

Expert Perspectives



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Cardiac implications of COVID-19

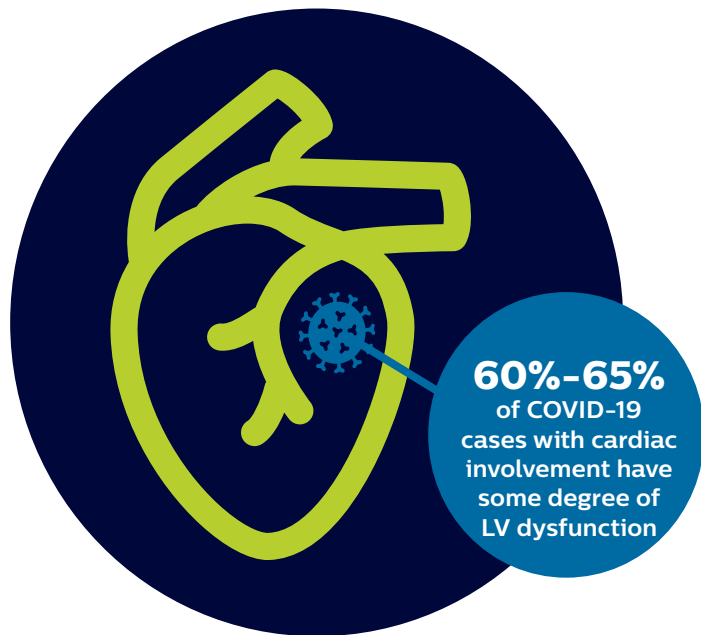
Dr. Roberto Lang, head of the noninvasive cardiac imaging lab at the University of Chicago, shared his perspective on the impact of COVID-19 on the heart, and how his echocardiography lab has rapidly adapted to provide care for these challenging patients.

“We are learning more and more about how the presentation of a patient influences the expected outcomes,” says Dr. Lang. “While the left heart is the primary area of focus when assessing these patients, addressing both chambers is important to the pathway of care for patients with COVID-19. Automated strain tools have simplified assessment of right ventricular function, which is important to their care.”

Impact on the left side of the heart

Dr. Lang has found the impact of COVID-19 on the left heart to be quite substantial, affecting, by his estimate, 60%-65% of cases. Most of these cases fall into one of these four categories.

- Hyperdynamic left ventricular (LV) function
- Regional wall motion suggestive of Takotsubo-like cardiomyopathy (CMP)
- Acute myocardial infarction (MI)
- Diffuse cardiac dysfunction myocarditis



Hyperdynamic LV function

Hyperdynamic LV function may be a stress response to system inflammatory response, preload augmentation due to fluid resuscitation, or a decrease in LV preload secondary to reduced peripheral vascular resistance. The use of contrast can help to delineate the endocardial border of these patients when they have technically difficult studies.

Takotsubo CMP

Identification of a typical dysfunction abnormality in the apex with relatively preserved basal function can be aided by the use of contrast.

Acute MI

Acute MI can be caused by cytokine storm with elevated levels of catecholamines, microvascular dysfunction, inflammation and/or spasm of the epicardial coronary arteries.

Complications in imaging COVID-19 patients

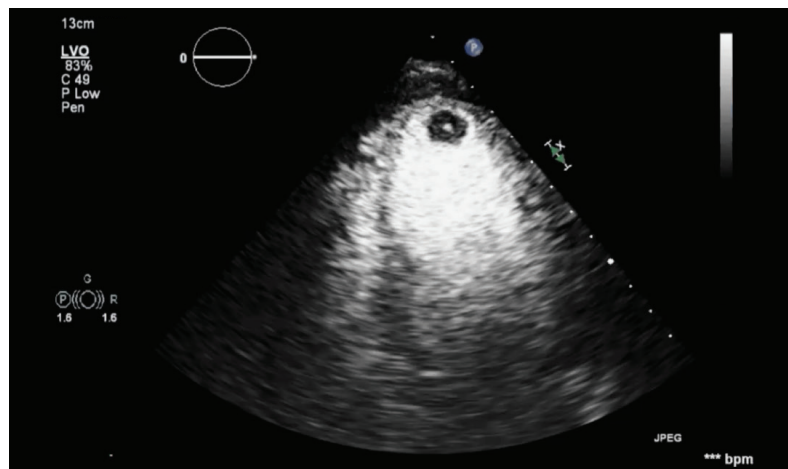
Dr. Lang has found that the left decubitus position which is ideal for cardiac scanning is difficult to maintain in patients who are very sick with respiratory symptoms. These patients are often coughing while needing to remain upright, making the scan technically difficult to acquire. In addition, scans can be recorded without an EKG in order to minimize exposure of the sonographer to the patient with COVID-19.

