

# Subdiaphragmatic Lymph Nodes Uptake on $^{18}\text{F}$ -FDG PET/CT After COVID-19 Vaccination in the Thigh

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**Abstract:** Since worldwide COVID-19 vaccination,  $^{18}\text{F}$ -FDG uptake in reactive axillary lymph nodes has been frequently observed in PET/CT studies. We describe a patient with breast cancer who underwent  $^{18}\text{F}$ -FDG PET/CT 7 days after receiving COVID-19 vaccination in the right thigh.  $^{18}\text{F}$ -FDG uptake was observed in nonenlarged right-sided inguinal, iliac, and para-aortic lymph nodes. As the thigh can be used as an alternate site for COVID-19 vaccine injection in case of lymphedema in both arms or for adequate axillary staging in patients with breast cancer, physicians should be aware of such  $^{18}\text{F}$ -FDG uptake pattern.

**Key Words:**  $^{18}\text{F}$ -FDG PET/CT, COVID-19, COVID-19 vaccine, vaccine-associated hypermetabolic lymphadenopathy

(*Clin Nucl Med* 2022;47: 275–276)

Received for publication July 11, 2021; revision accepted August 15, 2021.  
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Written informed consent was obtained from the patient.

Conflicts of interest and sources of funding: No competing financial interests exist related to the submitted work. E.Q. received speaker and congress fees from Advanced Accelerator Applications outside the submitted work.

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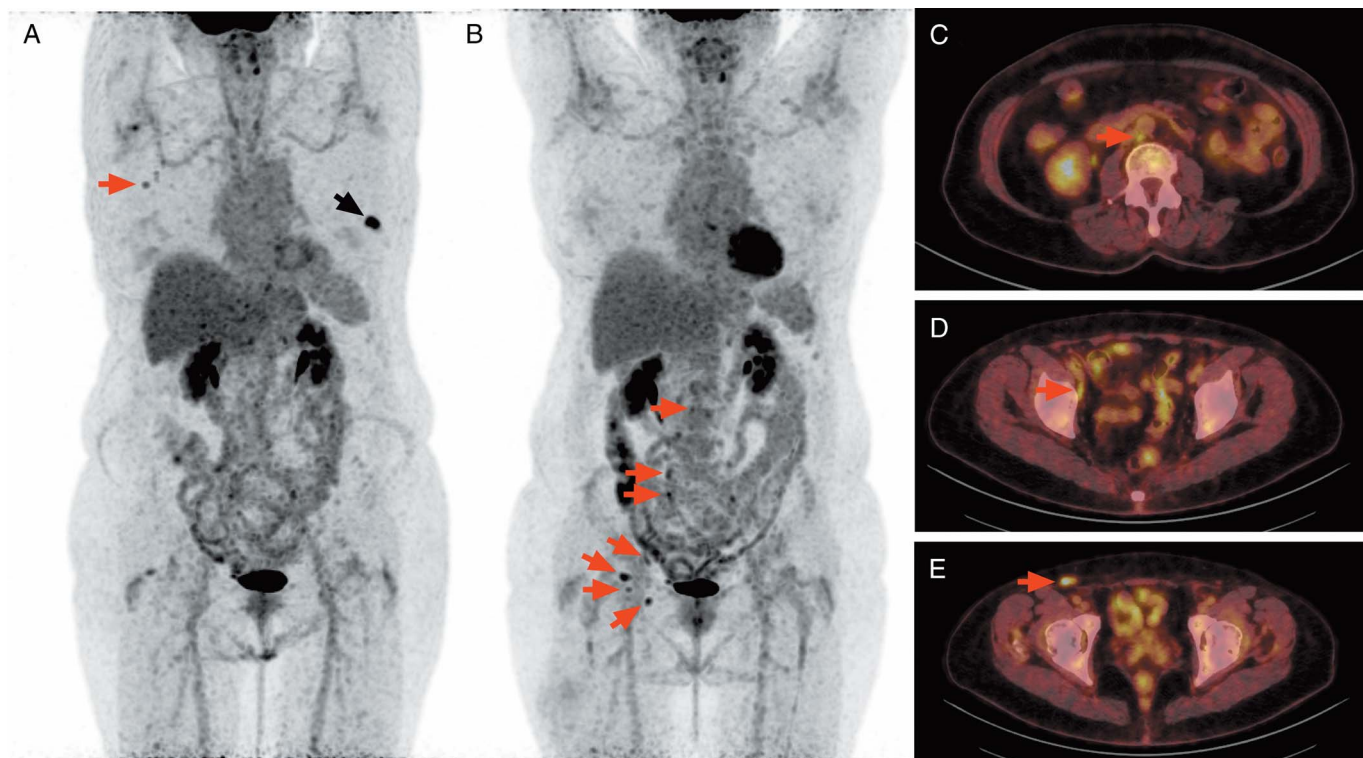
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ISSN: 0363-9762/22/4703-0275

