

CASE REPORT

Open Access



Chest computed tomography findings typical of COVID-19 pneumonia in Germany as early as 30 December 2019: a case report

Antonia Petersen*, Sebastian Nagel, Bernd Hamm and Matthias Taupitz

Abstract

Background The first cases of coronavirus disease 2019 were officially confirmed in Germany and its European neighbors in late January 2020. In France and Italy, there is evidence that coronavirus disease 2019 was spreading as early as December 2019.

Case presentation We report on a 71-year-old male patient from Germany who was admitted to our hospital on 30 December 2019 with pneumonia of unclear etiology and chest computed tomography findings typical of COVID-19 pneumonia.

Conclusion This case may indicate that coronavirus disease 2019 was already spreading in Germany as early as December 2019.

Keywords COVID-19, Computed tomography, Europe, Germany, 2019, Case report

Background

On 31 December 2019, the Wuhan Municipal Health Commission in Wuhan City, Hubei Province, China reported a cluster of pneumonia cases of unclear etiology [1]. On 9 January 2020, the identification of a novel coronavirus, later named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), as the causative agent was announced by Chinese scientists [2]. On 30 January 2020, the World Health Organization (WHO) declared that the outbreak constitutes a Public Health Emergency of International Concern [3]. The first cases of coronavirus disease 2019 (COVID-19) in Europe were confirmed in France on 24 January 2020 in persons with a recent stay in Wuhan [4]. In Germany, the first case of COVID-19

was officially confirmed on 27 January 2020. This person had attended meetings in Germany with a Chinese business partner who tested positive for SARS-CoV-2 after she developed symptoms on her flight back to China [5].

We report on a 71-year-old male patient from Germany with respiratory symptoms who was in our care from 30 December 2019. Chest computed tomography findings suggested an atypical pneumonia. Retrospectively, the infiltrates show the characteristic appearance and distribution pattern of COVID-19 pneumonia.

The case was discovered when we were looking for evidence that SARS-CoV-2 had spread in Germany earlier than officially confirmed. For this purpose, we looked for findings typical of COVID-19 pneumonia in the chest computed tomography scans from December 2019.

Case presentation

Admission to our hospital occurred on 30 December 2019 after the patient's general condition had continuously deteriorated over 7 days following a fall. On arrival, the patient presented in a poor general condition.

*Correspondence:

Antonia Petersen
antonia.petersen@charite.de
Department of Radiology, Charité-Universitätsmedizin Berlin, Corporate Member of Freie Universität Berlin and Humboldt-Universität zu Berlin, Hindenburgdamm 30, 12203 Berlin, Germany



© The Author(s) 2023. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

Auscultation revealed a reduced vesicular breath sound, bilateral rales, and an expiratory wheeze. Pulse oximetry showed an oxygen saturation of 90%. Heart rate was 92 beats per minute and blood pressure was 118/91 mmHg. The patient's body temperature was increased to 37.8 °C. Blood analysis showed an elevation in white blood cell count (11,230/mm³) and c-reactive protein (39 mg/l). Creatinine was 1.66 mg/dl (146.1 μmol/l), estimated glomerular filtration rate (eGFR) according to the Chronic Kidney Disease Epidemiology Collaboration was 41 ml per minute per 1.73 m² of body surface area. Known pre-existing conditions included diabetes mellitus type II, hypertension, and hyperlipidemia. The patient was overweight. He had a history of smoking and suffered a stroke in the past. The patient had not been vaccinated against influenza. In the weeks before his hospitalization, he had been in regular contact with different people. He had not taken a trip abroad recently.

A contrast-enhanced computed tomographic scan of the head, neck, thorax, and abdomen was performed on the day of admission to exclude traumatic injury and to search for infectious foci. No traumatic injuries were found. The chest computed tomography (Fig. 1A–D) showed bilateral areas of ground-glass opacity with peripheral distribution. Both lower lobes were involved, and a posterior predilection could be seen. In parts, interlobular lines were visible resulting in a “crazy paving”

pattern. Segmental and subsegmental vessels appeared dilated. There was no pleural effusion. The mediastinal lymph nodes were only slightly enlarged (Additional file 1 and 2). The computed tomography did not show evidence of other foci of infection. We diagnosed atypical pneumonia, including viruses as a possible causative pathogen.

Infection with *Legionella pneumophila* and *Streptococcus pneumoniae* was ruled out, but no further pathogen diagnostics took place. Blood and urine cultures remained without pathogen detection. Initially, the patient received antibiotic treatment with ampicillin/sulbactam and clarithromycin. His condition was stable when 2–4 l of oxygen per minute were administered via nasal cannula.

