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Should Vascular Abnormalities Be Integrated Into the Chest CT Imaging Signature of Coronavirus Disease 2019?



To the Editor:

We enjoyed reading the systematic review recently published in *CHEST* (November 2020) by Adams et al.¹ Based on 28 studies that included 3,466 patients, the authors analyzed known CT findings and structured the disease's imaging signature. Expectedly, the most frequent pattern was ground glass opacity (81.0%), but more interesting was the high prevalence of "vascular thickening" (72.9%). Although vascular abnormalities have escaped the attention of early reports, they are described increasingly and recently gained interest regarding both pathophysiologic condition and prognosis.² We regret that this review did not include more insights into those critical changes. In the current knowledge, vascular signs can be subdivided into two groups: thromboembolic-related abnormalities and nonthrombotic vascular changes. We believe that both should receive more attention, be identified, and reported in coronavirus disease 2019 (COVID-19) CT imaging.

From this perspective, we are intrigued by the fact that the potential incremental value of pulmonary CT angiography was not reported in this article nor discussed as a limitation. The use of IV contrast material may not be indicated in all individuals with known or suspected COVID-19; however, simultaneous severe acute respiratory syndrome coronavirus 2 pneumonia and acute pulmonary embolism is a common association that leads to specific therapeutic decisions.³ High incidence of thromboembolic disease is a hallmark of severe COVID-19 disease and should prompt pulmonary CT angiography in selected patients.⁴ Furthermore, the role of severe acute respiratory syndrome coronavirus 2-induced inflammation and thromboembolic events has been debated extensively.⁵

Additionally, we would like to comment that Adams et al¹ classified vascular abnormalities as "bronchovascular abnormalities." This classification scheme suggests two assumptions: (a) the dilated vessel is not independent of bronchial abnormalities and (b) the dilated vessel is part of the bronchovascular anatomy complex, therefore necessarily an artery. Actually, dilated vessels are mostly veins running at a distance from the bronchi. When examining Figure 5 in their article, the



Figure 1 – Axial oblique CT pulmonary angiography in a patient with severe acute respiratory syndrome coronavirus 2 pneumonia shows ground-glass opacity in the right lower lobe and dilation of a blood vessel draining the affected lung segment (arrow). The dilated blood vessel is connected to the left atrium (star), demonstrating its venous nature.

dilated vessel is more likely to be a vein. The connection of the dilated vein with the left atrium is better seen on adjusted multiplanar reformation, as shown in [Figure 1](#).

For those reasons, we believe that vascular changes are independent of bronchoalveolar damage and should be integrated into the signature of the COVID-19. Furthermore, we think that CT angiography should be considered part of the imaging findings and might have a crucial impact on the decision-making process and patient treatment.

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References

1. Adams HJA, Kwee TC, Yakar D, Hope MD, Kwee RM. Chest CT imaging signature of coronavirus disease 2019 infection:

in pursuit of the scientific evidence. *Chest*. 2020;158(5):1885-1895.

2. Tekcan Şanlı DE, Yıldırım D. A new imaging sign in COVID-19 pneumonia: vascular changes and their correlation with clinical severity of the disease. *Diagn Interv Radiol*. 2021;27(2):172-180.
3. Moores L, Tritschler T, Brosnahan S, et al. Prevention, diagnosis, and treatment of VTE in patients with coronavirus disease 2019: CHEST Guideline and Expert Panel report. *Chest*. 2020;158(3):1143-1163.
4. Hauguel-Moreau M, Hajjam ME, De Baynast Q, et al. Occurrence of pulmonary embolism related to COVID-19 [published online ahead of print October 6, 2020]. *J Thromb Thrombolysis*. <https://doi.org/10.1007/s11239-020-02292-4>.
5. Wells P. Hypercoagulability in COVID-19. *Journal of the South African Heart Association*. 2020;17(3):266-274.

Response



To the Editor:

We thank Rotzinger and Qanadli for the interest in our article on the chest CT imaging signature of coronavirus disease 2019 (COVID-19) infection.¹ In our article, we reported a pooled prevalence of vascular thickening of 72.9% (95% CI, 64.4% to 81.4%) in patients with COVID-19.¹ At the time our article was published, there was a lack of scientific data that correlated chest CT imaging to postmortem pathologic findings in this disease. Recently, Henkel et al² published a series of 14 patients who died of COVID-19, in whom a morphologic comparison of antemortem chest CT scans with postmortem gross findings and histopathologic findings was performed. Five of 14 patients in their study also underwent contrast-enhanced CT imaging.² Both vascular thickening (vascular enlargement/vascular congestion) and pulmonary arterial enlargement (related to the corresponding bronchus) were present in 12 of 14 patients (86%) on chest CT imaging.² Based on their histopathologic correlation and previous autopsy studies,^{3,4} Henkel et al² speculated that the observation of enlarged pulmonary arteries might be related to an increase of parenchymal and predominantly intravascular pressure, due to severe COVID-19 pulmonary microangiopathy that affected the alveolar capillary network. The high incidence of microthrombosis was also thought to be suggestive of a possible underestimation of the vascular alterations associated with COVID-19 with the use of imaging, especially on unenhanced scans.² Henkel et al² concluded that both severe acute lung injury and vascular complications contribute to fatal outcomes. These considerations largely resonate with the excellent remarks by Rotzinger and Qanadli.¹ Nevertheless, the scientific evidence on the pathophysiologic condition and clinical relevance of vascular changes on chest CT imaging in COVID-19, besides frank pulmonary

embolism, is still limited, and the interpretation of this limited evidence remains somewhat speculative. Further studies are warranted to understand the nature of vascular abnormalities seen on chest CT scans and how this can help to improve patient management and outcome.

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References

1. Adams HJA, Kwee TC, Yakar D, Hope MD, Kwee RM. Chest CT imaging signature of coronavirus disease 2019 infection: in pursuit of the scientific evidence. *Chest*. 2020;158(5):1885-1895.
2. Henkel M, Weikert T, Marston K, et al. Lethal COVID-19: radiological-pathological correlation of the lungs. *Radiol Cardiothorac Imaging*. 2020;2(6):e200406.
3. Wichmann D, Sperhake JP, Lütgehetmann M, et al. Autopsy findings and venous thromboembolism in patients with COVID-19: a prospective cohort study. *Ann Intern Med*. 2020;173(4):268-277.
4. Ackermann M, Verleden SE, Kuehnel M, et al. Pulmonary vascular endothelialitis, thrombosis, and angiogenesis in Covid-19. *N Engl J Med*. 2020;383(2):120-128.

Corticosteroid Plus Tocilizumab in COVID-19 When Two Is Better Than One



To the Editor:

We compliment the retrospective study by Narain et al¹ in *CHEST* (March 2021) that analyzed and compared the risk of death with different immunotherapies in patients with coronavirus disease 2019 (COVID-19). The findings of the study had some implications for the use of immunotherapy in this patient population. Specifically, the study found that the use of corticosteroids reduced the risk of death (hazard ratio [HR], 0.66; 95% CI, 0.57-0.76), but no survival advantage was observed with the use of tocilizumab, an IL-6 receptor monoclonal antibody (HR, 0.79; 95% CI,