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Novel ^{68}Ga-FAPI PET/CT offers oncologic staging without COVID-19 vaccine-related pitfalls

Tristan T. Demmert[1,2], Ines Maric[1,2], Kelsey L. Pomykala[3], Katharina Lueckerath[1,2], Jens Siveke[2,4], Benedikt M. Schaarschmidt[5], Rainer Hamacher[2,6], Ken Herrmann[1,2], Wolfgang P. Fendler[1,2]

[1] Department of Nuclear Medicine, West German Cancer Center, University of Duisburg-Essen, Essen, Germany

[2] German Cancer Consortium (DKTK), Partner Site University Hospital Essen, and German Cancer Research Center (DKFZ), Essen, Germany

[3] Institute for AI in Medicine (IKIM), University Medicine Essen, Germany

[4] Bridge Institute of Experimental Tumor Therapy, West German Cancer Center, University Hospital Essen, Essen, Germany

[5] Department of Diagnostic and Interventional Radiology and Neuroradiology, University Hospital Essen, University of Duisburg-Essen, Essen, Germany

[6] Department of Medical Oncology, West German Cancer Center, University Hospital Essen, Essen, Germany

Corresponding author:

Wolfgang Peter Fendler, M.D., Department of Nuclear Medicine, West German Cancer Center, University Hospital Essen, Hufelandstr. 55, 45147 Essen, Germany
Telephone number: +49 201 723 2032
Fax number: +49 201 723 5964
E-mail: wolfgang.fendler@uk-essen.de

First author:

Tristan Thorben Demmert, M.D. Student, Department of Nuclear Medicine, West German Cancer Center, University Hospital Essen, Hufelandstr. 55, 45147 Essen, Germany
Telephone number: +49 201 723 2032
Fax number: +49 201 723 5964
E-mail: tristan.demmert@web.de

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ABSTRACT

In the setting of ongoing COVID-19 vaccination, vaccine-related tracer uptake in locoregional lymph nodes has become a well-known issue in tumor staging by ^{18}F-FDG PET/CT. ^{68}Ga-FAPI PET/CT is a new oncologic imaging tool that may overcome this limitation.

Methods: We assessed post-vaccine, head-to-head and same-day ^{18}F-FDG and ^{68}Ga-FAPI-46 PET/CT findings in a series of 11 patients from a large prospective imaging registry. All patients with documented tracer uptake in locoregional lymph nodes on PET/CT or PET/MRI, following vaccination within 6 weeks, were eligible for investigation.

Result: Significant visual lymph node uptake adjacent to the injection site was noted in 11/11 (100%) patients with ^{18}F-FDG PET/CT versus 0/11 (0%) with ^{68}Ga-FAPI PET/CT. ^{18}F-FDG detected 73% and ^{68}Ga-FAPI PET/CT 94% of all tumor lesions.

Conclusion: In this case-series study, ^{68}Ga-FAPI showed its potential to avoid ^{18}F-FDG-PET/CT post-vaccination pitfalls and presented superior tumor localization.

INTRODUCTION

Since the outbreak of the COVID-19 pandemic in 2019 and the start of global mass vaccination in November 2020, several clinical studies have addressed the issue of reactive tracer accumulation in locoregional lymph nodes and upper arm muscles (*1*). At local sites, ^{18}F-FDG is taken up by immune cells responding to the mRNA inflammatory stimulus (*2–4*). This observation is concerning as vulnerable groups, such as oncologic patients, undergo both regular booster shots and medical imaging. False positive findings on ^{18}F-FDG PET due to uptake in inflammatory cells may trigger false management decisions.

^{68}Ga-FAPI PET/CT is a novel imaging test directed at cancer-associated fibroblasts in the tumor stroma. Due to its unique mechanism targeting only activated fibroblasts and subtypes of cancer-associated fibroblasts, ^{68}Ga-FAPI PET/CT may be able to avoid false positive post-vaccine uptake. ^{68}Ga-FAPI PET/CT has emerged as a potential alternative to ^{18}F-FDG PET/CT in many tumor types and may avoid locoregional pitfalls caused by vaccination. Here we assess, same-day head-to-head post-vaccine ^{18}F-FDG and ^{68}Ga-FAPI PET/CT uptake in patients from a large prospective registry of oncologic imaging collected during the ongoing mass vaccination campaign in Germany.

METHODS

We selected 11 patients with ^{68}Ga-FAPI and ^{18}F-FDG PET/CTs (May 2021 to April 2022) from our prospective database, which is part of a large prospective observational study (NCT04571086). Enrollment is offered to all patients who undergo ^{68}Ga-FAPI-46 PET in our Department. 11 patients met the following criteria: (a) same-day ^{68}Ga-FAPI and ^{18}F-FDG PET for oncologic staging/restaging with ^{18}F-FDG at least 4 hours after ^{68}Ga-FAPI PET, (b) ^{68}Ga-FAPI and/or ^{18}F-FDG tracer uptake of local soft tissue or nodes with visual positive target-to-

background ratio on PET/CT, (c) COVID-19 vaccination within 6 weeks (d) no change in treatment between PET and vaccination (Figure 1).

The study was approved by the ethics committee (20-9485-BO and 19-8991-BO) and all patients gave written consent for enrollment into a prospective observational trial (NCT04571086).

Lymph nodes were considered positive when demonstrating visual focal uptake above background. Visual readings were performed by two nuclear medicine physicians in consensus. The median injected dose was 333 MBq [IQR 245-421] for ^{18}F-FDG and 102 MBq [IQR 79-125] for ^{68}Ga-FAPI. Follow up data included imaging and clinical information. All patients fasted for 6 hours before the ^{18}F-FDG scan and blood glucose (<200 mg/dl) was measured. Descriptive statistics are provided. An ANOVA-test was applied for assessing differences in standardized uptake value (SUV) among the different time frames after vaccination. The SUV was measured in the center of each lymph node, determined on fused PET/CT images.

6 (55%) Patients underwent imaging on a Siemens Biograph Vision and 5 (45%) on a mCT device. SUVpeak was selected based on phantom cross-calibration for the PET/CT devices to achieve reproducible results.

RESULTS

Patient characteristics are shown in Supplemental Table 1. Following database screening, 11 patients (5 men and 6 women) were included. Mean age was 44 years [IQR 34-54]. 3 (27%) underwent PET for staging and 8 (73%) for restaging. 5 (45%) patients had sarcoma and 6 (55%) patients had carcinoma. Considering combined findings from ^{68}Ga-FAPI and ^{18}F-FDG scans, 3 (27%) patients showed primary lesions only, 1 (9%) patient showed locoregional lesions, and 7 (64%) patients showed distant metastases. Distant metastatic disease was noted in visceral organs, bone, or soft tissue in 5 (45%), 1 (9%), or 1 (9%) patients, respectively. In

total, the thoracic cavity was tumor-free in 7 (64%) patients. Two (18%) of 11 patients had a thoracic primary, i.e., lung (n=1) and breast cancer (n=1) before chemotherapy, which have a higher likelihood of axillary nodal involvement (Supplemental Table 2).

