



COVID-19 pandemic and cardiac imaging: EACVI recommendations on precautions, indications, prioritization, and protection for patients and healthcare personnel

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Introduction

The coronavirus disease 2019 (COVID-19) pandemic has created new and unpredictable challenges for modern medicine and healthcare systems. Preliminary reports have demonstrated that older age, previous cardiovascular disease, diabetes, and hypertension are risk factors for increased mortality.¹ Data on the cardiac affinity of the virus and its potential to harm the cardiovascular system and the mechanisms by which this occurs are sparse.^{2,3} A systemic infection generally increases demand on the heart, and can exacerbate underlying cardiac conditions. When the lungs are heavily involved, as seen in COVID-19 patients, this may have a major impact on cardiac function, particularly that of the right ventricle. Finally, COVID-19 may have direct effects on the heart, as may some drugs being used in its treatment.

The severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) is responsible for COVID-19 and is transmitted by droplets from person to person.⁴ Echocardiographers in particular, and cardiac imagers more generally, are in close contact with patients and therefore likely to have a high risk of being infected. To decrease the risk of patient to patient, patient to imager, and imager to patient contamination, the indication for any cardiac imaging test should be carefully considered, and only those tests considered essential to patient care performed.

Cardiologists and cardiology departments are heavily affected by this rapidly changing situation.⁵ The COVID-19 pandemic also increases the burden on cardiac imaging services generally. However, given its wide availability and key role as a bedside test, echocardiography is the most affected cardiac imaging modality. Common challenges faced by all cardiac imaging modalities during the pandemic

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Key point 3

Advice for cardiac imaging

- Echocardiography should not routinely be performed in patients with COVID-19 disease
- A range of different cardiovascular manifestations can be found in COVID-19 which may require cardiac imaging, including a bedside echocardiographic study
- A focused cardiac ultrasound study (FoCUS) is recommended to reduce the duration of exposure
- The risk of contamination of equipment and personnel is very high during TOE—consider repeat TTE, CT scan, or CMR as alternatives
- Chest CT is frequently used to confirm COVID-19 pneumonia and might provide possible synergies and opportunities of cardiac imaging
- Coronary CT angiography can exclude or confirm an acute coronary syndrome in COVID-19 pneumonia where elevated troponins are common
- LV function can be assessed by LV angiogram in patients with acute coronary syndromes during the invasive revascularization procedure
- Positive troponins and myocardial dysfunction or severe arrhythmia suggestive of Tako-tsubo or myocarditis may be an indication for acute CMR if of vital importance for treatment, and patient can be safely transferred for imaging
- Indications for foetal echocardiography remain the same as outside the COVID-19 pandemic

Echocardiography should not routinely be performed in patients with typical signs of COVID-19 disease. Indeed, it should be restricted to those patients in whom it is likely to result in a change in management. Nevertheless, many COVID-19 patients will develop a range of different cardiovascular manifestations which will require a bedside echocardiographic study.⁷ Moreover, there are reasons to believe that the need for echocardiography might expand further as we understand more about COVID-19, with early reports indicating that patients with established cardiovascular disease and cardiovascular risk factors have worse prognosis than others, and are more likely to be admitted to hospital and need respiratory support.¹

Dyspnoea is a typical finding in patients with cardiac disease, and echocardiography may be indicated in the diagnostic work-up, particularly in patients with subacute onset of dyspnoea, oedema, or cardiac murmurs and elevated cardiac biomarkers. Conversely, a normal pro-BNP test can frequently be used to exclude the need for an echocardiogram in patients with dyspnoea or oedema.

In the ICU, echocardiography has sometimes been used to routinely monitor the progress of certain patients.⁷ This should not be routinely performed in the COVID-19 pandemic. Instead, echocardiography should be restricted to patients with cardiovascular instability or signs of right ventricular dysfunction or pulmonary hypertension. Lung ultrasound to detect COVID-19 pneumonia is also useful.⁸ Thickening of the pleurae, the appearance of B-lines, and lung consolidation indicate pneumonia, with pleural effusions rarely reported. Due to its bedside availability, scanning of the lungs by ultrasound can be performed as a quick diagnostic tool.

