

COVID-19 and aspiration pneumonia: similar pulmonary findings with different diagnoses. A pitfall in [18F]FDG PET/CT.

Virginia Liberini (✉ v.liberini@gmail.com)

University of Turin Department of Medical Sciences: Università degli Studi di Torino Dipartimento di Scienze Mediche <https://orcid.org/0000-0001-9416-6965>

Serena Grimaldi

University of Turin Department of Medical Sciences: Università degli Studi di Torino Dipartimento di Scienze Mediche

Martin W. Huellner

Zurich University Hospital Department of Nuclear Medicine: UniversitätsSpital Zurich Klinik für Nuklearmedizin

Francesca Giunta

University of Turin Department of Medical Sciences: Università degli Studi di Torino Dipartimento di Scienze Mediche

Costanza Bachi

University of Turin Department of Medical Sciences: Università degli Studi di Torino Dipartimento di Scienze Mediche

Sara Dall'Armellina

University of Turin Department of Medical Sciences: Università degli Studi di Torino Dipartimento di Scienze Mediche

Federica Onesti

University of Turin Department of Medical Sciences: Università degli Studi di Torino Dipartimento di Scienze Mediche

Francesco Ceci

University of Turin Department of Medical Sciences: Università degli Studi di Torino Dipartimento di Scienze Mediche

Carola Boccomini

University of Turin Department of Oncology: Università degli Studi di Torino Dipartimento di Oncologia

Massimiliano Icardi

University of Turin Department of Oncology: Università degli Studi di Torino Dipartimento di Oncologia

Désirée Deandreis

University of Turin Department of Medical Sciences: Università degli Studi di Torino Dipartimento di Scienze Mediche

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Abstract

Since December 2019, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has become a worldwide pandemic. Especially in the centers most affected by the pandemic, symptoms (such as fever, cough, myalgia, or fatigue) and/or radiological signs (such as ground-glass opacity) typically related to COVID-19 often diverted clinicians' attention from other diseases.

Despite the urgency to recognize and cure SARS-CoV-2 infection, a plethora of differential diagnoses must be considered, and other diseases must be equally and promptly treated, as described in this case report.

Introduction

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has become a worldwide pandemic. The infective illness (COVID-19) may vary from asymptomatic disease to life-threatening pneumonia [1–3].

Computer tomography (CT) plays a key role in detecting COVID-19 pneumonia [4]. Moreover, few cases have been detected incidentally by ^{18}F -Fluorodeoxyglucose ([^{18}F]FDG) positron emission tomography (PET)/CT [5–7].

Despite their high sensitivity, CT and PET/CT findings are unspecific and may overlap with other diseases [8] and may mislead from the right diagnosis, challenging the differential diagnosis and delaying the correct individual patient management for physicians.

We present two asymptomatic, immunocompromised [^{18}F]FDG PET/CT patients from a hospital in a COVID-19 hotspot, having similar lung findings suspicious for COVID-19 pneumonia - one of which was false positive.

Case Report

Patient 1 is an asymptomatic 80-year-old man with a history of non-Hodgkin lymphoma who underwent [^{18}F]FDG PET/CT after the end of immuno-chemotherapy in March 2020.

Compared with the previous PET/CT scan (Fig. 1.a), the current PET/CT (Fig. 1.b) showed resolution of mediastinal lymph node [^{18}F]FDG uptake (black arrow). However, PET/CT and CT images (Fig. 1.c-l) revealed the appearance of multiple bilateral FDG-avid ground-glass opacities (GGOs, yellow arrows), with a predominantly peripheral distribution in the posterior segments of the inferior lung lobes. Moreover, new mildly increased uptake was seen in several mediastinal lymph nodes, without enlargement on CT images (Fig. 1.b, red arrow).

Ground glass opacities are the most common CT finding in COVID-19 pneumonia, particularly in the early phase of the disease, especially in asymptomatic patients [9]. The pattern is usually multifocal, bilateral

and peripheral, with a posterior distribution, mainly in the lower lobes, while enlarged mediastinal or hilar lymph nodes are not typically observed [4, 10, 11].

FDG uptake has been described in COVID-19 pneumonia-related GGOs in both symptomatic and asymptomatic patients [5, 6, 12, 13], as well as in mediastinal lymph nodes [14].

Due to these findings, the patient was counseled, and isolation procedures and scanner sanitation measures were started. The gold standard for the diagnosis of COVID-19 infection, a reverse transcriptase-polymerase chain reaction (RT-PCR) test from pharyngeal swabs, was subsequently performed and confirmed the diagnosis of COVID-19 [1, 15].

Patient 2 is an asymptomatic 51-year-old man with a history of oral cavity squamous cell carcinoma, associated swallowing difficulties and repetitive aspiration pneumonia, previously treated by surgery, chemotherapy and immunotherapy, who underwent [18F]FDG PET/CT for restaging in March 2020.