Diffuse cardiac dysfunction

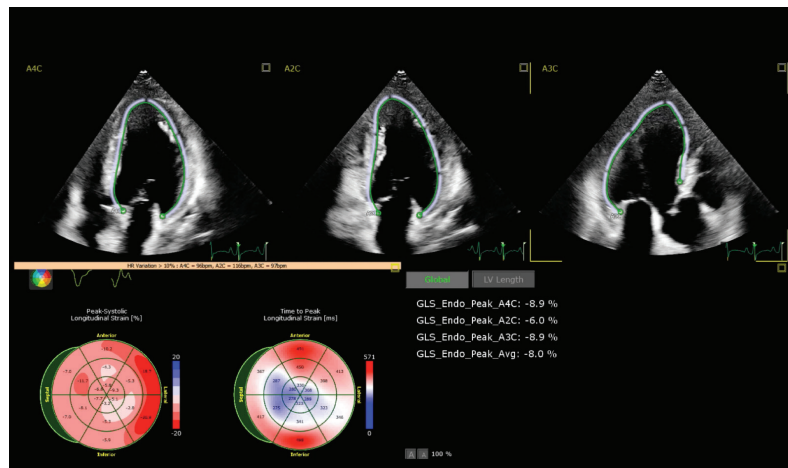
Some patients present diffuse cardiac dysfunction associated with moderate or severe reduction in LV ejection fraction (EF) and global longitudinal strain.

Strain

The lab has been performing strain on COVID-19 patients, using AutoStrain LV, which has been found to correlate closely with biplane echo LVEF. Sonographers acquire the images and then return to the echo lab to quickly calculate strain using automated tools, reducing potential infection exposure for the clinical team.



Patient with COVID-19 with a dilated poorly contracting LV. Contrast unmasked the presence of a large apical thrombus.



Patient with COVID-19 with significantly reduced LV global longitudinal strain (-8%).

LV Summary

Dr. Lang says, “More needs to be learned about the effects of COVID-19 on the left side of the heart. We are noticing that COVID-19 may affect the left heart in different ways, and we are still learning about how patient presentation may affect the patient’s outcome.”

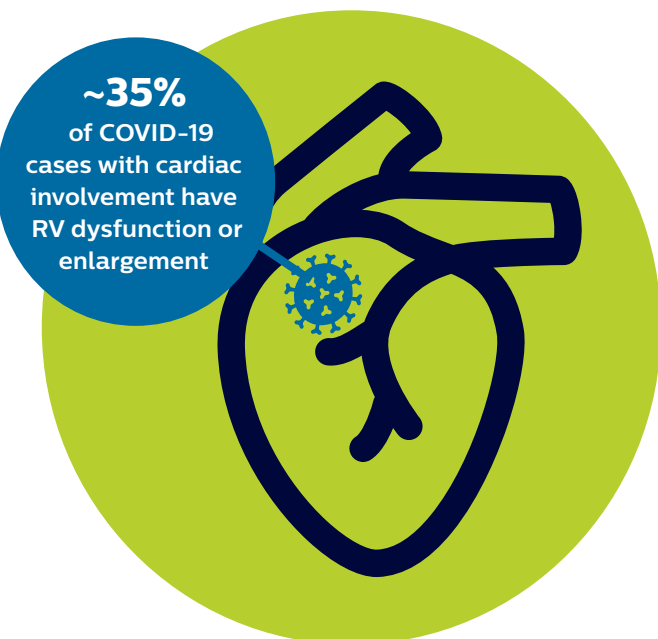
See the video on COVID-19 and the left heart

