



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



## Medical Imagery

## Destructive pulmonary fibrosis after severe COVID-19 pneumonia



## ARTICLE INFO

## Article history:

Received 10 August 2020

Received in revised form 9 September 2020

Accepted 11 September 2020

## Keywords:

COVID – 19 pneumonia

Pulmonary fibrosis

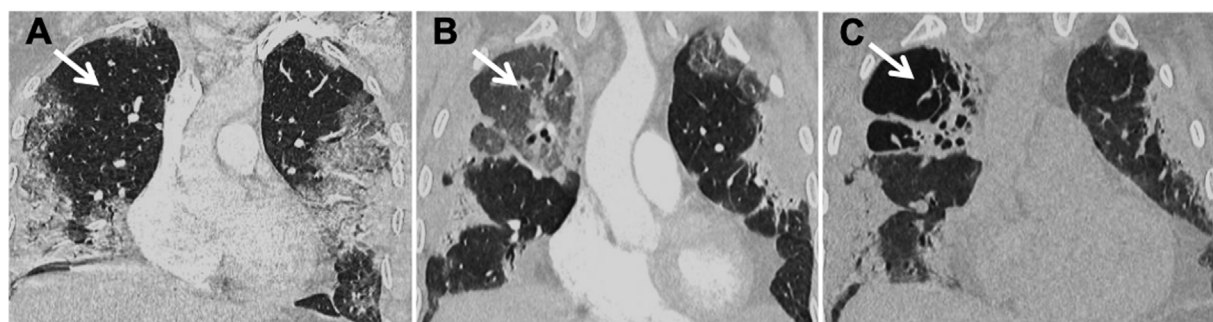
Pulmonary cavity

## Case presentation

A 65-year-old man was admitted to the intensive care unit (ICU) of Tenon hospital, a university teaching hospital in Paris, France, for severe confirmed COVID-19 pneumonia. He had a history of diabetes. In the preceding week, the patient developed fever (39 °C), cough, and shortness of breath. A chest computed tomography (CT) scan showed bilateral ground glass opacities with alveolar consolidation (Figure 1A) predominant in the lung periphery as usually reported in COVID-19 pneumonia (Chung et al. 2020; Jajodia et al. 2020). Advanced life support was administered including lung-protective ventilation, prone-positioning, and vasoconstrictors. Empirical antimicrobial therapy was initiated, in association with hydrocortisone. The infusion of Tocilizumab was administered (Zhang et al. 2020). After initial improvement, the patient's condition worsened. A second CT scan was performed

on day 20, showing the extent of the right upper lobe lesions with a crazy paving pattern (Figure 1B). Multiple organ failure persisted. Two episodes of ventilator-associated pneumonia (VAP) were treated on day 16 (*Citrobacter koseri*) and day 40 (*Achromobacter xylosoxidans*). Pulmonary fibrosis with bronchiectasis and cavitation developed in the right upper lobe (Figure 1C). A bronchoalveolar lavage revealed macrophagic alveolitis. Fifty-four days after admission, the patient died of persisting multiple organ failure.

Acute cavitary lung lesions are usually related to mycobacterial, parasitic, fungal, or bacterial infection, particularly *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and other gram-negative bacilli. In our case, despite VAP due to *Citrobacter koseri* and *Achromobacter xylosoxidans*, this hypothesis is unlikely because neither radiological changes nor signs of necrotizing pneumonia were present on successive chest x-rays. Other causes of lung cavitation, such as autoimmune disorder or genetic mutations, were not



**Figure 1.** Follow-up chest computed tomography scan of a 65-year-old man with confirmed COVID-19 pneumonia.

(A) Coronal chest computed tomography scan showing the evolution of the right upper lobe with initial normal pulmonary parenchyma on admission (day 1, arrow). (B) Ground-glass opacity at day 20 (arrow). (C) Fibrosis formation with traction bronchiectasis and cavitation at day 40 (arrow).

<https://doi.org/10.1016/j.ijid.2020.09.026>

1201-9712/© 2020 The Author(s). Published by Elsevier Ltd on behalf of International Society for Infectious Diseases. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

investigated but the speed of the development of cavitory lesion in a few days was considered atypical. In the last hypothesis, although interleukin 6 (IL-6) inhibitor-induced interstitial lung disease has already been described, cavitation related to tocilizumab has not been reported, thus it should be reported as a related side adverse event.

Severe COVID-19 pneumonia may progress to pulmonary fibrosis (George et al. 2020) related to diffuse alveolar damage, but the association with lung cavitation is uncommon and may significantly impair the outcome (Chen et al. 2020).

#### Authors' contributions

All authors had access to the data and a role in writing the manuscript.

#### Funding

No specific funding was available for the generation of this manuscript.

#### Compliance with ethical standards

Consent was obtained from the relative.

#### Disclosure of interest

The authors declare that they have no competing interest.

#### Acknowledgments

We would like to thank Prof. François Cornelis for the selection and formatting CT images.

#### References

- Chen Y, Chen W, Zhou J, Sun C, Lei Y. Large pulmonary cavity in COVID-19 cured patient case report. *Ann Palliat Med* 2020; Jun 9.
- Chung M, Bernheim A, Mei X, Zhang N, Huang M, Zeng X, et al. CT Imaging Features of 2019 Novel Coronavirus (2019-nCoV). *Radiology* 2020;295(1):202–7.
- George PM, Wells AU, Jenkins RG. Pulmonary fibrosis and COVID-19: the potential role for antifibrotic therapy. *Lancet Respir Med* [Internet] 2020;. . May 15 [cited 2020 Aug 3]; Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7228727/>.
- Jajodia A, Ebner L, Heidinger B, Chaturvedi A, Prosch H. Imaging in corona virus disease 2019 (COVID-19)-A scoping review. *Eur J Radiol Open* 2020;100237 May 11.
- Zhang C, Wu Z, Li J-W, Zhao H, Wang G-Q. The cytokine release syndrome (CRS) of severe COVID-19 and Interleukin-6 receptor (IL-6R) antagonist Tocilizumab may be the key to reduce the mortality. *Int J Antimicrob Agents* 2020;105954 Mar 29.

Alice Letellier<sup>a</sup>

Aude Gibelin<sup>a</sup>

Guillaume Voiriot<sup>a,b</sup>

Muriel Fartoukh<sup>a,b</sup>

Michel Djibré<sup>a,\*</sup>

<sup>a</sup>AP-HP, Hôpital Tenon, Service de Médecine intensive Réanimation, DMU APPROCHES, Hôpital Tenon, 4 rue de la Chine 75020 PARIS cedex 20, France

<sup>b</sup>Sorbonne Université, Groupe de Recherche Clinique CARMAS, Collégium Gallilée, Paris, France

\* Corresponding author at: Hôpital Tenon, Assistance Publique - Hôpitaux de Paris, 04 rue de la Chine, 75020 Paris, France.  
E-mail address: [michel.djibre@aphp.fr](mailto:michel.djibre@aphp.fr) (M. Djibré).

Received 10 August 2020

Received in revised form 9 September 2020

Accepted 11 September 2020