10 (91%) patients received BNT162b2 vaccine and 1 (9%) patient mRNA1273 vaccine at a median interval of 19 [IQR 8-30] days before PET/CT. 11 (100%) patients demonstrated focal ^{18}F-FDG tracer uptake in axillary lymph nodes on PET/CT; none of the patients had focal ^{68}Ga-FAPI uptake. Details are listed in Supplemental Table 3. Uptake (SUV) at different times after vaccination in Figure 2A demonstrates highest ^{18}F-FDG accumulation in lymph nodes 2-4 weeks post-vaccination (ANOVA p=0.002), while no increase in uptake on ^{68}Ga-FAPI was observed at any of the time points (Figure 2B, ANOVA p=0.79).

Imaging follow-up data at an average of 120 days [IQR 44-196] confirmed reactive nodal uptake in all patients: Decrease in uptake was documented in all 4 (100%) lymph nodes of the patient who underwent a follow-up ^{18}F-FDG PET/CT (n=1). A decrease in lymph node size was documented for all patients (on CT n=5 (100%), ultrasound n=4 (100%)). One patient underwent a biopsy confirming reactive lymphoid hyperplasia with no evidence of malignancy (Supplemental Figure 1). Further tracer accumulation at the injection site in the deltoid muscle was detected in 5 (45%) patients (Supplemental Figure 2.2). Another patient showed generalized tracer accumulation in the bone marrow on ^{18}F-FDG PET in addition to splenic uptake above liver uptake, indicating reactive bone marrow and splenic activation by a vaccine-induced immune response (Supplemental Figure 3). According to combined ^{18}F-FDG and ^{68}Ga-FAPI PET/CT reports, none of the patients had tumor involvement of the arm or axillary lymph nodes. One patient with breast cancer demonstrated new bone metastases 4 years after initial therapy. Local recurrence was not noted, and focal nodal uptake was seen ipsilateral to vaccination and contralateral to the former tumor site.

The combined analysis of ^{68}Ga-FAPI and ^{18}F-FDG scans detected in total 102 (100%) tumor lesions (primary 6 (6%), locoregional 26 (25%), distant nodal 10 (10%), lung 7 (7%), liver 18 (18%), bone 28 (27%), soft tissue 7 (7%)). Lesion Detection efficacy was higher for ^{68}Ga-FAPI versus ^{18}F-FDG PET (96 (94%) vs. 74 (73%)). ^{68}Ga-FAPI PET detected additional tumor lesions in the lung (7 (100%) vs. 5 (71%)), liver (17 (94%) vs. 9 (50%)) and bone (28 (100%) vs. 23 (82%)). The superior efficacy was based on higher detection rate in 3 patients with different tumor entities (ovarian cancer, solitary fibrous tumor, breast cancer). There was no ^{18}F-FDG-positive, ^{68}Ga-FAPI-negative primary tumor lesion (Supplemental Table 4).

Representative images are shown for all included patients in Supplemental Figure 1 to 11.

DISCUSSION

The COVID-19 pandemic is active globally with an estimated 12.8 billion vaccine doses given and 627.1 million registered infections (accessed October 21, 2022) (*5*). Vaccines aim to decrease COVID-19 spread and severe disease, protecting vulnerable groups, including cancer patients (*6*). Repeat vaccinations have been endorsed by the CDC and many national infection agencies (*7*). Thus, most cancer patients underwent 3 vaccinations within the last year (*7*). Based on current knowledge of decreasing protection over time and the emergence of new variants, vaccination at least annually is the likely scenario (*8–10*). For vulnerable groups, repeat COVID-19 vaccination will come in addition to annual flu shots.

Post-vaccination lymph node uptake on ^{18}F-FDG PET has been demonstrated in prior case reports/series on COVID-19 and flu vaccine for a variety of tumor entities (*1–4,11–16*). Increase in annual vaccination will put oncologic patients at considerable risk of false positive ^{18}F-FDG PET findings. Here we confirm ^{18}F-FDG uptake within 6 weeks of vaccination in a case series of oncologic patients. Non-specific ^{18}F-FDG uptake will adversely influence staging and restaging

procedures of oncology patients (*3*). Patients are at risk of false positive lymph node findings when undergoing ^{18}F-FDG PET/CT within 6 weeks of vaccination. Therefore, PET/CT appointments for patients at risk must be planned carefully with consideration of any vaccination. In addition, bone marrow uptake was seen in one patient pointing to additional pitfalls in patients with myeloproliferative disease (*2*).

The regulation of fibroblast activation protein alpha (FAPα) in cancer is not completely understood. TGFbeta, associated with epithelial–mesenchymal transition, angiogenesis, or immune suppression, participates in the upregulation of FAPα expression, suggesting a lower susceptibility of ^{68}Ga-FAPI PET to acute inflammation (*17*). Fittingly, none of the patients demonstrated focal ^{68}Ga-FAPI uptake in locoregional lymph nodes post vaccination. In addition, ^{68}Ga-FAPI PET demonstrated higher detection efficacy when compared to ^{18}F-FDG PET/CT both for locoregional and distant staging. Tumor detection was based on the PET/CT findings; however, lesions were not verified by imaging follow-up and findings are limited by a low sample size. Superior detection for ^{68}Ga-FAPI versus ^{18}F-FDG PET is in line with previous reports on carcinoma of unknown primary, sarcoma, and breast carcinoma imaging (*18*). Our findings indicate that ^{68}Ga-FAPI PET delivers oncologic staging with equal or superior accuracy when compared with ^{18}F-FDG PET, however with no risk of false diagnosis post vaccination (*19*).

An ongoing prospective trial at our institution aims to assess accuracy and correlation with histopathology for various types of cancer (clinicaltrials.gov, NCT05160051). Our study is limited by low number of patients and low histopathologic confirmation rate for lymph node findings.

Conclusion

Increased annual vaccinations are expected for vulnerable groups, including cancer patients. ^{18}F-FDG may trigger costly follow-up investigations and false management decisions. In our study, ^{68}Ga-FAPI PET, a promising novel imaging tool, avoided post-vaccination lymph node

and bone marrow pitfalls and provided accurate oncologic staging. ^{68}Ga-FAPI PET should be assessed as an alternative to ^{18}F-FDG PET in ongoing (NCT05160051) and future prospective studies.

CONFLICT OF INTEREST DISCLOSURES

Katharina Lueckerath reports fees from SOFIE Bioscience (consultant) and Enlaza Therapeutics (consultant).

Rainer Hamacher is supported by Clinician Scientist Program of the University Medicine Essen Clinician Scientist Academy (UMEA) sponsored by faculty of medicine and Deutsche Forschungsgemeinschaft (DFG) and has received travel grants from Lilly, Novartis and PharmaMar as well as fees from Lilly and PharmaMar.