Four days after admission, the patient showed new neurological symptoms. In the subsequent computed tomography scan, an occlusion of the right internal carotid artery was diagnosed. Progressive pneumonic infiltrates were seen in the included lung portions (Fig. 2A, B). During the attempt to recanalize the occluded right internal carotid artery, the patient required intubation and remained intubated for 5 days.

The inflammatory parameters reached a maximum 6 days after hospitalization (C-reactive protein 177 mg/l, white blood cell count 16,300/mm³). Under escalated antibiotic therapy, they decreased again. Later in the course, the patient also suffered from catheter-associated

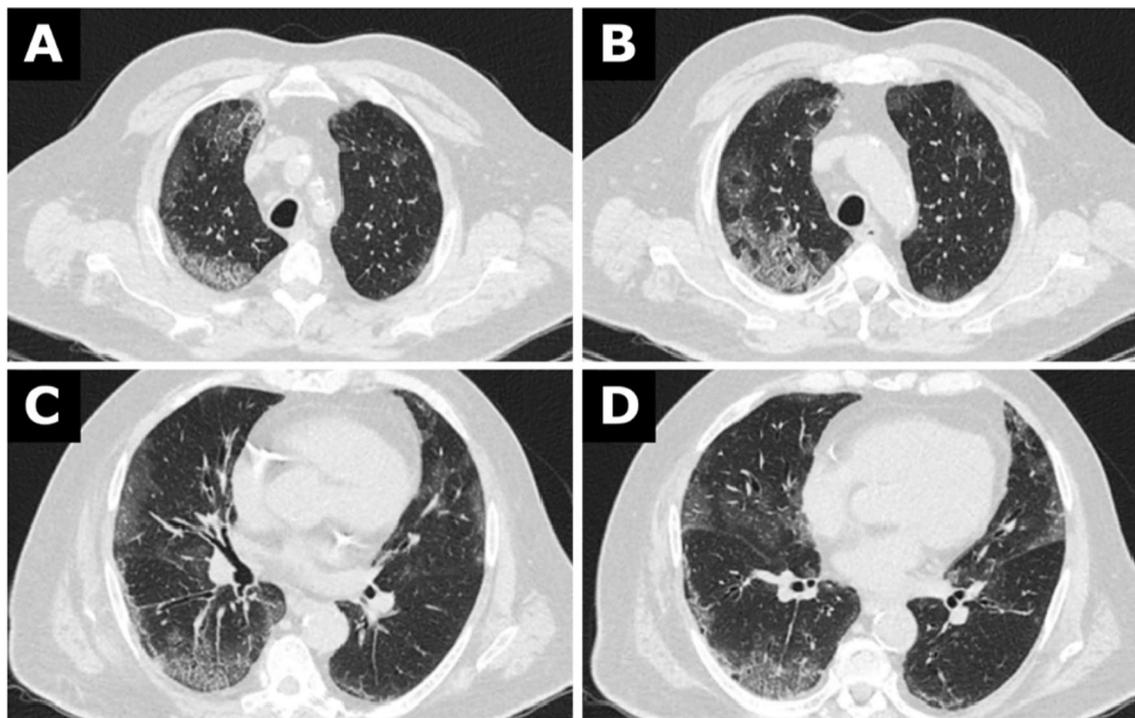


Fig. 1 A–D Chest computed tomography from 30 December 2019

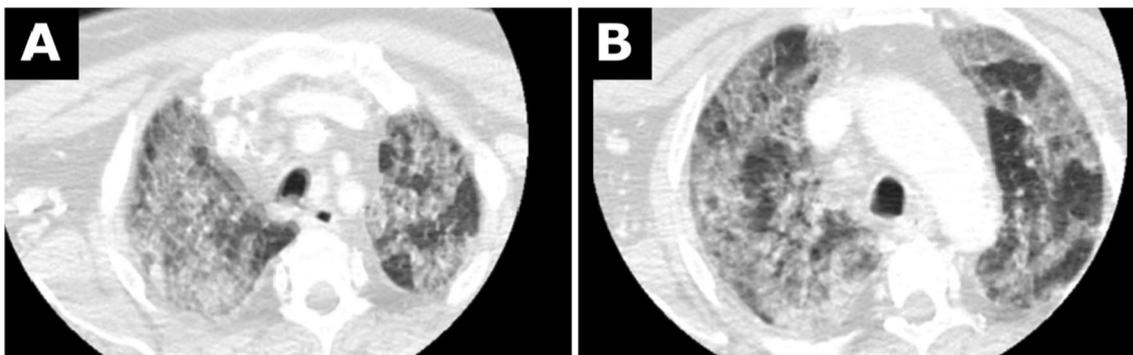


Fig. 2 A, B Chest computed tomography images as part of head and neck computed tomography from 3 January 2020

sepsis. Renal function recovered. Creatinine dropped to 0.75 mg/dl (66 μ mol/l, eGFR > 90 ml per minute per 1.73 m² of body surface area).