Follow-up PET/CT (Fig. 2.b) showed a good partial metabolic response of the primary tumor (black arrows) compared with the baseline scan (Fig. 2.a). However, PET/CT showed the appearance of few bilateral GGOs (yellow arrows) in the posterior segments of the inferior lung lobes (Fig. 2.c-h) associated with hilar and mediastinal lymph nodes (Fig. 2.b, red arrow), both mildly FDG-avid.

Due to these findings suspicious for COVID-19, the patient was counseled, and isolation and sanitation measures were triggered. The patient was quarantined at home with adequate clinical monitoring. After two days, he developed fever $> 38^{\circ}\text{C}$, which resolved spontaneously. RT-PCR for SARS-CoV-2 was negative in two consecutive tests.

In this patient, considering the clinical history, [18F]FDG PET/CT findings matched an aspiration pneumonia, mimicking COVID-19 infection [16, 17].

Discussion

The SARS-CoV-2 pandemic has a considerable impact on nuclear medicine departments worldwide, and also false-positive cases may entail enormous efforts. While several articles have reported and suggested a potential clinical usefulness of [18F]FDG PET/CT in patients with suspected COVID-19 infection, especially at early stages when clinical symptoms are nonspecific, only Treglia has recently emphasized the risk of considering these findings as a “peculiar metabolic behavior of this infection” [18].

Different conditions, both infectious and noninfectious, are responsible for bilateral lung parenchymal involvement, developing either as focal or diffuse lung disease. Most of these diseases are characterized by an increased tropism for glucose by inflammatory cells recalled and activated by the infectious process or by tumor cells, translating into an increased uptake of [18F]FDG related to the increased glucose metabolism. PET/CT with [18F]FDG helps the characterization of these pathological processes, however, some of these, especially in the early stages of disease, may be difficult to distinguish from each other. Several studies have highlighted the few differences present radiologically and metabolically

between COVID-19 infection and other viral pneumonias: COVID-19 pneumonia is more likely to have a peripheral distribution (80% vs. 57%), ground glass opacity (91% vs. 68%), fine reticular opacity (56% vs. 22%), but less likely to have a central plus peripheral distribution (14% vs. 35%) and pleural effusion (4% vs. 39%) [19–21].

However, to the best of our knowledge, there is currently no evidence in the literature regarding the radiological and metabolic differences between COVID-19 and aspiration pneumonia. Aspiration pneumonia presents on [18F]FDG PET/CT with different patterns, usually very striking, as this clinical condition often leads to severe over-infection, with the development of lobar or segmental pneumonia, bronchopneumonia, lung abscess, and empyema. Frequently, PET/CT shows increased diffuse, intense and bilateral uptake especially in the posterior segment of the upper lobes and the superior segment of the lower lobes, which may mimic other FDG-avid pulmonary diseases. Nevertheless, in some cases, especially if diagnosed early, aspiration pneumonia may occur only with unilateral or bilateral ground glass, especially in cases of diffuse aspiration bronchiolitis in patients with esophageal conditions such as achalasia, Zenker's diverticulum or carcinoma of the oral cavity, especially esophageal, associated with dysphagia, regurgitation, and aspiration [22].

Therefore, there is currently no scientific evidence about the usefulness of [18F]FDG PET/CT in the evaluation of COVID-19 pneumonia, as metabolic behavior of this infection is not pathognomonic, but rather nonspecific. On the other hand, one should be more careful about the not remote possibility of identifying with [18F]FDG PET/CT an interstitial pneumonia (with ground-glass opacity) suspected of COVID-19 infection [18].

To the best of our knowledge, this report is the first to present a concrete example of the lack of specificity of PET/CT findings in COVID-19 pneumonia comparing to aspiration pneumonia. In case of PET/CT findings suggestive for COVID-19 pneumonia, asymptomatic patients should be carefully monitored or tested with RT-PCR, but at the same time, the differential diagnosis must be considered.

This case highlights how differential diagnosis on imaging remains a challenge, with the additional reason of providing proper individual patient management and avoiding overload of the COVID-19 surveillance system.

Declarations

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Conflict of interest: All the authors (VL, SG, MWH, FG, CB, SD, FO, FC, CB, MI and DD) declare that they have no conflict of interest. The authors received no financial support for the research, authorship, and/or publication of this article.

Ethical approval: All procedures performed in studies involving human participants were in accordance with ethical standards of the institutional and/or national committee and with the 1964 Helsinki

declaration and its later amendments or comparable ethical standards. The use of the data of these two patients was approved by A.O.U. Città della Salute e della Scienza di Torino Ethics Committee.

Consent to participate: Informed consent was obtained from all individual participants included in the study prior to imaging procedures.

Consent for publication: Not applicable.

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Author Contribution: DD designed the study; VL, SG, MWH and DD wrote the manuscript; FO, FG, CB, SD, FC, CB and MI contributed to collect the data and the images and commented on the manuscript. All authors reviewed the final manuscript.