Jens T. Siveke received honoraria as consultant or for continuing medical education presentations from AstraZeneca, Bayer, Bristol-Myers Squibb, Eisbach Bio, Immunocore, Novartis, Roche/Genentech, Servier; his institution receives research funding from Bristol-Myers Squibb, Celgene, Eisbach Bio, Roche/Genentech; he holds ownership and serves on the Board of Directors of Pharma15, all outside the submitted work.

Benedikt M. Schaarschmidt received a research grant from PharmaCept for an undergoing investigator-initiated study not related to this paper.

Ken Herrmann reports personal fees from Bayer, personal fees and other from Sofie Biosciences, personal fees from SIRTEX, non-financial support from ABX, personal fees from Adacap, personal fees from Curium, personal fees from Endocyte, grants and personal fees from BTG, personal fees from IPSEN, personal fees from Siemens Healthineers, personal fees from GE Healthcare, personal fees from Amgen, personal fees from Novartis, personal fees from ymabs, personal fees from Aktis Oncology, personal fees from Theragnostics, personal fees from Pharma15, outside the submitted work.

Wolfgang P. Fendler reports fees from SOFIE Bioscience (research funding), Janssen (consultant, speakers bureau), Calyx (consultant), Bayer (consultant, speakers bureau, research funding), Parexel (image review) and AAA (speakers bureau) outside of the submitted work.

All disclosure were outside of the submitted work.

All other authors have nothing to disclose.

AUTHOR CONTRIBUTIONS

Wolfgang P. Fendler and Tristan T. Demmert had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Concept and design: Wolfgang P. Fendler, Tristan T. Demmert

Financial support: Ken Herrmann, Wolfgang P. Fendler

Supervision: Wolfgang P. Fendler

Administrative, technical, or material support: Tristan T. Demmert, Ines Maric, Kelsey L. Pomykala, Katharina Lueckerath, Rainer Hamacher, Ken Herrmann, Wolfgang P. Fendler

Acquisition, analysis, or interpretation of data: Tristan T. Demmert, Ines Maric, Wolfgang P. Fendler

Manuscript writing: Wolfgang P. Fendler, Tristan T. Demmert, Kelsey L. Pomykala

Critical revision of the manuscript for important intellectual content: Tristan T. Demmert, Ines Maric, Kelsey L. Pomykala, Katharina Lueckerath, Rainer Hamacher, Ken Herrmann, Wolfgang P. Fendler

Critical revision of the manuscript for important intellectual content: All authors.

Statistical analysis: Wolfgang P. Fendler, Tristan T. Demmert

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Key Points:

QUESTION: Can ^{68}Ga-FAPI PET prevent COVID-19 vaccine-related reactive lymph node uptake?

PERTINENT FINDINGS: We compared ^{18}F-FDG and ^{68}Ga-FAPI PET/CTs acquired on the same day within 6 weeks of COVID19 vaccination in 11 oncology patients. While ^{18}F-FDG was visually positive in 11 patients, ^{68}Ga-FAPI showed no vulnerability to vaccine-related tracer uptake in any patients, but higher tumor detection efficacy. Additionally, the tracer-uptake intensity of ^{18}F-FDG was time-dependent to the vaccination interval, ^{68}Ga-FAPI was visual negative at all time points.

IMPLICATIONS FOR PATIENT CARE: ^{68}Ga-FAPI avoids vaccine-associated reactive lymph node uptake and is therefore superior to ^{18}F-FDG in tumor staging in the period up to 6 weeks after COVID-19 vaccination.