No further computed tomography was obtained. Chest radiographs showed decreasing pneumonic infiltrates. The patient was discharged home on 28 January 2020 with a severe persistent neurological deficit. He died in April 2020.

During his stay in hospital, the patient received regular visits from his family. One member of the family fell ill in early February 2020 and suffered from fever up to 41 °C for several days. A pathogen diagnosis did not take place.

Discussion

If an infection is suspected, COVID-19 can be diagnosed in several ways [6], with reverse transcription polymerase chain reaction (RT-PCR) as recommended by the WHO as the preferred method [7]. Unfortunately, blood samples are no longer available from our patient for subsequent analysis.

Meta-analyses have shown that chest computed tomography has a sensitivity of over 90% in the case of patients experiencing symptoms of COVID-19 [8, 9], which was the case with our patient. His chest computed tomography findings match the typical appearance of COVID-19: peripheral, bilateral, ground-glass opacities with or without consolidation or visible intralobular lines (“crazy-paving”) [10]. Beyond that, vascular enlargement, bilateral abnormalities, lower lobe involvement, and posterior predilection are among the computed tomography abnormalities with a high incidence (>70%) in RT-PCR test-proven COVID-19 cases [11]. There was no pleural effusion and no lymphadenopathy, which is also characteristic of COVID-19 [12].

Considering the chest computed tomography findings, it is likely that our patient is one of the earliest cases of COVID-19 in Germany. The clinical course is consistent with this assumption. Advanced age and male gender, as

well as comorbidities, are more often associated with a more severe course [13]. High creatinine on admission is associated with a higher risk of in-hospital death [14]. Acute ischemic stroke severity in patients with COVID-19 is typically moderate at least (NIHSS score 19 ± 8), with a high prevalence (40.9%) of large vessel occlusion [15]. The high inflammatory parameters that the patient presented 6 days after hospitalization could have been caused by a bacterial superinfection.

This case suggests that COVID-19 was already spreading in Germany in December 2019. There is other evidence that SARS-CoV-2 was already spreading in Europe in December 2019. SARS-CoV-2-RNA was detected in wastewater samples in northern Italy as early as 18 December 2019 [16]. Wastewater-based epidemiology has proven to be a helpful tool for COVID-19 surveillance. In many places worldwide, the level of SARS-CoV-2-RNA in wastewater samples correlated with local COVID-19 incidence, preceding the increase of new clinical cases in the population by 1–3 weeks [17]. In France, RT-PCR was performed retrospectively on stored respiratory samples from December 2019. In one case dated 27 December 2019, the diagnosis of COVID-19 was confirmed [18].

As a limitation, it must be noted that a COVID-19 diagnosis could not be confirmed by RT-PCR for our patient. Differentially, an atypical pneumonia caused by another pathogen or other pathological conditions with similar chest computed tomography findings must be considered.

Conclusion

The WHO has set itself the goal of investigating the origins of COVID-19 further. Retrospective examination of chest computed tomography for evidence of COVID-19 is listed as an appropriate means in this regard [19]. We present a patient who was admitted to our hospital on 30 December 2019 with pneumonia of unclear etiology, with

chest computed tomography findings typical of COVID-19 pneumonia. This may indicate that COVID-19 was already spreading in Germany as early as December 2019.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s13256-023-03809-0>.

Additional file 1. Chest computed tomography from 30 December 2019.

Additional file 2. Chest computed tomography from 30 December 2019, lungs window.

Acknowledgements

Not applicable.

Author contributions

AP: conceptualization, manuscript writing. SN: conceptualization, manuscript editing. BH: conceptualization, manuscript editing. MT: conceptualization, manuscript editing. All authors read and approved the final manuscript.

Funding

Open Access funding enabled and organized by Projekt DEAL. No funding to declare.

Availability of data and materials

Not applicable.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Written informed consent was obtained from the patient's next of kin for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing interests

See ICMJE form for disclosure of potential competing interests.

