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Screening and Diagnosis of PAH: Cardiopulmonary Exercise Testing (CPET)

Announcer:
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Dr. McLaughlin:
Hello, I'm Val McLaughlin from the University of Michigan, and today I'm going to talk to you a little bit about the use of cardiopulmonary exercise testing for screening and diagnosis.

So one use of cardiopulmonary exercise testing is to try to find patients earlier. And often we apply this to patients who may have risk factors for the development of pulmonary hypertension. Potentially patients who are in families where we know there is heritable disease, they may actually have the mutation but not have a lot of symptoms yet, sometimes patients with connective tissue diseases. Another place we're using it frequently is in patients with chronic thromboembolic disease. So we know they have chronic thromboembolic disease anatomically, but they don't have hemodynamics consistent with pulmonary hypertension. But sometimes these patients can get symptoms either because of exercise pulmonary hypertension or dead space ventilation. And the cardiopulmonary exercise test can be very useful for that.

Another area that I use cardiopulmonary exercise testing in frequently is those patients with dyspnea. So they have dyspnea, you know that they have a limitation in their exercise capacity and quality of life. But nothing's really popping out on their exam so far, that, you know, they don't have very abnormal PFTs or a very abnormal echo. And sometimes using a CPET can help point you in the direction of is it a cardiac limitation? Is it a pulmonary limitation? Or is it deconditioning? Is it musculoskeletal? So the further evaluation of unexplained dyspnea, I think is really important.

I will also say that there are some centers that use cardiopulmonary exercise testing to follow patients exercise capacity, most centers use 6-minute hall walk, but there are some that rely on cardiopulmonary exercise testing to monitor patients as well.

So kind of the fundamentals. You know, sometimes early in the disease, the symptoms are nonspecific, and they include impaired exercise tolerance, but before you're seeing a lot of abnormalities in some of the other testing that we do. And some of the parameters derived from cardiopulmonary exercise testing have been shown to aid in diagnosis, treatment response, and even have prognostic significance in PAH. They're underutilized. I think it's really important to remember that this testing has a high technical component, a high complexity of interpreter skill, as well. And so sometimes there are just centers that don't have the technical expertise to use this as much. But we know that changes in exercise physiology and gas exchange can reflect the pathophysiology in pulmonary hypertension, including a reduction in the oxygen uptake, the VO2, the anaerobic threshold, and at peak exercise, the ventilatory efficiency, arterial hypoxemia, and then of course, altered kinetics of VO2, as well.

So it's really important to know the parameters that are most important in terms of association with PAH and, to some extent, prognosis as well. So patients with PAH on cardiopulmonary exercise testing often have a reduction in the peak VO2, the peak work rate, the VO2 divided by work rates slope, the VE/VCo2 slope, and the end-tidal Co2 tension as well as are at anaerobic threshold. So these are some of the variables that we look at. And as I said, sometimes these variables can point you in various directions. So sometimes there's

really more of a cardiovascular limitation, where sometimes there's a pulmonary limitation. You know, sometimes obesity and deconditioning can cause exercise limitation. And of course, we want to make sure that we have a very thorough evaluation of a patient before we just say, 'Oh, you're deconditioned.' We don't want to delay diagnosis of someone who actually has a serious disease by attributing it to deconditioning. So I think this test is really useful in this situation where a patient has a lot of limitations, but not a particularly abnormal echo or PFTs. And you want to dig deeper and see if this is really early pulmonary vascular disease, or if it is associated with deconditioning. And of course, there are some musculoskeletal diseases that can cause the sensation of dyspnea as well.

So I think it's really important to use this technology in very specific indications. And this was discussed in the ERS/ESC guidelines. They really acknowledged that cardiopulmonary exercise testing is a useful tool that can help sort out the pathophysiological mechanisms of exercise intolerance. They acknowledge some of the patterns that we see in PAH, as I've already alluded to, and, you know, sometimes if we see these things means it should prompt further consideration of pulmonary vascular disease. But of course, we might see other findings on cardiopulmonary exercise testing in patients with other limitations such as left heart disease or COPD. So it can be useful to help sort out the etiology of dyspnea.

So kind of in summary, when do we use it? Well, we can sometimes use it in symptomatic patients who have risk factors for PAH and, you know, maybe the rest of their testing is not suggesting a high probability and we want to do a less invasive test before we go to right heart catheterization. It can improve the diagnostic accuracy of the algorithm. So in this context, we look at a number of different variables, particularly VE/Vco2. I think we also have the opportunity to find disease earlier in certain patients such as patients with scleroderma. Potentially, we could use this in patients who have a high detect score before going to more invasive procedures. And I think it's also important to acknowledge those with chronic thromboembolic disease when you're trying to sort out the etiology of their dyspnea. So - and these indications have even been added to the recommendations. The evidence-based recommendations in patients - or in the ERS/ESC guidelines.

So to sum up, it's a highly technical procedure, cardiopulmonary exercise testing, but there are a number of indications for both early diagnosis and for sorting out the etiology of dyspnea in patients with unexplained dyspnea.

So thank you very much for joining me on this review of cardiopulmonary exercise testing.

Announcer:
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