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FIGURES

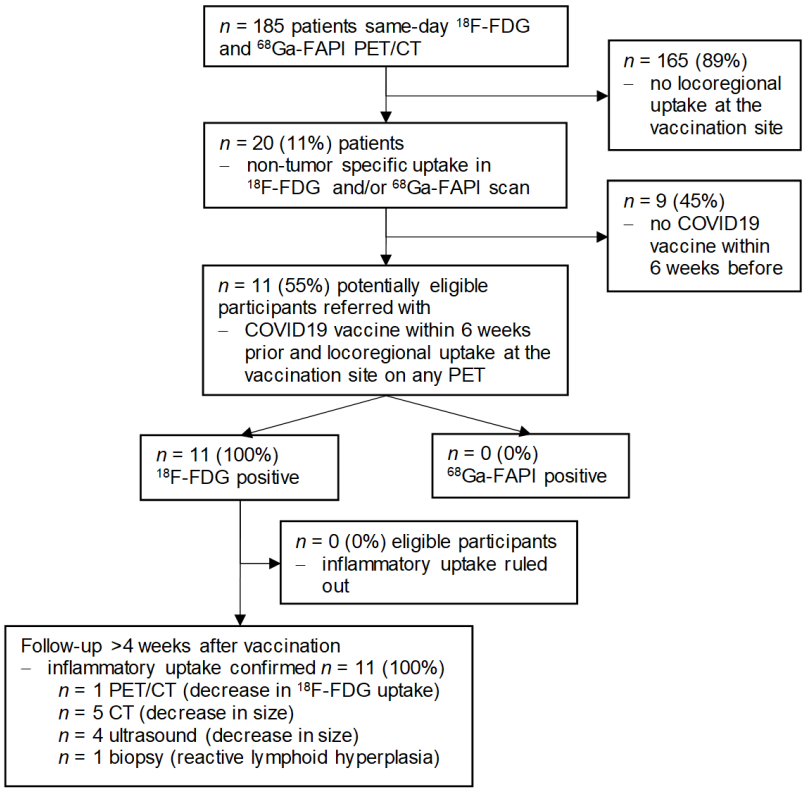


Figure 1. Patient Flow Diagram

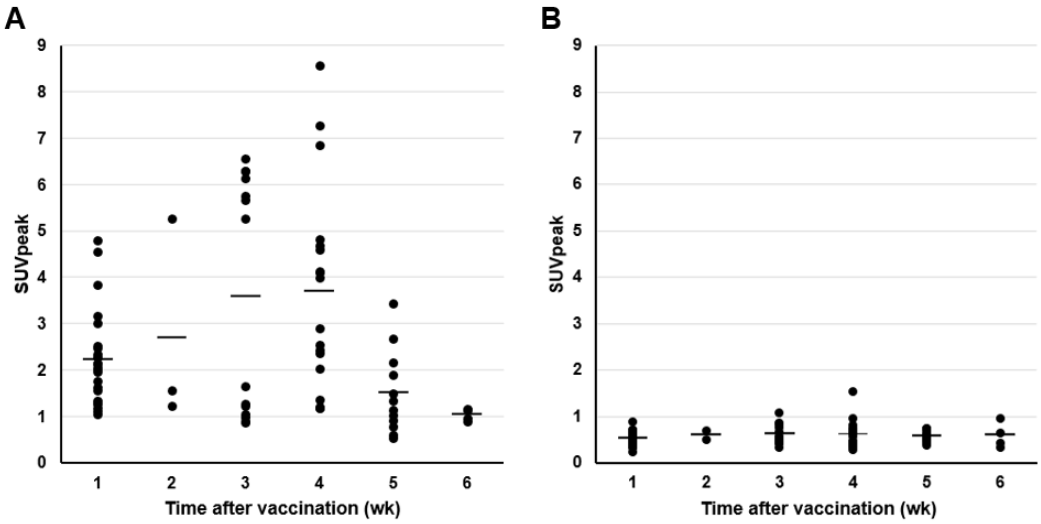
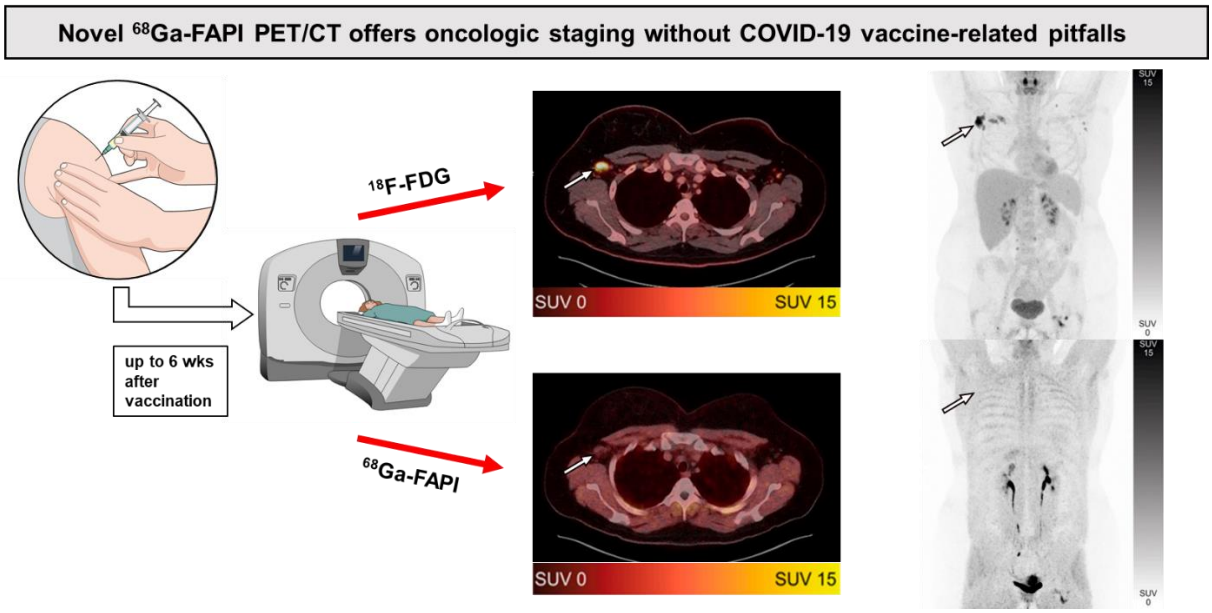


Figure 2. SUVpeak over time for n=78 locoregional lymph nodes for (A) ^{18}F-FDG (ANOVA p=0.002) and (B) ^{68}Ga-FAPI (ANOVA p=0.791) PET/CT.

The average SUVpeak for week 1 through 6 was 2.2, 2.7, 3.6, 3.7, 1.5, 1.0 for ^{18}F-FDG (A) and 0.5, 0.6, 0.6, 0.6, 0.6, 0.6 for ^{68}Ga-FAPI (B) PET, respectively.

Graphical Abstract



Novel ^{68}Ga-FAPI PET/CT offers oncologic staging without COVID-19 vaccine-related pitfalls

ONLINE MATERIAL

Supplemental Table 1. Patient Characteristics (n=11)

Supplemental Table 2. Tumor stage by combined ^{18}F-FDG and ^{68}Ga-FAPI PET/CT in 11 patients

Supplemental Table 3. Non-tumor specific uptake

Supplemental Table 4. Tumor detection efficacy for ^{18}F-FDG vs. ^{68}Ga-FAPI PET/CT (n=11 patients)

Supplemental Figure 1-11. ^{18}F-FDG PET/CT and ^{68}Ga-FAPI PET/CT images in all 11 patients

TABLES

Characteristic	Mean [IQR]	N (%)
Gender		
Male		5 (45)
Female		6 (55)
Age (years)	44 [34-54]	
Indication for PET/CT		
Sarcoma (SFT)		2 (18)
Ovarian carcinoma		1 (9)
Pleomorphic sarcoma		1 (9)
Sarcoma		1 (9)
Colorectal carcinoma		1 (9)
Breast carcinoma		1 (9)
Prostate carcinoma		1 (9)
Lung carcinoma		1 (9)
Urothelial carcinoma		1 (9)
Myxofibrosarcoma		1 (9)
Type of mRNA vaccine		
BNT162b2		10 (91)
mRNA1273		1 (9)
Time between vaccine and PET/CT (days)	19 [8-30]	
Concominant tumor therapy at PET		
None		6 (55)
Radionuclide		1 (9)
Chemo		2 (18)
Immune		3 (27)

Supplemental Table 1. Patient Characteristics (n=11)

Characteristic		N	(%)
Indication			
Staging		3	(27)
Restaging		8	(73)
Extent			
No disease		0	(0)
Primary tumor only		3	(27)
Locoregional disease only		1	(9)
Distant metastatic:	nodal	3	(27)
	bone	1	(9)
	organ	5	(45)

Supplemental Table 2. Tumor stage by combined ^{18}F-FDG and ^{68}Ga-FAPI PET/CT in 11 patients

Patient No.	Tumor			Injection site		Axillary & Adjacent Nodes						Distant Nodes, Spleen, BM	
	Entity	SUVpeak		^{18}F-FDG	^{68}Ga-FAPI	^{18}F-FDG			^{68}Ga-FAPI			^{18}F-FDG	^{68}Ga-FAPI
		^{18}F-FDG	^{68}Ga-FAPI			visual	N	SUVpeak	visual	N	SUVpeak		
1	Ovarian	4.1	4.7	positive	negative	positive	12	2.2	negative	0	0.7	negative	negative
2	Sarcoma (SFT)	3.3	11.7	positive	negative	positive	4	2.1	negative	0	0.7	negative	negative
3	Pleomorphic sarcoma	3.9	1.8	positive	negative	positive	12	4.8	negative	0	0.5	positive*	negative
4	Sarcoma	1.0	2.5	positive	negative	positive	2	2.7	negative	0	0.7	negative	negative
5	Colorectal	3.8	6.0	positive	negative	positive	12	9.1	negative	0	1.5	negative	negative
6	Sarcoma (SFT)	4.4	8.1	positive	negative	positive	8	6.6	negative	0	1.1	negative	negative
7	Breast	2.1	4.0	positive	negative	positive	1	1.5	negative	0	0.9	negative	negative
8	Prostate	10.1	12.0	positive	negative	positive	2	2.9	negative	0	0.4	negative	negative
9	Lung	20.2	18.8	positive	negative	positive	5	1.9	negative	0	0.9	negative	negative
10	Urothelial	7.1	5.3	positive	negative	positive	12	3.4	negative	0	0.9	negative	negative
11	Myxofibrosarcoma	4.4	4.0	positive	negative	positive	4	1.6	negative	0	0.7	negative	negative
Sum (%) or Median [IQR]	-	4.1 [0-9.4]	5.3 [0.2-10.4]	11 (100%)	0 (0%)	11 (100%)	74	2.7 [1.1-5.9]	0 (0%)	0	0.7 [0.4-1.0]	1 (9%)	0 (0%)