<https://www.youtube.com/watch?v=wgAlcE17bzg>

Impact on the right side of the heart

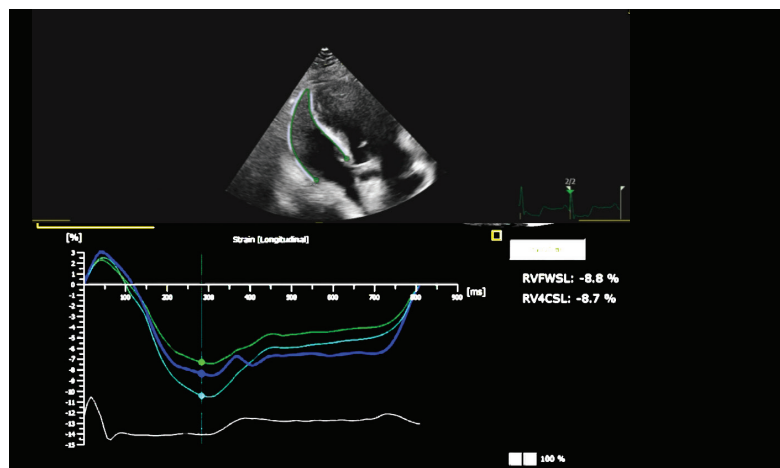
COVID-19 also has a unique impact on the right side of the heart. Dr. Lang has seen the right heart affected by enlargement or dysfunction in approximately 35% of patients, which is not completely unexpected given the impact of COVID-19 on the lungs.

RV imaging can depict the right ventricle to be enlarged and with reduced systolic performance. These morphological changes are seen as secondary to an increase in pulmonary vascular resistance, which may occur due to multiple causes such as hypoxia, pulmonary vasospasm, hypercapnia, inflammation, fluid overload, unsuitable mechanical ventilator settings and pulmonary embolus. It is not uncommon for these patients to have a history of smoking, asthma, COPD or sleep apnea.



Tips for assessing the RV

Generally speaking, the RV systolic performance can be assessed using the tricuspid annular plane systolic excursion (TAPSE) and the DTI-derived tricuspid lateral annular systolic velocity (S'). Recently the use of strain imaging to assess RV function has been used as an alternative because of its advantages. RV strain imaging is simplified and reproducible using AutoStrain RV for right ventricular quantification.



Patient with COVID-19 with a dilated RV. The strain of the RV free wall is greatly reduced (-9%).

RV Summary

Dr. Lang notes that RV free wall strain can be measured reproducibly from RV-focused views using AutoStrain. Moreover, he proposes that RV strain should be assessed in every patient because TAPSE and S' measurements can be misleading and do not correlate well with MRI measurements in certain conditions. Dr. Lang cites published literature that associates RV dysfunction, as measured by RV free-wall strain, with increased morbidity and mortality in COVID-19.^{1,2} A recent study highlighted that mortality of COVID-19 patients has been directly correlated to the degree of abnormality in RV free-wall strain.³

See the video on COVID-19 and the right heart

<https://www.youtube.com/watch?v=JBJEolc33ZY&t=47s>

References

1. Szekely Y, Lichter Y, Taieb P, et al. Spectrum of cardiac manifestations in COVID-19: a systematic echocardiographic study. *Circulation*. 2020;142(4):342-353. DOI:10.1161/CIRCULATIONAHA.120.047971
2. Argulian E, Sud K, Vogel B, et al. Right ventricular dilation in hospitalized patients with COVID-19 infection. *J Am Coll Cardiol Img*. 2020 Jul 15. DOI:10.1016/j.jcmg.2020.05.010
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Results from case studies are not predictive of results in other cases. Results in other cases may vary.

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