

## Case Report

# COVID-19 messenger ribonucleic acid vaccination and abnormal radiopharmaceutical uptake in the axilla visualized on $^{68}\text{Ga}$ -DOTATATE positron-emission tomography/computed tomography

## ABSTRACT

As COVID-19 vaccination rates continue to rise, it is becoming increasingly important to understand diagnostic imaging associations' resultant from the vaccines. Here, we report a case of a 59-year-old female who was in remission for gastrointestinal neuroendocrine carcinoma and presented for standard follow-up imaging evaluation. Positron-emission tomography (PET) images from a  $^{68}\text{Ga}$ -DOTATATE PET (NETSPOT) demonstrated moderate focal radiotracer uptake in the right axilla. Interestingly, this uptake localized to several normal-sized lymph nodes on the corresponding computed tomography (CT). A medical history revealed the patient received both doses of an ipsilateral COVID-19 messenger ribonucleic acid vaccine injection at 17 and 38 days before the PET/CT study. Subsequent scans 2 months later revealed no radiotracer uptake.

**Keywords:**  $^{68}\text{Ga}$ -DOTATATE, COVID-19, NETSPOT, positron-emission tomography, vaccination

## INTRODUCTION

As of April 18, 2021, 206 million doses of COVID-19 vaccinations have been given in the United States.<sup>[1]</sup> As vaccination rates continue to rise, it is becoming increasingly important to understand incidental imaging findings resultant from these new messenger ribonucleic acid (mRNA) vaccines. Recently, there have been several groups that have reported fludeoxyglucose (FDG) uptake on positron-emission tomography/computed tomography (PET/CT) regarding COVID-19-related findings.<sup>[2-4]</sup> The most commonly reported features visualized on FDG-PET/CT in patients with COVID-19 include FDG uptake in pulmonary parenchymal lesions that are typically peripheral, bilateral, and ground-glass opacities.<sup>[3]</sup> In addition to this, COVID-19 disease having an association with radiopharmaceutical uptake in FDG-PET/CT, mRNA vaccinations have also been implicated with benign axillary node uptake.<sup>[5]</sup> False-positive associations can lead to unwarranted additional testing and biopsies of benign etiologies. With the growing uncertainty of COVID-19, it is critical that we understand and report diagnostic false positives on a variety of imaging modalities to ensure best practices.

One diagnostic agent used in the detection and characterization of neuroendocrine tumors is gaining substantial ground in clinical practice. Specifically, NETSPOT PET/CT utilizes a somatostatin analog to capture whole-body imaging of somatostatin receptor expression. The speed of  $^{68}\text{Ga}$ -DOTATATE PET/CT relative to FDG-PET/CT allows for the detection of smaller somatostatin-avid tumors such as neuroendocrine neoplasms.<sup>[6]</sup> Here, we report a rare false-positive case of right

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**Submitted:** 02-May-2021, **Revised:** 24-May-2021

**Accepted:** 24-May-2021, **Published:** 20-Aug-2021

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**How to cite this article:** Weissman JP, Bartel T. COVID-19 messenger ribonucleic acid vaccination and abnormal radiopharmaceutical uptake in the axilla visualized on  $^{68}\text{Ga}$ -DOTATATE positron-emission tomography/computed tomography. *World J Nucl Med* 2021;20:392-4.

Access this article online	
<b>Website:</b> www.wjnm.org	<b>Quick Response Code</b> 
<b>DOI:</b> 10.4103/wjnm.wjnm_54_21	

axillary radiopharmaceutical nodal uptake visualized with <sup>68</sup>Ga-DOTATATE PET/CT for a patient who presented to our nuclear medicine department for neuroendocrine indications. A medical history revealed that the patient received both doses of an ipsilateral COVID-19 mRNA vaccine injection at 17 and 38 days before the PET/CT evaluation.

