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Echocardiography in the Time of COVID-19



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In this issue of the *Journal of the American Society of Echocardiography*, there are three reports that discuss the impact of the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) on echocardiography laboratories and echocardiography service providers. The coronavirus disease 2019 (COVID-19) pandemic has resulted in multidimensional strain on the health care system, and although each of these reports includes authors from different “hot spots” around the world and evaluates issues from different perspectives, common themes emerge. The COVID-19 pandemic is forcing health care systems and societies to scrutinize how care is delivered, and valuable lessons are being learned, many of which will provide lasting insights past the time when the worst of this pandemic is behind us.

From Wuhan, China, three cases are presented that illustrate not only the complex spectrum of cardiovascular disease associated with this coronavirus but also different ways in which cardiovascular ultrasound can be delivered.¹ We are still learning the many ways this virus affects the heart. Cardiac failure has been noted to occur in a significant number of hospitalized infected patients. There is the potential for cardiomyopathy due to direct effects of the virus, also as a result of the toxic effects of the cytokines that are released during the infection, and even stress cardiomyopathy (i.e., takotsubo cardiomyopathy) has been noted. In many, a prothrombotic state or coagulopathy is induced, which can lead to pulmonary emboli, intracardiac thrombus, and exacerbation of coronary artery disease. The data show that patients with preexisting cardiovascular disease are at highest risk for complications, which suggests that in addition to the mechanisms described above, the stress of infection can transform a patient with heart failure or coronary artery disease from a compensated state quickly to an unstable state.² For example, the hypoxemia from acute respiratory distress syndrome will exacerbate preexisting cardiac disease. In the cases presented by Zhang *et al.*,¹ it is likely that some or all of these patients had preexisting cardiac disease given features noted on the echocardiographic assessments of cardiac structure and function.

Regardless of whether the viral infection exacerbates preexisting heart disease or causes new cardiac abnormalities, these cases can serve as a platform to consider many issues. We know that chest pain is a common occurrence in this infection. We are also learning that biomarkers of cardiac injury are elevated in many of the infected, critically ill patients.³ Although in other circumstances either one of these might trigger a request for transthoracic echocardiography (TTE), now we need to ensure that performing TTE will truly provide information not obvious on clinical assessment and that the results will assist in important treatment decisions. Thus, a pragmatic and

practical approach is in order. Although echocardiography might be of assistance, we need to ask whether the use of limited personal protective equipment and the exposure of additional personnel is justified. We also need to recognize that providing imaging services for this high-risk population will differ from our typical model. We should encourage focused examinations to limit the exposure time of the imager and also use cardiac point-of-care ultrasound (POCUS) by the clinical personnel who might already be in the room with these patients (thus conserving personal protective equipment).

Similar to the Chinese experience, our colleagues from Italy tell us of important roles for echocardiography in managing critically ill patients.⁴ In addition, they highlight the role of lung ultrasound, which may streamline the assessment of pulmonary involvement in patients with COVID-19. Although lung ultrasound has previously been part of the skill set for critical care physicians who perform POCUS, the opportunity and need now arise for sonographers and echocardiographers to rapidly learn this skill. In addition, we should consider this an opportunity to work with intensivists to enhance their cardiac imaging skills.⁵ Again, although cardiac and lung imaging can be performed in many of these patients, it should be reserved for patients in whom the immediate information from echocardiography is needed and in whom it has the potential to result in lifesaving treatments.

The opinion piece by Drake *et al.*⁴ provides much information unrelated to cardiac imaging, but because cardiologists are being called to take on frontline clinical care responsibilities unrelated to cardiac imaging, this information will be helpful to our echocardiography community. Such topics include how a public health crisis is defined and the processes for dealing with limited resources (both personnel and equipment). The authors provide thoughtful guidance on how the move toward surge capacity at each hospital will affect practitioners and echocardiography laboratories. It is likely that few of us have in the past had to consider the implications of triaging patients and limited equipment during a public health crisis. A grim but realistic picture is painted by the authors as the focus shifts from optimizing care for each patient to a population-wide approach. Although it is hoped that the “crisis standards of care” guidelines will not be needed, it is best that we all think about these issues in advance. Many facilities have clear crisis triage plans based on thoughtful ethical discussions, prior experiences (such as the 9/11 and Boston Marathon attacks), and disaster preparedness drills. It is our obligation to make sure our hospitals are prepared and that everyone understands how and why such difficult decisions are made. Perhaps if the public understands that typical medical options might not be available for all, they will also clearly understand the importance of current efforts to slow the pandemic by “flattening the curve.” Drake *et al.* also importantly stress that decisions regarding the allocation of limited resources should be made by committees composed of appropriate personnel, not by the people directly caring for patients. Many such committees have been formed in hospitals across the United States.

