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Time needed to complete: 1h 51m

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Diagnosing PAH: New Emphases on Imaging Modalities

Announcer:

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Dr. Krasuski:

Hello, I'm Dr. Richard Krasuski from Duke University Medical Center. Today we're going to be discussing Diagnosing Pulmonary Arterial Hypertension: New Emphasis on Alternative Imaging Modalities. We're going to mainly focus on cardiac MRI.

The new 2022 ESC/ERS guidelines have included cardiac MRI as an important diagnostic modality in pulmonary arterial hypertension. It's important to recognize that this provides a complete picture of the heart and the pulmonary vasculature. It accurately and reproducibly assesses atrial and ventricular size, morphology, and function. It helps us to rule out left heart disease. We can do that by looking at LA to RA ratio; we can look for the presence of left ventricular hypertrophy or valve or structural lesions; we can assess right ventricular and left ventricular strain by tagging or post processing feature tracking; we can measure blood flow in the pulmonary artery, aorta, and vena cava that allows us to calculate stroke volume, intracardiac shunt and retrograde flow.

Initial measures have been shown to add prognostic value to current risk scores and reassessment at 1-year follow-up when patients are treated with medical therapy, appears at least equal to right heart cath in terms of prognostication. And as a limitation, unfortunately, there's still no established method to estimate the pulmonary artery pressure, so that still remains something that we're trying to work out.

Now, here's cardiac magnetic resonance imaging. In 2023, we have a lot of different modalities. Some of the advantages include the fact that we can assess right and left heart structures well. It's really the best imaging we have for what I'm most passionate about, which is congenital heart lesions. You can get 3D and even 4D imaging capability. You can see in that lower right-hand picture what 4D flow looks like in the pulmonary vessels. It's noninvasive; there's less toxic contrast agent that's administered; and it has the ability to characterize soft tissue, so you really get a complete picture.

Like any imaging modality, there are some disadvantages. It's still limited in availability; you need a variety of different things to make this work, including the proper scanner, the cardiac software package, a trained technician to take us through the various protocols, and of course, a trained reader as well to interpret the findings. It's still expensive, it's not often covered by insurance, and we still have to work for that. There are longer scan times which are clearly dependent on the number of sequences that are obtained. Artifacts, including motion, respiration and implants of devices can impact the pictures. And there's still some incompatibility with pacers and ICD wires and aneurysm clips, although I think we're getting much better at identifying that before so that we implant devices that are compatible.

Here is how it's been added to the Risk Assessment Profile. You can see in addition to echocardiography as an imaging modality, we have cardiac MRI, with assessment of right ventricular ejection fraction, with assessment of the stroke volume index, and the right ventricular end systolic volume that's index, which is all of these three criteria can allow you to place the patient into a low-risk category, in intermediate-risk category, or a high-risk category.

So the comprehensive MRI exam collects extensive and potentially prognostic data. There is Cine cardiac imaging, which we can measure volumes, function, mass, the systolic septal angle, and the strain. We can do black-blood imaging to look at the structures. We can do phase contrast MRI, which allows us to assess PA velocity and right atrial reservoir volume that's indexed. We can look at late gadolinium enhancement, which allows us to assess scar at the right ventricular insertion point. And you can also do perfusion imaging or MRA, magnetic resonance angiograph. With this, you can assess the pulmonary transit time, and you can also do a visual inspection.

In this example, on the bottom of the screen, you can see a normal pulmonary - set of pulmonary vessels with the pulmonary arteries. In the middle, you can see pulmonary arterial hypertensive arteries, where in fact, you probably have some regurgitation, you have a slower transit time. You can see the contrast is still seated in the right side. And you can see that the vasculature is kind of pruned. On the right, you can see a CTEPH, in which case with CTEPH, you have loss of segments of the lung with no perfusion. And finally, we can look at ultra short echo time as well.

So MRI can be potentially helpful in all types of pulmonary hypertension. On this diagram, you can see the variety of different things we can look at. With Group 1 PH, we can make diagnoses, for instance, looking at the veins and looking at shunts, which allows us to exclude left heart causes. With Group 2 pulmonary hypertension, we may see characteristics of the left ventricle in particular that can be assessed with a variety of different techniques to make us recognize this is more pulmonary venous, rather than pulmonary arterial. In Group 3, we can look for fibrosis of the lung parenchyma and other sequences to allow us to assess just how much of the disease appears to be related to the lung parenchyma and how much is related to the lung vessels. In Group 4, again, angiography is a wonderful way to assess whether or not you have classic CTEPH lesions. And finally, in Group 5, there can be a variety of different things, including lymphadenopathy and absence of a spleen, and local uptake of late gadolinium like sarcoidosis.

So today, we talked a little bit about MRI and just how useful it can be as a potential adjunct to imaging, so much so that the ESC and ERS have now included it in the assessment of cardiovascular risk in patients with pulmonary hypertension.

And I thank you for your attention.

Announcer:

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