separate as per above mentioned category.
- The doors of echo room should be kept open, where entry and exit of the patient is present along with changing room.
- The doors, handles, electrical switches and all other metallic things in the room should be frequently cleaned and decontaminated with sodium hypochlorite solution.
- The echo room should have a good ventilation system with presence of a powerful exhaust and ceiling fan to keep the air clean. The exhaust fan should be closure to examination table and away from the examiner. It is preferable to switch off all type of airconditioning system so as to prevent spread of the virus.

- e. The examination table should be covered with separate disposal plastic sheets for every patient.
- f. The examination table and machine should be placed in such a way that the patients face is away from the echocardiologist/echocardiographer or on right side of patient, as this will help in aerosol to go on opposite side of the examiner. The habit of echocardiographer to sit on the right edge of the bed of the patient is to be strictly avoided/condemned.
- g. Alternatively, we can install a plastic curtain shield between the patient and the examiner with a hole in it, through which examiner can perform echo without coming in contact with the patient.
- h. Echocardiologist who still favour to do echo, when patient is lying on left hand side, we recommend using plastic curtain shield between the patient and the examiner.

#### 6.4. Preparation of the echo machine and probe

- a. The portability of echocardiography offers a clear advantage in imaging patients without having to move them and risk virus transmission in the clinic or hospital. A dedicated echo machine in ICU can be used for doing echo for Group A - category 1 & 2, Group B - Category 1 patients, the machine should be covered with transparent polythene disposable sheet. The probe once being used on the patient should be thoroughly cleaned with disinfecting agent like soap water and cidex swabs available in the ICU or one can use latex sheath (condom) filled with jelly and subsequently disposed off after examining each patient.
- b. Echo machines in non ICU setting for Group A- Category 3, Group B category 2 patients: Preferably all measures as taken in ICU should be followed, as many of these patients may be carriers or in the incubation period(Fig. 3).
- c. Echo machine in non-ICU setting for Group B-category 3 can be dealt with normal settings of the echo lab. However the probe should be thoroughly cleaned with disinfectant after completing the echo of each patient.
- d. We can avoid putting ECG leads in this COVID time to reduce incidence of virus transmission, in case of repeat/follow up study.

#### 6.5. Performance of echo

- a. Echo exam should be done quickly and in a focused manner so as to minimize your exposure time to the patient (possibly limited to 5–7 min)
- b. We suggest following views to be recorded and stored in 5 cardiac cycles in the following sequence:
  - i. PLAX view with and without CFM.
  - ii. AP4C view with and without CFM.
  - iii. PSAX view (basal) and at great vessel level.
  - iv. AP2C view
  - v. Apical RV focussed view.
  - vi. IVC Dynamic view.
- c. We also recommend recording of 5 Doppler parameters:
  - i. Mitral inflow trace
  - ii. PAT
  - iii. e' wave at septal annulus
  - iv. TR jet velocity.
  - v. LVOT CW trace.
- d. Above recording parameters in our opinion will give you almost all of the structural and clinically relevant hemodynamic information. The measurements can be done later on and not at patient's bedside. This in turn will save lot of time and

will minimize health care workers (HCW) exposure and risk of infection. Remember even level III PPE is of no 100% guarantee.

#### 6.6. Preparation of the cardiologist/echocardiographer (Figs. 4 and 5)

- a. Group A –category 1 and category 2, Group B – Category 1: Level III of complete protection (preferably PPE gear of atleast 70 gsm) (Figs. 4 and 5).
- b. Group A – Category 3, Group B -category 2 patients: 2nd level of PPE (Figs. 4 and 5).
- c. Group B – category 3: 1st level of PPE (Figs. 4 and 5).
- d. For healthcare professionals: It may be worthwhile to mention few additional aspects which need special consideration like role of hydroxychloroquine (HCQS) for prophylaxis, emotional lability due to social lockdown and stress of managing suspected or diagnosed COVID-19 patients in ICU. Both anxiety and depression are global phenomenon at this point of time and healthcare professionals are no exception and hence need management.

## 7. Conclusion

The present COVID-19 pandemic is a medical emergency of an unprecedented scale in recent human history. It has called into question, on a global scale, not only the medical preparedness to handle this contagious disease but has also changed the paradigm for management of everyday procedures. As we continue to handle the onslaught of this pandemic, strategies may continue to evolve. In any given patient with COVID-19, clinical assessment will be necessary to determine whether patient is experiencing a primary coronary event or other cardiac involvement. If there is a suspicion of cardiac involvement, the risk-to- benefit ratio of doing an echo becomes extremely helpful in deciding the need for the same. If echo is performed, it should be brief and target- oriented and should be performed following all the protocols as outlined above.

Protection of healthcare workers is paramount so that workforce is not depleted in this pandemic and is available as the pandemic evolves. Social distancing and adequate sanitization are crucial. Adequate PPE's (atleast level 2) are mandatory for all health workers engaged in the care of suspected or proven COVID-19 with pre-existing cardiac or new onset cardiac illness.

COVID 19 has been quite a leveller and has made even most powerful of countries to crawl on their knees. One feels cheated by science and the fatalistic righteous and reformist will have a congratulatory rage for them for having seen sciencefail ....!

#### Sources of funding

Unknown.

#### Declaration of competing interest

The author has none to declare.

