

## The image of pulmonary hypertension

A imagem da hipertensão pulmonar

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Pulmonary hypertension is a condition defined by a mean pulmonary artery pressure above 25 mmHg. The first step in the assessment of pulmonary hypertension is to consider it within the context of the symptoms or the underlying medical condition. When pulmonary hypertension is suspected, echocardiography is the next logical step in the diagnostic process. Pulmonary hypertension is sometimes diagnosed on the basis of accidental findings on chest X-rays or CT scans made for other purposes. In a review published in the current issue of the *Brazilian Journal of Pulmonology*, Hovnanian et al.<sup>(1)</sup> summarize the major diagnostic information that can be used in order to detect pulmonary hypertension. Although the results of noninvasive tests can raise the diagnostic suspicion of pulmonary hypertension, there is as yet no simple, specific, inexpensive instrument that is also highly sensitive for the diagnosis of pulmonary hypertension. It is therefore of interest to explore the potential of electrical impedance tomography in this respect, as proposed by Hovnanian et al.<sup>(1)</sup>

If noninvasive tests produce evidence of pulmonary hypertension, further diagnostic tests are required in order to diagnose the underlying condition. According to The World Health Organization, the causes of pulmonary hypertension are divided into five major groups: pulmonary arterial hypertension; pulmonary hypertension secondary to left heart disease; pulmonary hypertension secondary to lung diseases (obstructive or interstitial) or sleep-disordered breathing; pulmonary hypertension caused by blood clots in the lungs or blood clotting disorders; and pulmonary hypertension secondary to various other diseases, including blood disorders, systemic disorders, and metabolic disorders, as well as other conditions, such as tumors.<sup>(2)</sup> An accurate diagnosis of pulmonary hypertension is important for the patient, because the various diagnostic classes require different medical treatments. For instance, although the use of endothelin receptor antagonists is indicated in pulmonary arterial

hypertension, they can cause considerable harm if the underlying cause of the pulmonary hypertension is left heart disease or COPD. The choice of diagnostic tools is based not only on current recommendations and guidelines but also on the availability of techniques and expertise.<sup>(3)</sup> For instance, although the current guidelines strongly recommend the use of ventilation/perfusion imaging to exclude chronic thromboembolic pulmonary hypertension, this technique is not always available. At facilities staffed with well-trained radiologists who are familiar with the diagnosis of chronic thromboembolism, CT and magnetic resonance (MR) angiography present potential alternatives to ventilation/perfusion imaging. The ideal situation is that in which the various techniques are available and are used in a complementary manner, experienced hands making optimal use of the strengths of each imaging modality. For instance, when pulmonary hypertension is suspected, ventilation/perfusion imaging is considered the most sensitive tool for the diagnosis of chronic thromboembolic pulmonary hypertension. However, this technique provides no information on the pulmonary vasculature. Therefore, if ventilation/perfusion imaging indicates chronic thromboembolic pulmonary hypertension, additional investigation is required. Although CT angiography provides excellent data on the central pulmonary arteries, it is limited in the detection of small peripheral artery lesions.<sup>(4)</sup> In addition, although pulmonary angiography provides excellent information on peripheral chronic pulmonary embolism, it can miss centrally located lesions adhered to the pulmonary vascular wall. By combining CT angiography and pulmonary angiography, we can obtain excellent information on the central and peripheral pulmonary vasculature, which is needed in order to determine whether surgery is a therapeutic option or not.

How do the new imaging modalities, such as MR imaging (MRI), fit into this picture? Because MRI can be used for perfusion imaging and MR angiography, it can be considered a

one-stop shop for the diagnosis of pulmonary hypertension, given that it can also provide detailed information on the right ventricle.<sup>(5,6)</sup> However, due to issues related to availability and costs, the application of this technique is limited in most countries around the world.

An accurate diagnosis of pulmonary hypertension depends not only on the correct use of imaging techniques, as is nicely outlined in the review by Hovnanian et al.,<sup>(1)</sup> but also on expertise in the diagnosis of this condition. In particular, rare conditions, such as pulmonary veno-occlusive disease<sup>(7)</sup> and pulmonary hypertension in patients with amyloidosis, can be easily overlooked by non-experts. Therefore, patients with pulmonary hypertension should be referred to a large referral center where not only are the required imaging techniques available but, more importantly, the staff knows how to use them for the benefit of the patient.

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