Received: 21 November 2021 Accepted: 31 January 2023

Published online: 24 March 2023

References

- European Centre for Disease Prevention and Control. Rapid Risk Assessment: Outbreak of acute respiratory syndrome associated with a novel coronavirus, Wuhan, China; first update. ECDC: Stockholm, January 2020. <https://www.ecdc.europa.eu/en/publications-data/risk-assessment-outbreak-acute-respiratory-syndrome-associated-novel-coronavirus>. Accessed 2 Nov 2021.
- Zhu N, Zhang D, Wenling W, Li X, Yang B, Song J, et al. A novel coronavirus from patients with pneumonia in China, 2019. *N Engl J Med*. 2020;382(8):727–33.
- Global Research Collaboration for Infectious Disease Preparedness. COVID 19 Public Health Emergency of International Concern. R&D Blueprint, February 2020. https://www.who.int/blueprint/priority-diseases/key-action/Global_Research_Forum_FINAL_VERSION_for_web_14_feb_2020.pdf. Accessed 2 Nov 2021.
- Stoecklin SB, Rolland P, Silue Y, Maillies A, Campese C, Simondon A, et al. First cases of coronavirus disease 2019 (COVID-19) in France: surveillance, investigations and control, January 2020. *Euro Surveill*. 2020;25(6):2000094.
- Rothe C, Schunk M, Sothmann P, Bretzel G, Froeschl G, Wallrauch C, et al. Transmission of 2019-nCoV Infection from an asymptomatic contact in Germany. *N Engl J Med*. 2020;382(10):970–1.
- Taleghani N, Taghipour F. Diagnosis of COVID-19 for controlling the pandemic: a review of the state-of-the-art. *Biosens Bioelectron*. 2021;174:112830.
- WHO/2019-nCoV/Surveillance_Case_Definition/2020.2. https://www.who.int/publications/i/item/WHO-2019-nCoV-Surveillance_Case_Definition-2020.2. Accessed 2 Nov 2021.
- Adams HJA, Kwee TC, Yakar D, Hope MD, Kwee RM. Systematic review and meta-analysis on the value of chest CT in the diagnosis of coronavirus disease (COVID-19): sol scientiae. *Illustra nos AJR Am J Roentgenol*. 2020;215(6):1342–50.
- Böger B, Fachi MM, Vilhena RO, Cobre AF, Tonin FS, Pontarolo R. Systematic review with meta-analysis of the accuracy of diagnostic tests for COVID-19. *Am J Infect Control*. 2021;49(1):21–9.
- Simpson S, Kay FU, Abbara S, Bhalla S, Chung JH, Chung M, et al. Radiological Society of North America Expert Consensus statement on reporting chest CT findings related to COVID-19. Endorsed by the Society of Thoracic Radiology, the American College of Radiology, and RSNA. *J Thorac Imaging*. 2020;2(2):e200152.
- Kwee TC, Kwee RM. Chest CT in COVID-19: what the radiologist needs to know. *Radiographics*. 2020;40(7):1848–2186.
- Carotti M, Salaffi F, Sarzi-Puttini P, Agostini A, Borgheresi A, Minorati D, et al. Chest CT features of coronavirus disease 2019 (COVID-19) pneumonia: key points for radiologists. *Radiol Med*. 2020;125(7):636–46.
- Hu B, Guo H, Zhou P, Shi Z-L. Characteristics of SARS-CoV-2 and COVID-19. *Nat Rev Microbiol*. 2020;19(3):141–54.
- Portolés J, Marques M, López-Sánchez P, Valdenebro M, Muñoz E, Serrano ML, et al. Chronic kidney disease and acute kidney injury in the COVID-19 Spanish outbreak. *Nephrol Dial Transplant*. 2020;35(8):1353–61.
- Tan YK, Goh C, Leow AST, Tambyah PA, Ang A, Yap E, et al. COVID-19 and ischemic stroke: a systematic review and meta-summary of the literature. *J Thromb Thrombolysis*. 2020;50(3):587–95.
- La Rosa G, Mancini P, Ferraro GB. SARS-CoV-2 has been circulating in northern Italy since December 2019: evidence from environmental monitoring. *Sci Total Environ*. 2021;1(750):141711.
- De Lourdes A-O, Campos A, Matos AR, Rigotto A, Sotero-Martins A, Teixeira PFP, et al. Wastewater-based epidemiology (WBE) and viral detection in polluted surface water: a valuable tool for COVID-19 surveillance—a brief review. *Int J Environ Res Public Health*. 2020;17(24):9251.
- Deslandes A, Berti V, Tandjaoui-Lambotte Y, Alloui C, Carbone E, Zahar JR, et al. SARS-CoV-2 was already spreading in France in late December 2019. *Int J Antimicrob Agents*. 2020;55(6):106006.
- WHO (2020) WHO-convened Global Study of the Origins of SARS-CoV-2: Terms of References for the China Part. Terms of References—FINAL DRAFT. <https://www.who.int/publications/m/item/who-convened-global-study-of-the-origins-of-sars-cov-2>. Accessed 2 Nov 2021.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Ready to submit your research? Choose BMC and benefit from:

- fast, convenient online submission
- thorough peer review by experienced researchers in your field
- rapid publication on acceptance
- support for research data, including large and complex data types
- gold Open Access which fosters wider collaboration and increased citations
- maximum visibility for your research: over 100M website views per year

At BMC, research is always in progress.

Learn more biomedcentral.com/submissions