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Figures

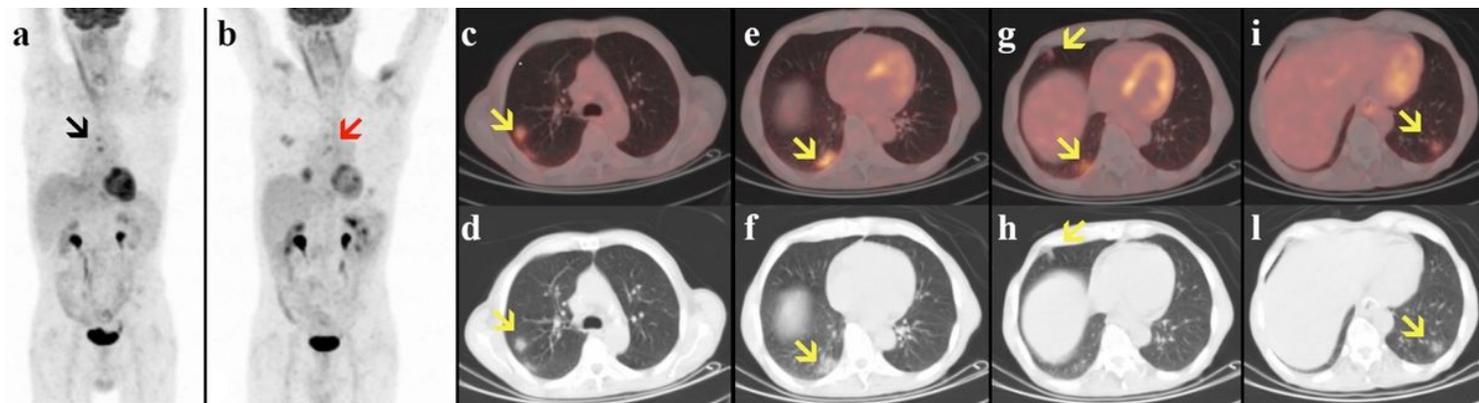


Figure 1

Previous (a) and current (b-l) [18F]FDG PET/CT of an asymptomatic 80-year-old man with a history of non-Hodgkin lymphoma. Maximum intensity projection (a-b), transaxial fused PET/CT (c, e, g, i) and CT (d, f, h, l) images of [18F]FDG uptake in the lungs.

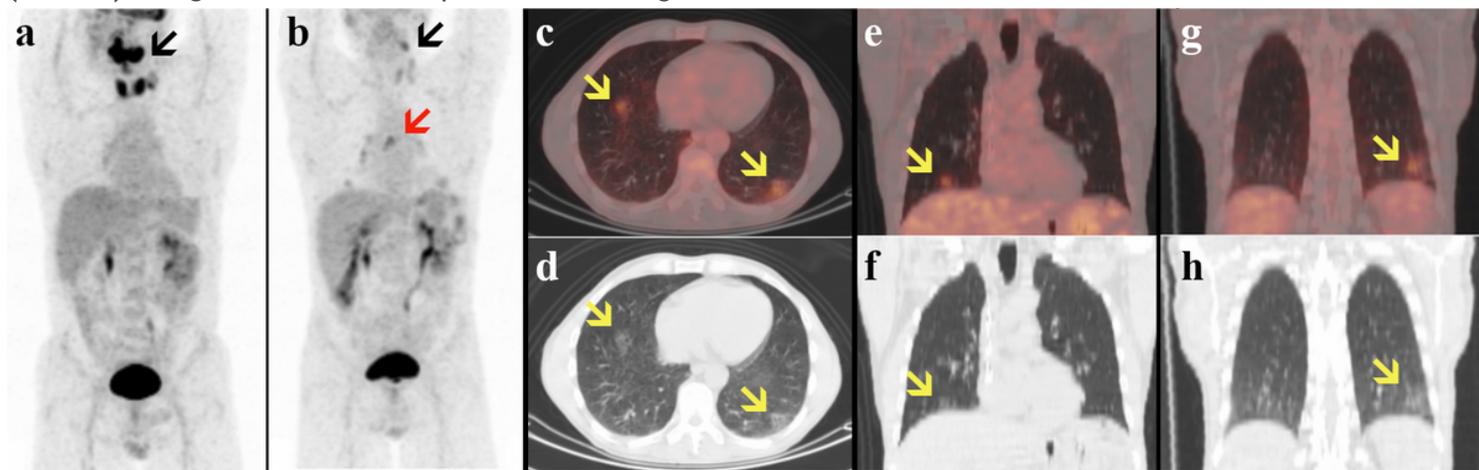


Figure 2

Previous (a) and current (b-l) [18F]FDG PET/CT of an asymptomatic 51-year-old man with a history of oral cavity squamous cell carcinoma. Maximum intensity projection (a-b), transaxial and coronal fused PET/CT (c, e, g) and CT (d, f, h) images of [18F]FDG uptake in the lungs.