Although Drake *et al.*⁴ remind us of the ethical principles and duties to treat all patients in the current pandemic, the ethical framework is complex. In addition to beneficence, or doing good, the ethical framework includes nonmaleficence, or avoiding harm.⁶ In this current

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situation we must all recognize that not only it is important to avoid harm to our patients, it is critical to carefully practice the necessary procedures to avoid spreading infection that could harm ourselves or others.

From the report by Ward *et al.*⁷ we see the impact COVID-19 has had on echocardiography ordering, screening, and performance at the University of Chicago. This analysis of the utilization and appropriateness of TTE provides many important insights. First, from an echocardiography laboratory operations standpoint, it is notable that with hospital and state directives to defer elective procedures, the weekly volume of TTE has been markedly decreased (by 84% among outpatient studies in this report). This is similar to the experience at our institution, with the primary goal to help protect patients and hospital staff members by minimizing nonessential travel and practicing rigorous social distancing. What impact deferring these studies will have on future patient outcomes is not clear. From a practical standpoint, how busy echocardiography laboratories will ultimately reschedule these studies for patients remains to be seen. The pandemic has provided an unexpected opportunity for clinicians and procedural laboratories to focus on which studies are truly needed. Appropriate use criteria for echocardiography have been in existence for more than a decade⁸ and the subject of much clinical investigation, although integration into routine clinical practice has been varied. The COVID-19 pandemic has mandated a change in work flow, and the University of Chicago authors instituted a protocol that involves physician review of all echocardiography referrals. This essentially eliminated “rarely appropriate” TTE (down to 1%). Although many echocardiography laboratories have physician or other clinician review of transesophageal echocardiographic examinations, the volume of TTE has been a barrier for doing so for that modality. This report shows that when given no choice, it can be done, and it improves patient selection for TTE. The sustainability of such a protocol after the pandemic is an obvious question, yet the principle that improved screening of ordered TTE reduces inappropriate studies is a valuable lesson to carry forward.

Ward *et al.*⁷ also focus on the risks and benefits of performing TTE in the midst of the pandemic, which is also highlighted in the other reports. Specifically, the main risk considered is to the sonographers (or physicians) performing TTE, as the procedure requires prolonged and close contact with patients. Sonographer workplace safety has previously focused on areas such as radiation safety and ergonomic issues related to the nature of the work, although the COVID-19 situation has rightfully brought a new dimension to this discussion. The authors examined an alternative imaging protocol (limited TTE), which reduces imaging time and minimizes high-risk exposure, and saw a significant increase in the use of limited TTE during the pandemic.

There are many take-home points from these reports that highlight the worldwide reach of echocardiography, especially in the COVID-19 pandemic. This crisis has, ironically, forced us all to bring existing quality improvement initiatives to the forefront. Almost overnight, cardiology divisions have needed to enact new protocols to help strike a balance of optimal patient care, clinical workforce safety, and societal responsibility. Deferring echocardiography studies deemed nonurgent (or inappropriate) has greatly reduced volumes in an effort to protect patients and echocardiography laboratory staff members. For the studies that should and must be done, evaluating limited imaging protocols and other modalities (POCUS) are well under way. This will provide an opportunity for needed real-world study. Before the pandemic, there had been growing use of POCUS, and

guidelines were written on its use.⁵ Smaller ultrasound machines, including handheld devices, have been deployed in this new workflow model, and it will be interesting to see whether such implementation sticks. Some have raised concerns that lack of uniform reporting and image storage for later review may be limiting factors to optimal adoption of this technology. We owe it to the patients being cared for during the pandemic, and to future patients, to rigorously evaluate the rapidly escalating incorporation of these technologies into clinical care. In an analogous fashion in clinical cardiology care, the use of virtual (video or telephone) visits is increasing rapidly by necessity and represents an area that can be studied to help guide optimal utilization in postpandemic times.

The COVID-19 pandemic has forced echocardiography and cardiovascular practitioners, and all medical personnel for that matter, to critically evaluate clinical work flows and how care is delivered. A potential silver lining to our current situation, if there is one, is that cardiac imaging and cardiac clinical care are being streamlined, with a renewed focus on appropriate use and performing imaging and other procedures that truly stand to benefit patients. These are valuable lessons that in some form should be carried forward when the COVID-19 pandemic is behind us, and perhaps we can emerge as a more efficient and patient-centered health care system that will prepare us for any future challenges that may arise. In conclusion, the model for how we provide echocardiography and to whom may be permanently modified by this current experience and improved as we move forward.

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