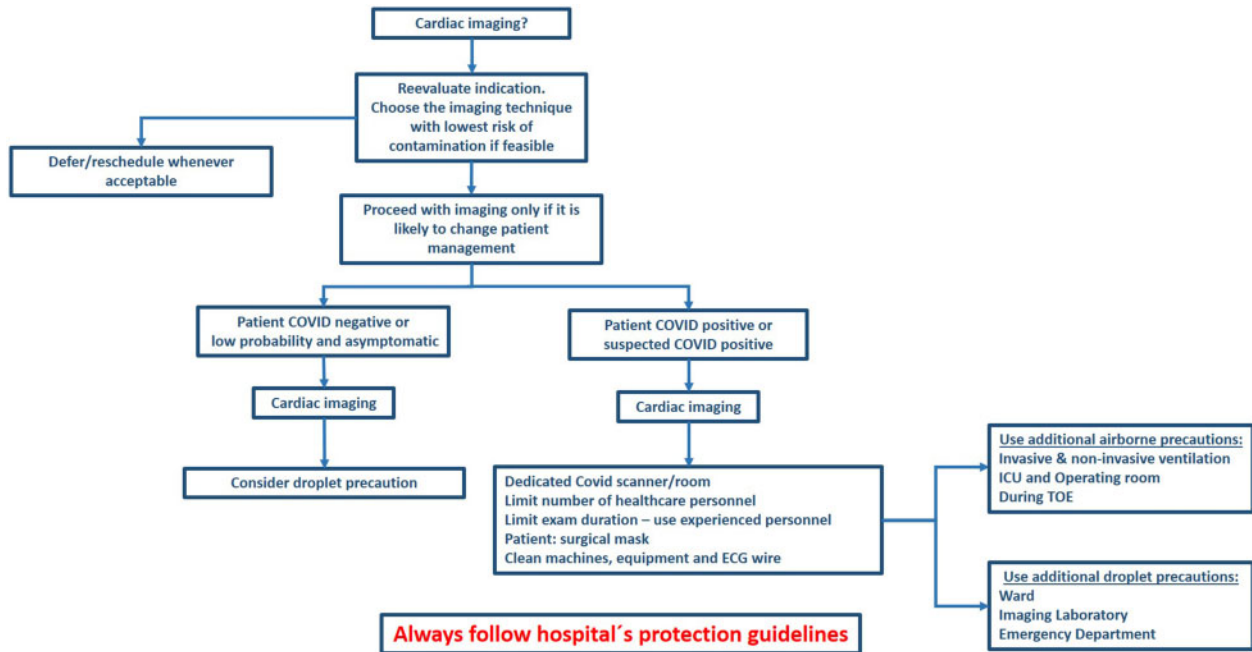


Figure 1 Suggested considerations and precautions before and during cardiac imaging.

echocardiographer brings the echocardiographic machine to the patient, and the patient can remain in their isolation. Local factors must be considered with dedicated COVID-19 areas respected, ensuring COVID-19 'clean' and 'dirty' areas are not mixed.

Reading and conference rooms where echocardiograms are presented on small PC screens may prevent the recommended 2 m distance between the experts. Thus, larger rooms, with projectors that can present the images on large screens are recommended. Virtual communication technology that allows several colleagues to simultaneously visualise images on geographically remote screens is the preferred solution for multidisciplinary team meetings.

Healthcare personnel

All advice regarding personal protective equipment (PPE) should follow the internal rules in each institution. This will vary according to the local nature of the pandemic and the availability of PPE. We here offer some general advice. Repeated and thorough handwashing is the basis of virus protection for everyone, including patients and health professionals. In addition to handwashing after every examination, disinfecting agents should be used on the hands.

When examining a patient with confirmed or suspected COVID-19, protective clothing, gloves, headcovers, specific facemasks, and eye shields must be used (*Table 1*). Patients should wear a surgical mask during imaging (*Table 2*). During TOE, medical protective masks must be used due to risk of aerosols and airborne spread (*Table 3*). How to adequately dress and undress is

described in several publications and is not further described here.

When performing an echocardiogram in patients without confirmed COVID-19, surgical facemasks should be used in regions where the risk of virus spread is high or uncertain. Non-sterile gloves should also be used and renewed between every patient since the persistence of the virus on plastic is long. If the patient has low risk of infection due to low risk in the respective regions or has no symptoms, this may be omitted, especially if there is shortage of face masks or gloves in the hospital.

Precautions in other imaging modalities

Precautions for all the other imaging modalities are similar. Imagers and technologists should wear protective clothing, gloves, and facemasks while undergoing scanning, and patients should wear a surgical mask during imaging. The scanner, coils, and ECG cables are mandatory for cardiac CMR and CT scans but need to be thoroughly disinfected after imaging (*Table 1*). Cleaning of the scanners after imaging patients with COVID-19 infection is also obligatory (see above). An important strategy to reduce contamination is to reserve one scanner for known infected patients and another for low-risk and non-infected patients.

Conclusion

The COVID-19 pandemic has forced us to reconsider how best to perform cardiac imaging in the right patients at the right time and how to minimize the risk of cross-infection for imagers and patients alike. These recommendations are suggested as tools to guide good clinical practice during what is a turbulent period in our practice, and one that is rapidly changing both the premises and demands for cardiac imaging. We expect our understanding of how best to image patients during the COVID-19 pandemic to change rapidly and will adapt our guidance accordingly.

Conflict of interest: none declared.

Table 2 Recommendations for patients during all imaging modalities

Risk of infection	Surgical mask
Lower risk	Preferable
Moderate risk	Obligatory
Severe risk/confirmed COVID-19	Obligatory

Table 3 Recommendations during TOE

Risk of contamination	Handwashing	Surgical mask and gloves	Protective clothing, eye protection, head cap	Study completeness	Equipment protection
Lower risk	Obligatory	Obligatory	Optional/Preferable	Full	None/protection of parts near the patient
Moderate risk	Obligatory	Obligatory	Obligatory	Preferably full/depending on severity of the cardiac pathology	Intermediate/protection of leads and other parts near the patient
Severe risk/confirmed COVID-19	Obligatory	Obligatory (double gloves, protective masks FFP2/FFP3/N95/N99)	Obligatory 'advanced kit'	Problem focused adjusted for clinical importance of the cardiac pathology	Full cover/dedicated scanners

For definition of risks of contamination, see *Table 1*. Washing and disinfection of the TOE probe and its leads are not further described as standard procedures should include sufficient virus protection.

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