Supplemental Table 3. Non-tumor specific uptake

*Diffuse bone marrow uptake - SUVpeak 3.4

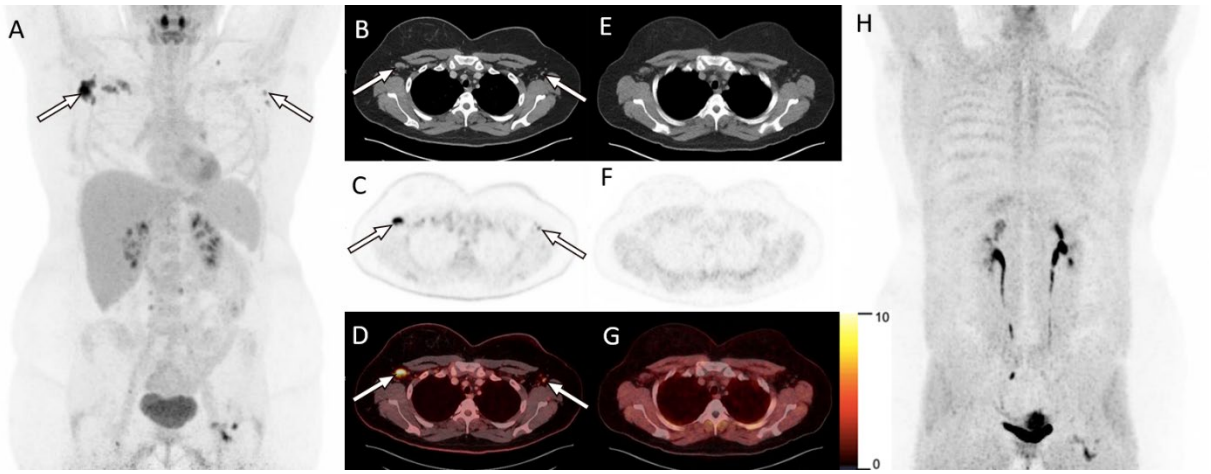
	overall detection N	^{18}F-FDG N (%)	^{68}Ga-FAPI N (%)
Patient level detection of tumor	11	11 (100)	11 (100)
Total N of detected tumor lesions	102	74 (73)	96 (94)
Primary lesion	6	6 (100)	6 (100)
Local nodal	26	20 (77)	21 (81)
Distant nodal	10	8 (80)	10 (100)
Lung	7	5 (71)	7 (100)
Liver	18	9 (50)	17 (94)
Bone	28	23 (82)	28 (100)
Other	7	3 (43)	7 (100)

Supplemental Table 4. Tumor detection efficacy for ^{18}F-FDG vs. ^{68}Ga-FAPI PET/CT (n=11 patients)

FIGURES

Supplemental Figure 1-11. ^{18}F-FDG PET/CT and ^{68}Ga-FAPI PET/CT images in all 11 patients

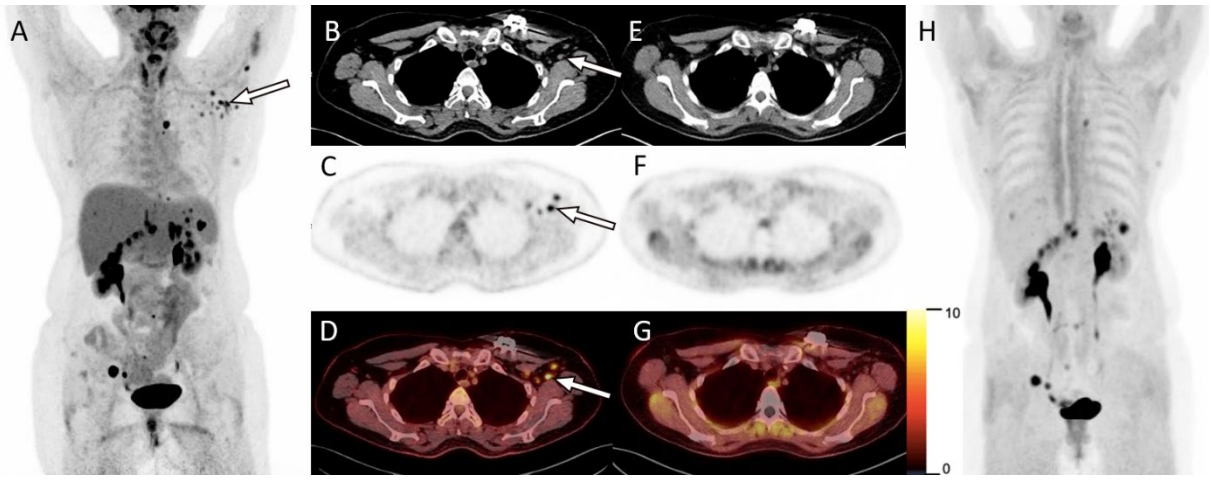
^{18}F-FDG **(A-D)** and ^{68}Ga-FAPI **(E-H)** Maximum intensity projection images (MIP) of the PET/CT scan **(A, H)**, axial CT **(B, E)**, PET **(C, F)**, PET/CT **(D, G)** are shown.



Supplemental Figure 1. Patient 1, female, 32 y

Tumor stage: Colorectal cancer, R0 resection with locoregional and distant metastases.

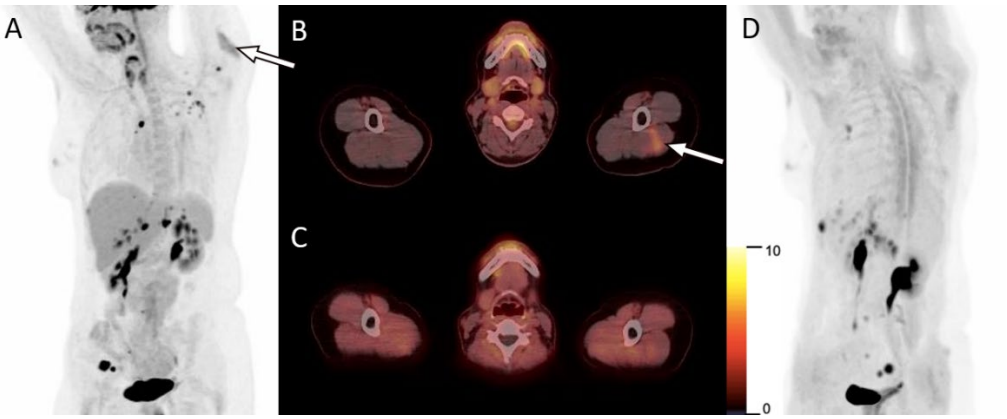
PET uptake in the vaccination region: ^{18}F-FDG positive (n=12 lymph nodes, arrow) vs. ^{68}Ga-FAPI negative (bilateral findings after vaccination on right side followed by a biospy confirming reactive lymphoid hyperplasia)



Supplemental Figure 2.1. Patient 2, female, 49 y

Tumor stage: Ovarian cancer, R0 resection with locoregional and distant metastases.

