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V/Q Scans and Computed Tomographic Approaches to PH Diagnosis: Finding CTEPH

Announcer:
Welcome to CME on ReachMD. This episode is part of our MinuteCME curriculum and is titled “V/Q Scans and Computed Tomographic Approaches to PH Diagnosis: Finding CTEPH”.

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Dr. Preston:
V/Q Scans and Computed Tomographic Approaches to PH diagnosis: Finding Chronic Thromboembolic Pulmonary Hypertension, or CTEPH. The first key point that I would like to address is that always, always, always rule out CTEPH because it's very hard to diagnose and it has a slightly different treatment approach. So it's very important to always rule out CTEPH. And V/Q scan is currently the only screening tool to screen for the presence of chronic clots. This is an example of a proximal chronic clot from a patient who underwent thromboendarterectomy or pulmonary endarterectomy which is a surgical, very complex procedure, surgical procedure that has a chance to cure the disease. So that's why it's very important to rule out CTEPH. If you can look at the lung perfusion scan, it has a sensitivity of over 95% and the specificity over 95% because it has a, it can pick up not only proximal clots, but more importantly, more distal clots.

V/Q Scintigraphy and SPECT. They're a little more detailed tests. The SPECT is not quite available everywhere, but it does give you a better picture of the defects. So SPECT scan is an imaging test that shows how blood flows to tissues and organs. And it may be used to help diagnose several conditions such as seizure disorder, stroke, but also pulmonary hypertension. The top images show a planar ventilation and profusion image and it shows multiple segmental and subsegmental defects. You can see the sharp demarcation between perfused and non-perfused areas. And this is a picture of a CTEPH patient. So this type of abnormalities are very suggestive of CTEPH. Now the lower images are SPECT profusion images which provide a more detailed analysis of profusion defects in a coronal plane. So you can see the sharpness of the defect much better with the SPECT.

Now let's talk a little bit about CTA. Advanced CTA of the lung has sensitivity and specificity regarding CTEPH related to changes of 92-100% and 95-97% respectively at the main, lobar and segmental pulmonary artery levels. But that's it. Because a conventional CTA does not provide functional information concerning pulmonary perfusion. So it does not tell you anything about how the blood flows, or if it flows into that area that you may or may not see a clot. And its sensitivity is 64-70% for depiction of subsegmental chronic thromboembolism compared to selective pulmonary angiography. So the sensitivity of a CTA drops dramatically as the clots are smaller and in the more peripheral pulmonary branches. Now, it can show direct vascular signs of CTEPH, such as complete obstruction, partial obstruction, bands or webs, but you have to have a trained eye to pick them up and look at the very thin cuts in order to pick up webs and bands. It also can show you the size of the right ventricle, right? And that would be an indirect sign that there may be chronic clots. It also can show enlarged main pulmonary arteries and also a mosaic lung pattern. Those are all signs of pulmonary hypertension.

So again, a CT scan is the diagnosis of choice for acute PE. BQ is for chronic PE. These are two examples of acute PEs in the operating room. A fresh clot that is dark, that is dark red and very friable. And then the CT scan that shows the main pulmonary arteries obstructed almost in its entirely, especially look at the left lower lobe is completely blocked with an acute clot. And very poor perfusion

throughout both lungs. So this is a massive, massive pulmonary embolism and we don't know clinically the importance of it, but looking at the fresh clot in the picture, one might suspect that this was a fatal event.

The angiography confirms CTEPH. Again, it has to be done by a more experienced radiologist because the amount of contrast may be changed if they suspect high pressures and also to look carefully and in different angles and different planes, where is an obstruction, whether it's acute or complete or partial. And that will map out whether and how a surgeon can address this type of disease, surgically. There are pouches, there's absent branches and no profusion and there are bands, but these are subtle signs and you have to look for them.

Another modern imaging, Dual-Energy Computed Tomography Angiography or DECT. It enables a combined functional and morphological analysis of the lung. So this is a very interesting and, hopefully, a very useful imaging modality in the near future. Now attenuation properties of iodine occur at two different photon energies and this dual energy, and that's why it's called dual energy technique, can generate pulmonary blood volume maps correlated to pulmonary perfusion. In comparison to a conventional CT, no additional intravenous iodine contrast is needed. The functional image processing is simply added, it's a software upgrade, if you would. DECT is not associated with increased radiation levels. So not more IV dye, not more radiation, but it's more expensive because there is another software added. Study examining correlation between DECT and single photon emission computed tomography or SPECT in 51 patients, found that DECT with iodine maps has a sensitivity of 96%, a specificity of 76% for CTEPH. So it's very good tool that warrants further investigation whether it can be used in clinical practice.

This is an example of a DECT imaging of the lung where it shows arterial stenosis. The left hand side are the conventional imaging, but on the right hand side it shows the functional aspect of DECT where there are perfusion defects.

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