DOI: 10.1097/RLU.00000000000003941

## REFERENCES

1. Brown AH, Shah S, Groves AM, et al. The challenge of staging breast cancer with PET/CT in the era of COVID vaccination. *Clin Nucl Med*. 2021. DOI: 10.1097/RLU.00000000000003683.
2. Cohen D, Krauthammer SH, Wolf I, et al. Hypermetabolic lymphadenopathy following administration of BNT162b2 mRNA COVID-19 vaccine: incidence assessed by [(18)F]FDG PET-CT and relevance to study interpretation. *Eur J Nucl Med Mol Imaging*. 2021;48:1854–1863.
3. Doss M, Nakhoda SK, Li Y, et al. COVID-19 vaccine-related local FDG uptake. *Clin Nucl Med*. 2021;46:439–441.
4. Moghimi S, Wilson D, Martineau P. FDG PET findings post-COVID vaccinations: signs of the times? *Clin Nucl Med*. 2021;46:437–438.
5. Nawwar AA, Searle J, Hopkins R, et al. False-positive axillary lymph nodes on FDG PET/CT resulting from COVID-19 immunization. *Clin Nucl Med*. 2021. DOI: 10.1097/RLU.00000000000003657.
6. Ulaner GA, Giuliano P.  $^{18}\text{F}$ -FDG-avid lymph nodes after COVID-19 vaccination on  $^{18}\text{F}$ -FDG PET/CT. *Clin Nucl Med*. 2021;46:433–434.
7. Xu G, Lu Y. COVID-19 mRNA vaccination-induced lymphadenopathy mimics lymphoma progression on FDG PET/CT. *Clin Nucl Med*. 2021;46:353–354.
8. The National Cancer Institute. Coronavirus vaccines and people with cancer: a Q&A with Dr. Steven Pergam 2021. <https://www.cancer.gov/news-events/cancer-currents-blog/2021/people-with-cancer-coronavirus-vaccine>. Accessed June 15, 2021.
9. Lehman CD, Lamb LR, D'Alessandro HA. Mitigating the impact of coronavirus disease (COVID-19) vaccinations on patients undergoing breast imaging examinations: a pragmatic approach. *AJR Am J Roentgenol*. 2021;217:584–586.
10. Lehman CD, D'Alessandro HA, Mendoza DP, et al. Unilateral lymphadenopathy after COVID-19 vaccination: a practical management plan for radiologists across specialties. *J Am Coll Radiol*. 2021;18:843–852.



**FIGURE 1.** Since the launch of large-scale COVID-19 vaccination,  $^{18}\text{F}$ -FDG uptake in reactive axillary lymph nodes (LNs) is frequently observed in PET/CT studies.<sup>1–7</sup> A 74-year-old woman underwent  $^{18}\text{F}$ -FDG PET/CT for staging of left breast cancer 2 weeks after receiving the first dose of the Oxford-AstraZeneca COVID-19 vaccination in the right arm.  $^{18}\text{F}$ -FDG PET/CT showed high uptake in the primary tumor (A, black arrow) without signs of LN or distant metastasis and moderate LN uptake in the right axilla related to vaccination (A, red arrow). After 3 cycles of neoadjuvant chemotherapy and 7 days after repeat Pfizer-BioNTech COVID-19 vaccine in the right thigh, she underwent  $^{18}\text{F}$ -FDG-PET/CT for response evaluation. Complete metabolic response was observed for the primary tumor, but  $^{18}\text{F}$ -FDG uptake was observed in nonenlarged right-sided inguinal, iliac, and para-aortic LNs related to the vaccination in the thigh (B–E, red arrows). In patients who previously received COVID-19 vaccine in the deltoid muscle, PET/CT studies can show  $^{18}\text{F}$ -FDG–positive LNs in the ipsilateral axilla that should not be mistaken for cancer, highlighting the need for the nuclear medicine physician to check timing and side of prior vaccination. The thigh can be used as an alternate injection site, for example in case of lymphedema in both arms.<sup>8</sup> COVID-19 vaccination in the thigh might also be an option for adequate axillary staging in patients with breast cancer.<sup>9,10</sup> Physicians should be aware of the previously described  $^{18}\text{F}$ -FDG uptake pattern in the subdiaphragmatic LN chains that vaccination in the thigh may provoke.