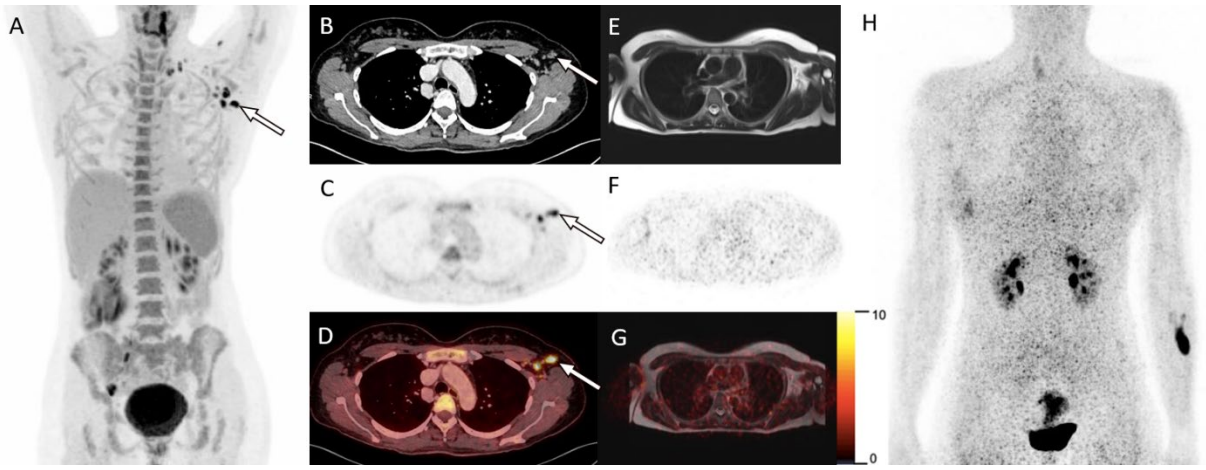
PET uptake in the vaccination region: ^{18}F-FDG positive (n=12 lymph nodes, arrow) vs. ^{68}Ga-FAPI negative



Supplemental Figure 2.2.

Same patient showing additional deltoid muscle uptake on ^{18}F-FDG^{18} (SUV_{peak} 2.3, arrow).

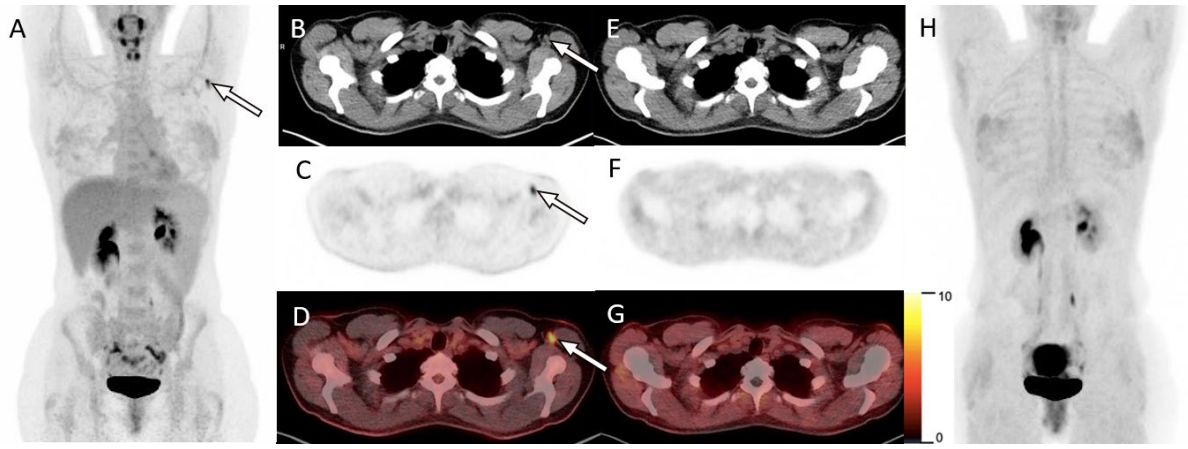
^{18}F-FDG **(A, B)** and ^{68}Ga-FAPI **(C, D)**, MIP **(A, D)**, PET/CT **(B, C)**



Supplemental Figure 3. Patient 3, female, 42 y

Tumor stage: Undifferentiated pleomorphic sarcoma (UPS), primary lesion with one locoregional metastasis.

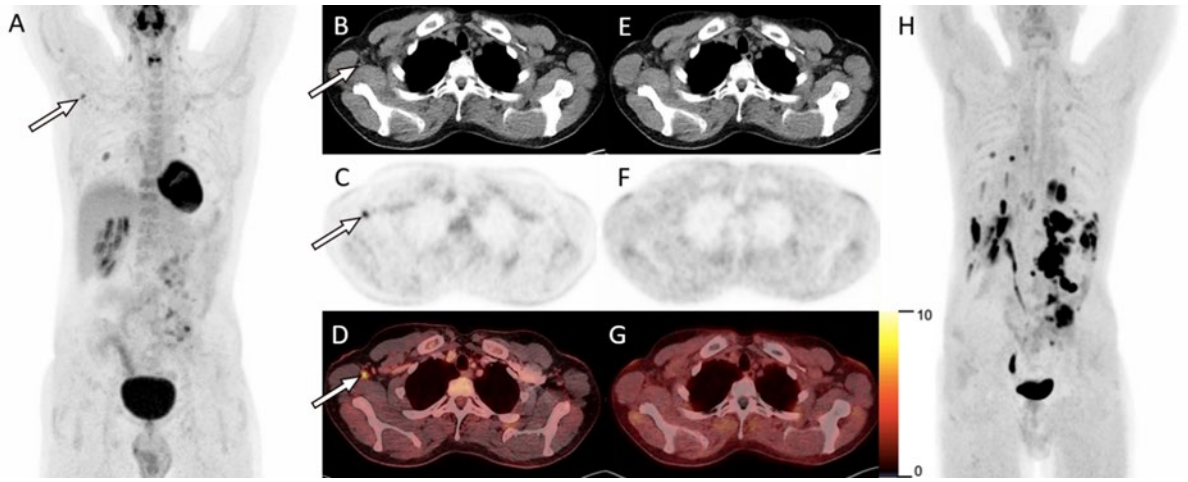
PET uptake in the vaccination region: ^{18}F-FDG positive (n=11 lymph nodes, arrow) vs. ^{68}Ga-FAPI negative



Supplemental Figure 4. Patient 4, female, 39 y

Tumor stage: Low grade myxoid liposarcoma, primary lesion with no metastases.

