



## The reversed halo sign in COVID-19

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Two patients diagnosed with COVID-19, confirmed by RT-PCR, presented distinct aspects of the reversed halo sign on chest computed tomography (CT) scans (Figure 1).

The reversed halo sign (RHS), seen on chest CT scans, is defined as a rounded or oval area of ground-glass opacity, completely or partially surrounded by a consolidation ring. This sign is described not only in organizing pneumonia (OP) but in a broad spectrum of infectious and non-infectious diseases. Despite being considered a nonspecific sign, the careful analysis of its morphological characteristics can narrow down the differential diagnosis, helping assistant physicians establish the definitive diagnosis.

The RHS in patients with COVID-19 may be related to associated infectious diseases, or might be due to the evolutionary phases of COVID-19 itself. The primary alterations related to COVID-19 that can occur with RHS are OP and pulmonary infarction. This differential diagnosis is extremely important, as different therapeutic approaches

will be needed. RHS secondary to the organization of the inflammatory process, with OP, presents with the classical aspect of ground-glass opacities surrounded by a halo of consolidation.

Areas of low attenuation within the halo, with or without reticulation (reticular RHS), strongly suggest pulmonary infarction. The subpleural and inferior pulmonary location, as well as the occurrence of pleural effusion in association with RHS, may also favor this diagnosis. In reticular RHS, the patient's immunological status is the most important clinical information for the differential diagnosis. In immunodeficient patients, the main diagnostic hypothesis is invasive fungal diseases. Meanwhile, in immunocompetent patients, the finding of reticular RHS, in general, corresponds to pulmonary infarction. The pathophysiology of vascular disease in patients with COVID-19 is controversial and may involve *in situ* microvascular thrombosis or pulmonary embolism originating from pelvic or lower limb veins. Since pulmonary vascular disease in COVID-19 mainly



**Figure 1.** In A, classical reversed halo sign, with rounded ground-glass opacity surrounded by a halo of consolidation (asterisk). Also note the consolidation in the posterior lung parenchyma. In B, reticular reversed halo sign (arrows) with an aspect of central reticulation and peripheral, subpleural location, in addition to associated pleural effusion. Note also the thinning of the adjacent artery, with an aspect of irregularities in its contours (arrowheads).

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involves segmental and subsegmental arteries, some authors suggest that the development of pulmonary infarction in COVID-19 is more often attributable to pulmonary vessel thrombosis caused by severe pulmonary inflammation and hypercoagulability than to thromboembolism<sup>(1,2)</sup>.

In conclusion, the RHS is a common, non-contrast CT finding in patients with COVID-19 that may be related

to two distinct pathophysiological events with different imaging characteristics: classical RHS, suggestive of diagnosis of OP, and reticular RHS, which suggests the diagnosis of pulmonary infarction, especially when accompanied by pleural effusion, sudden clinical worsening, and elevation of the D-dimer. Under these conditions, unless contraindicated, CT pulmonary angiography should be considered.

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## REFERENCES

1. Sales AR, Casagrande EM, Hochegger B, Zanetti G, Marchiori E. The Reversed Halo Sign and COVID-19: Possible Histopathological Mechanisms Related to the Appearance of this Imaging Finding. *Arch Bronconeumol*. 2021;57(S1):70–96. <https://doi.org/10.1016/j.arbres.2020.06.029>.
2. Marchiori E, Nobre L, Hochegger B, Zanetti G. The Reversed Halo Sign: Considerations in the Context of the COVID-19 Pandemic. *Thromb Res* 2020;195:228-30. <https://doi.org/10.1016/j.thromres.2020.08.001>.