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CT-based radiomics of benign and malignant features in multiple cavitary pulmonary lesions

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In this issue of the JBP, Giacomelli et al.[1] aimed to identify characteristics of pulmonary cavitary lesions on CT scans, which could allow the differentiation between benign and malignant features. Pulmonary cavities are a common diagnostic dilemma for radiologists because they cover a wide range of etiologies that, at first glance, may have similar morphological CT features. Possible differential diagnoses include infectious diseases, such as tuberculosis, fungal infections, and parasitic infections, as well as noninfectious diseases, such as malignant and autoimmune diseases.[2,3] Tuberculosis and aspergilloma are common benign causes of multiple cavitary lung lesions. Among malignant causes, metastases from extrathoracic malignancy are by far more common than primary lung cancer.[2,3]

Giacomelli et al.[1] found that the clinical presentation can be similar in patients with benign or malignant multiple cavitary nodules.[1] Therefore, radiological criteria indicating the nature of these lesions may be crucial, particularly in patients who are not candidates for invasive diagnostic procedures or in order to expedite treatment interventions.

The authors tested various radiological parameters and concluded that a greater number of cavities favors malignant etiologies.[1] In contrast, the presence of centrilobular nodules significantly correlates with benign etiologies. Their observations have also reinforced previous findings in Brazilian studies regarding the association of the reversed halo sign with nodularity and active pulmonary tuberculosis.[4-6] The finding that nodular walls or nodules within reversed halo sign lesions are highly suggestive of granulomatous diseases, especially tuberculosis, rather than of cryptogenic organizing pneumonia, is a significant contribution that allows radiologists to be confident about the nature of such lesions.[4-6] However, Franquet et al.[7] reported that centrilobular nodules and centrilobular branching opacities (tree-in-bud pattern) can also be identified in some metastatic tumors and in thrombotic microangiopathy. The latter is a rare and distinct form of tumor embolism, with widespread fibrocellular intimal hyperplasia of small pulmonary arteries and arterioles that is induced by tumor microemboli. The presentation can be similar to infectious bronchiolitis, with small centrilobular nodules and tree-in-bud opacities.[7]

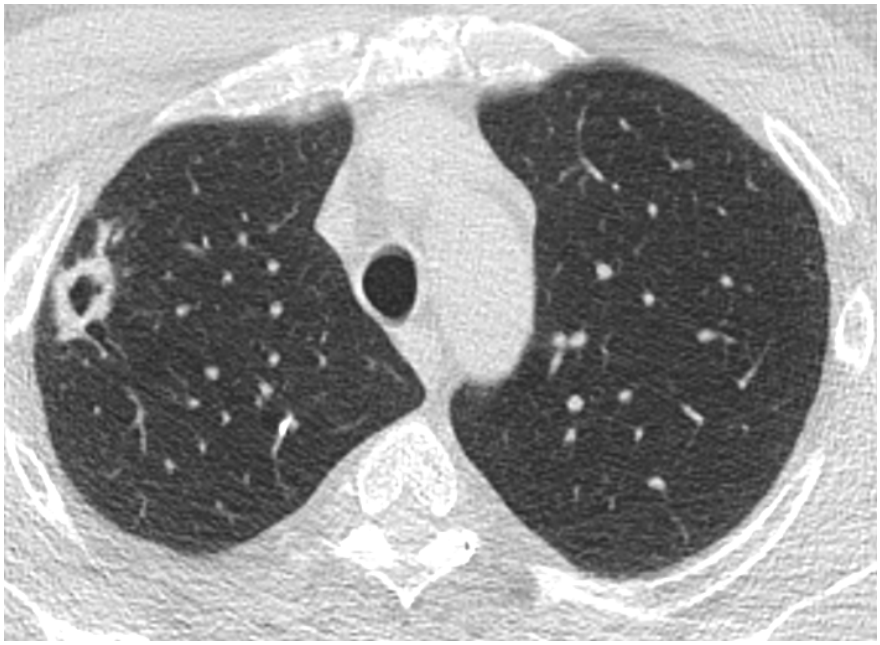

Figure 1. Axial CT scan at the level of the upper lobes with a lung window setting showing a cavitary lesion with an irregular and thick wall. A CT-guided biopsy was taken from the thick wall, and histological evaluation confirmed non-small cell adenocarcinoma.

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Another contribution of Giacomelli et al.[1] is the unexpected observation that the wall thickness and the diameter of the largest lesion, as well as its location, are not reliable discriminators between benign and malignant lesions is another contribution from their study.[1]

Lung neoplasms manifesting as cystic lung lesions are among the causes of a lack of correlation between wall thickness and the benign or malignant nature of cavitary lung lesions. These are forms of lung cancer in which the growth of cancerous cells occurs in the wall of a thin-walled cyst, usually in an asymmetric fashion to a focal or diffuse thickening of the walls.[8,9] Although malignancy can be the cause of the cyst, this tends to be diagnosed at a later stage, when asymmetric thickening of the walls is perceptible on CT (Figure 1).

The findings of Giacomelli et al.[1] can support future research on radiomics of lung lesions. Their study adds information to the findings of Beig et al.,[10] who also highlighted the importance of analyzing the internal structure and perinodular regions of lung lesions in order to distinguish between malignant and benign lung diseases.

This editorial acknowledges the contribution of that study[1] and aims to instigate further research and systematic reviews that can support the development of robust radiomics in thoracic imaging, which is crucial to provide an accurate and fast diagnosis, minimizing the variability of patient care.

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