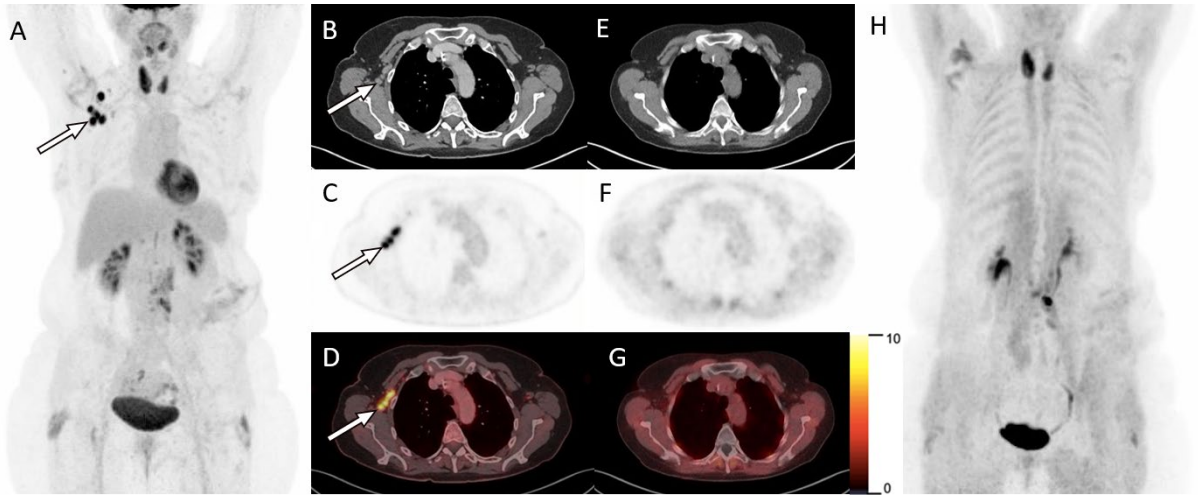
PET uptake in the vaccination region: ^{18}F-FDG positive (n=2 lymph nodes, arrow) vs. ^{68}Ga-FAPI negative



Supplemental Figure 5. Patient 5, male, 36 y

Tumor stage: Solitary fibrous tumor, R0 resection with locoregional and distant metastases.

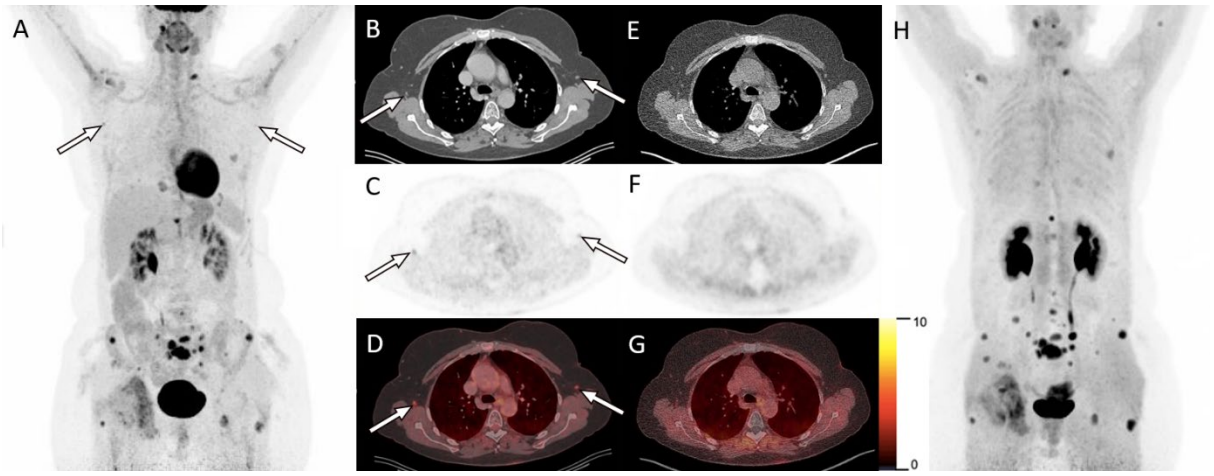
PET uptake in the vaccination region: ^{18}F-FDG positive (n=4 lymph nodes, arrow) vs. ^{68}Ga-FAPI negative



Supplemental Figure 6. Patient 6, female, 57 y

Tumor stage: Solitary fibrous tumor, primary lesion with no metastases.

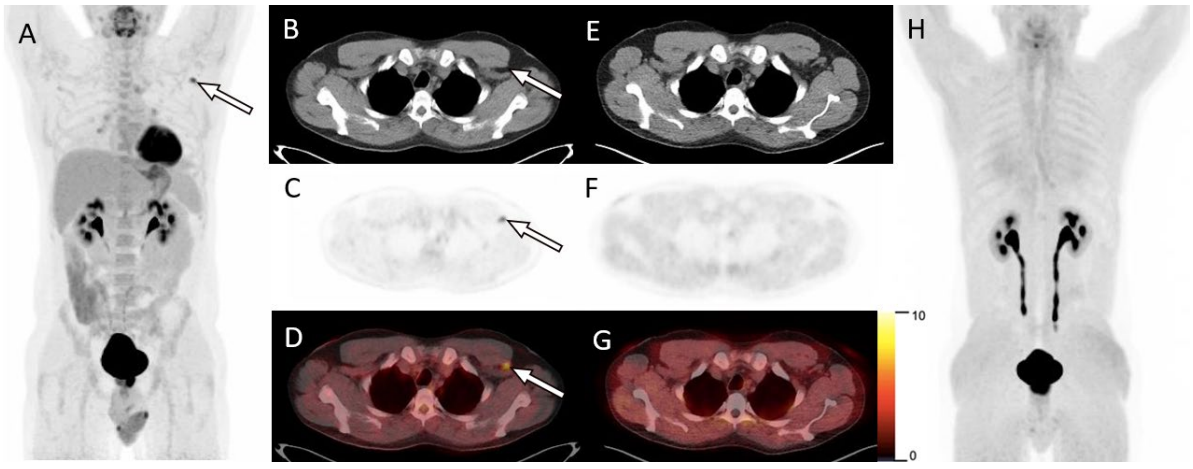
PET uptake in the vaccination region: ^{18}F-FDG positive (n=8 lymph nodes, arrow) vs. ^{68}Ga-FAPI negative



Supplemental Figure 7. Patient 7, female, 44 y

Tumor stage: Breast cancer, prior lumpectomy, bone metastases.