#### Acknowledgments

We would like to thank following cardiologist colleagues for their expert opinion: Sangeeta Porwal FIAE,India, Sanjivini Inamdar MD,India, RohitTandan MD,India, Sidharth Mangla MD,India, Tanya Gupta MBBS,India, Dhairya Shrivastava MBBS,India, Fabiola SozziMD,PhD,Italy, NilarOo MD,Myanmar, Prof. MyintSoe Win, MRCP (UK), Dr. Med Sc. (Cardiology), Myanmar, Mubarak Raseed MD,FACC, Sri Lanka, Prof. Yadav Kumar Deo Bhatta MD, DM, Nepal,

BarenChakraborti MD,FACC,Bangladesh, Abdullah Al Shafi Majumder MD, FACC, Bangladesh.

We would also like to thank Mrs. Reena Dua, India for manuscript help.

## References

1. *Coronavirus Disease (COVID-19)*; 14th May, 2020. <https://www.worldometers.info/coronavirus/>.
2. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention. *J Am Med Assoc*. 2020. <https://doi.org/10.1001/jama.2020.2648>. Epub ahead of print].
3. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet*. 2020 Feb 15;395(10223):507–513.
4. Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet*. 2020;6736:30566–30573.
5. Wang D, Hu B, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus–infected pneumonia in Wuhan, China. *J Am Med Assoc*. 2020;323:1061–1069.
6. Clerkin KJ, Fried JA, Raikhelkar J, et al. Coronavirus disease 2019 (COVID-19) and cardiovascular disease. *Circulation*. 2020 Mar 21. <https://doi.org/10.1161/CIRCULATIONAHA.120.046941> [Epub ahead of print].
7. Hu H, Ma F, Wei X, Fang Y. Corona virus fulminant myocarditis saved with glucocorticoid and human immunoglobulin. *Eur Heart J*. March 16, 2020. <https://doi.org/10.1093/eurheartj/ehaa190> [Epub ahead of print].
8. Driggin E, Madhavan MV, Bikdeli B, et al. Cardiovascular considerations for patients, health care workers, and health systems during the coronavirus disease 2019 (COVID-19) pandemic. *J Am Coll Cardiol*. May 12, 2020;75(18):2352–2371. <https://doi.org/10.1016/j.jacc.2020.03.031>.
9. Chan JWM, Ng CK, Chan YH, et al. Short term outcome and risk factors for adverse clinical outcomes in adults with severe acute respiratory syndrome (SARS). *Thorax*. 2003;58:686–689.
10. Booth CM, Matukas LM, Tomlinson GA, et al. Clinical features and short-term outcomes of 144 patients with SARS in the greater Toronto area. *J Am Med Assoc*. 2003;289:2801–2809. by on April 7, 2020. <https://doi.org/10.1161/CIRCULATIONAHA.120.046941> <http://ahajournals.org>.
11. Badawi A, Ryoo SG. Prevalence of comorbidities in the Middle East respiratory syndrome coronavirus (MERS-CoV): a systematic review and meta-analysis. *Int J Infect Dis*. 2016;49:129–133.
12. Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet*. March 11, 2020. [https://doi.org/10.1016/S0140-6736\(20\)30566-3](https://doi.org/10.1016/S0140-6736(20)30566-3) [epub ahead of print].
13. Guan W-j, Ni Z-y, Hu Y, et al. Clinical characteristics of coronavirus disease 2019 in China. *New Eng J Med*. February 28, 2020. <https://doi.org/10.1056/NEJMoa2002032> [epub ahead of print].
14. Zheng Y-Y, Ma Y-T, Zhang J-Y, Xie X. COVID-19 and the cardiovascular system. *Nat Rev Cardiol*. March 5, 2020. <https://doi.org/10.1038/s41569-020-0360-5> [epub ahead of print].
15. Yang J, Zheng Y, Gou X, et al. Prevalence of comorbidities in the novel Wuhan coronavirus (COVID-19) infection: a systematic review and meta-analysis. *Int J Infect Dis*. March 12, 2020. <https://doi.org/10.1016/j.ijid.2020.03.017> [epub ahead of print]. <https://doi.org/10.1016/j.jacc.2020.03.031>. [Epub ahead of print].
16. Xiong TY, Redwood S, Prendergast B, Chen M. Coronaviruses and the cardiovascular system: acute and long-term implications. *Eur Heart J*. 2020;1–3. <https://doi.org/10.1093/eurheartj/ehaa231>, 0.

## Abbreviations

COVID-19: Coronavirus disease – 19  
 Echo: Echocardiography  
 ICMR: Indian Council of Medical Research  
 CVD: Cardiovascular disease  
 ECG: Electrocardiogram  
 SARS: Severe Acute Respiratory Syndrome  
 MERS: Middle East Respiratory Syndrome  
 HTN: hypertension  
 DM: Diabetes mellitus  
 ICU: Intensive care unit  
 NHC: National Health Commission  
 CI: Confidence Interval  
 ACE2: Angiotensin Converting Enzyme 2  
 TEE: Transesophageal Echo  
 PPE: Personal Protection Equipment  
 CT: Computed Tomography  
 PLAX view: Parasternal long axis view  
 CFM: Color Flow Mapping  
 AP4C view: Apical 4 Chamber view  
 PSAX view: parasternal short axis view  
 AP2C view: Apical 2 chamber view  
 RV Focussed view: Right ventricle Focussed view  
 IVC Dynamic view: Inferior Vena Cava dynamic view  
 PAT: Pulmonary artery acceleration time  
 TR jet velocity: Tricuspid regurgitation jet velocity  
 LVOT CW trace: Left ventricular outflow tract Continuous Wave trace  
 HCW: Health Care Workers  
 GSM: Gram per square meter  
 HCQS: Hydroxychloroquine sulfate