## CASE REPORT

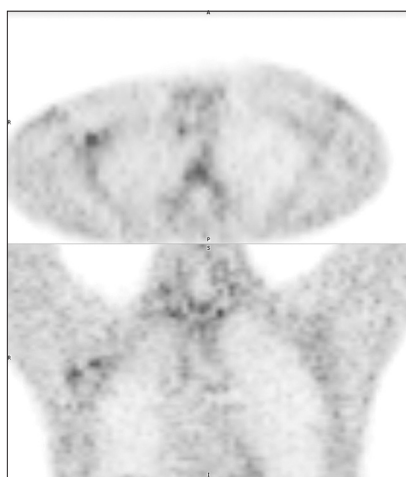
In January of 2021, a 59-year-old female with a known history of gastrointestinal neuroendocrine carcinoma presented to our clinic for the status of disease and was evaluated with <sup>68</sup>Ga-DOTATATE PET/CT. The PET scan displayed focal uptake of the somatostatin analog in the right axilla [Figure 1]. The intensity of uptake was moderate and corresponded to several normal-sized lymph nodes with no enlargement [Figure 2] on CT. Upon questioning, it was discovered that the patient had received both doses of a COVID-19 mRNA vaccination at 17 days and 38 days prior to this PET/CT. The ipsilateral COVID vaccine injection at 17 days and 38 days prior to imaging was given in the right deltoid. These findings were not present on a previous scan 4 months earlier (not shown). Subsequent scan 2 months later for standard treatment follow-up demonstrated resolution of infiltrates and associated radiopharmaceutical uptake (not shown).

## DISCUSSION

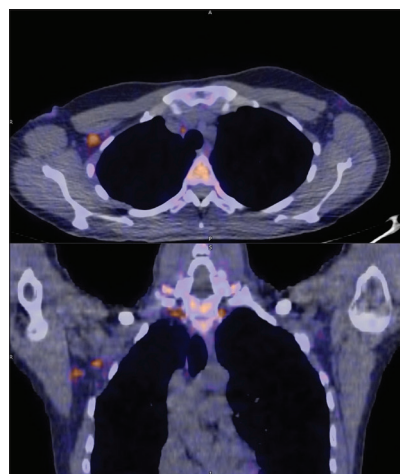
The COVID-19 pandemic has caused significant mortality throughout the world as well as social and economic disturbances. In the field of nuclear medicine, we describe some impactful imaging findings associated with the COVID-19 mRNA vaccinations.

The increase in reported incidental findings of COVID-19 on FDG-PET/CT imaging highlights the role nuclear medicine may have outside of the oncologic setting. FDG-PET/CT plays a role in evaluating various infectious, inflammatory, and other hypermetabolic diseases which may guide patient management and treatment. A few case reports and series have identified radiopharmaceutical uptake on FDG-PET/CT due to both COVID-19 disease and vaccination.<sup>[7,8]</sup> However, the association between NETSPOT PET/CT and COVID-19 vaccinations has not been previously reported.

In our case, a patient in remission for neuroendocrine cancer presented to our clinic for routine screening, and we observed benign uptake using <sup>68</sup>Ga-DOTATATE PET/CT. The patient had previously received a right ipsilateral COVID-19 injection 17 and 38 days prior to imaging. This was consistent with the observed findings. It is important that the clinician be aware of potential false positives when imaging with this radiopharmaceutical. We anticipate the utility of NETSPOT will gain a wider clinical approval within the coming years, and with the uncertainty of COVID-19, we must understand potential false-positive associations with this imaging modality. Documenting any vaccination prior to imaging may help to avoid false interpretation of the PET/CT scan. Current documented false-positive findings for <sup>68</sup>Ga-DOTATATE PET/CT include prostatitis, splenosis, pancreatic uncinata process activity, paraganglioma, meningioma, and osteoblastic activity among others.<sup>[7]</sup> This case adds COVID-19 vaccination to the list. With the growing number of worldwide COVID-19 cases, and the continued use of NETSPOT for somatostatin receptor-avid neoplasms, it is imperative that diagnostic measures of this disease are clearly understood. This case highlights the importance of including



**Figure 1:** Axial (top) and Coronal (bottom) <sup>68</sup>Ga-DOTATATE positron-emission tomography/computed tomography fusion images demonstrate focal uptake in the right axilla. Intensity of uptake is moderate



**Figure 2:** Axial (top) and coronal (bottom) <sup>68</sup>Ga-DOTATATE positron-emission tomography/computed tomography fusion images demonstrate that the uptake corresponds to several normal-sized and benign-appearing lymph nodes. Seventeen days before the scan, the patient had received an ipsilateral COVID vaccine injection on this side

COVID-19 vaccinations as a potential false positive when radiopharmaceutical uptake appears on NETSPOT PET/CT.

#### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

#### Financial support and sponsorship

Nil.

#### Conflicts of interest

There are no conflicts of interest.

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