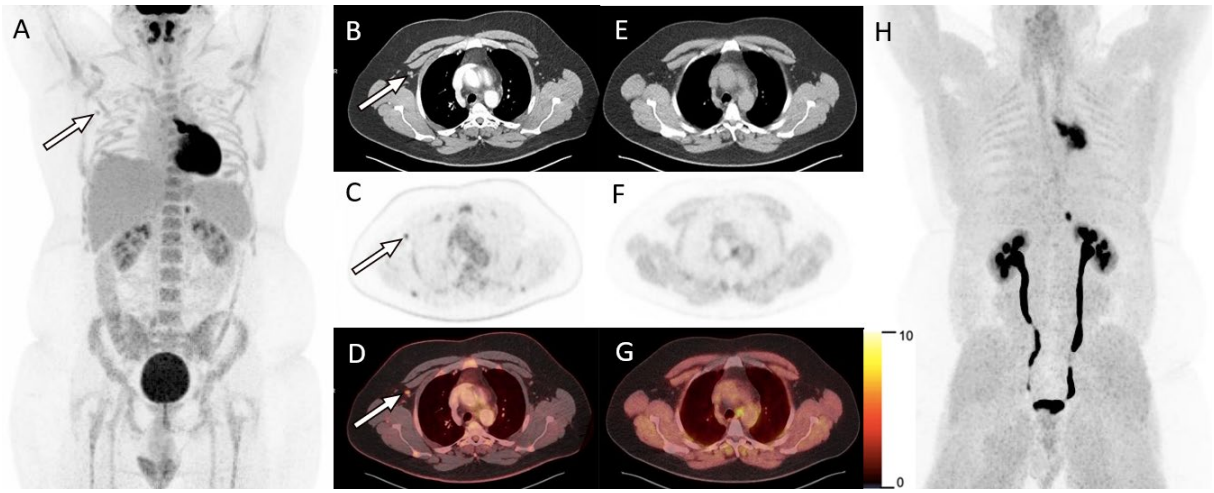
PET uptake in the vaccination region: ^{18}F-FDG positive (n=2 lymph nodes, arrow) vs. ^{68}Ga-FAPI negative



Supplemental Figure 8. Patient 8, male, 47 y

Tumor stage: Prostate cancer, primary lesion with no metastases.

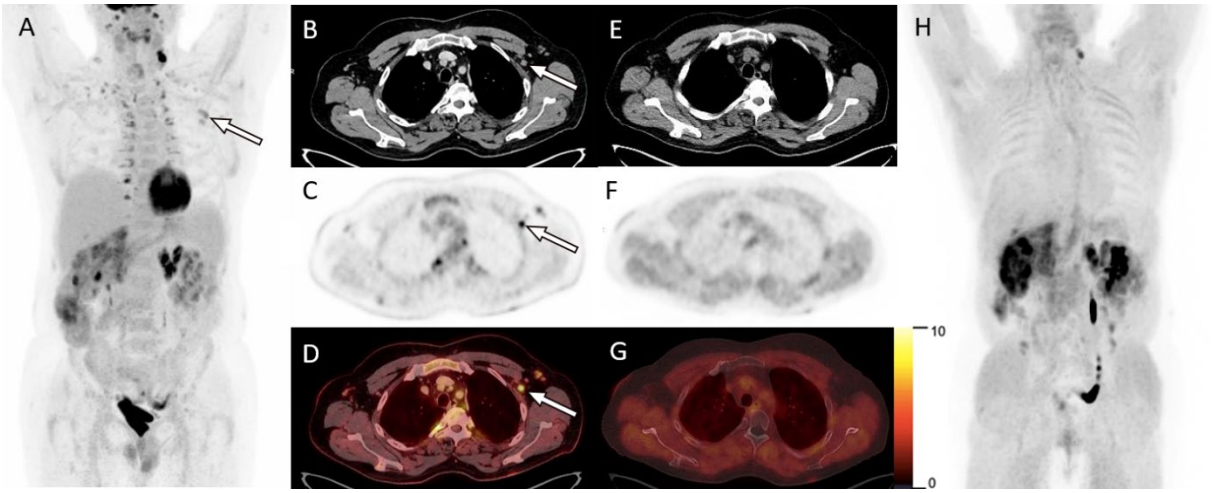
PET uptake in the vaccination region: ^{18}F-FDG positive (n=2 lymph nodes, arrow) vs. ^{68}Ga-FAPI negative



Supplemental Figure 9. Patient 9, male, 39 y

Tumor stage: Lung cancer, primary lesions with one distant metastasis.

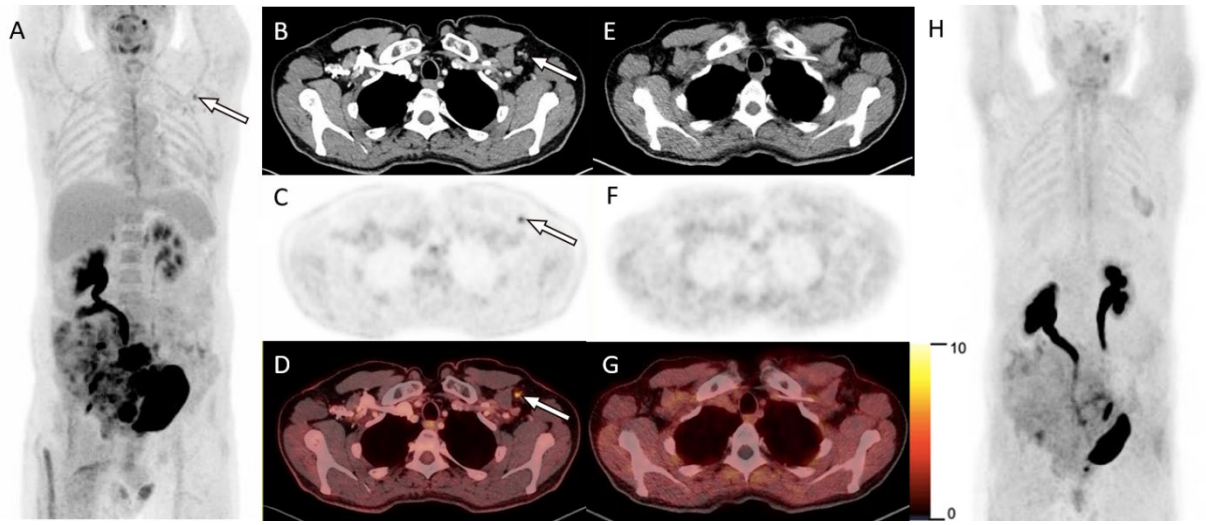
PET uptake in the vaccination region: ^{18}F-FDG positive (n=5 lymph nodes, arrow) vs. ^{68}Ga-FAPI negative



Supplemental Figure 10. Patient 10, male, 47 y

Tumor stage: Urothelial cancer, primary lesion with locoregional and distant metastases.

PET uptake in the vaccination region: ^{18}F-FDG positive (n=12 lymph nodes, arrow) vs. ^{68}Ga-FAPI negative



Supplemental Figure 11. Patient 11, male, 62 y

Tumor stage: Myxofibrosarcoma, primary lesion, left gynecomastia with no metastases.

PET uptake in the vaccination region: ^{18}F-FDG positive (n=4 lymph nodes, arrow) vs. ^{68}Ga-FAPI negative