

^{68}Ga -FAPI PET/MR is Helpful in Differential Diagnosis of Pancreatitis From Pancreatic Malignancy Compared to ^{18}F -FDG PET/CT

Yi Shou

Tongji University Affiliated East Hospital: Shanghai East Hospital

Qiaoyi Xue

Central Research Institute, UIH Group, Shanghai, China

Jianmin Yuan

Central Research Institute, UIH Group, Shanghai, China

Jun Zhao (✉ petcenter@126.com)

Shanghai East Hospital <https://orcid.org/0000-0002-9887-5512>

Research Article

Keywords: ^{68}Ga -FAPI, PET/MR, pancreatitis, pancreatic cancer, IgG4-RD

Posted Date: March 9th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-202037/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background: ^{68}Ga -fibroblast activation protein specific enzyme inhibitor (FAPI) is a novel PET agent for tumor imaging.

Case description: We herein present a case where ^{68}Ga -FAPI PET/MR helped to diagnose IgG4-RD that involved pancreas and bile duct. Our 62-year-old patient suffered from middle upper abdomen and brown urine. Blood test revealed abnormal liver function and elevated IgG4 (4.830g/L \uparrow). ^{18}F -FDG PET showed enlarged uncinate process and dilated bile duct tree. Mild increase of FDG uptake in uncinate process and head of pancreas indicated possible pancreatic malignancy, but the evidence was not sufficient enough. ^{68}Ga -FAPI PET revealed prominent fibroblast mediated inflammation in the entire pancreas and bile duct, suggesting IgG4-RD.

Conclusion: The case illustrates that ^{68}Ga -FAPI PET is more sensitive to IgG4-RD than ^{18}F -FDG, and thus could be helpful in improving the differential diagnosis of pancreatitis and pancreatic cancer.

Background

^{18}F -FDG PET/CT imaging is gaining increasing use in clinical applications, but it has still some limitations in the differential diagnosis of inflammatory or malignant pancreatic diseases [1]. This is mainly due to the fact that ^{18}F -FDG is a non-specific imaging agent. In most cases, both tumorous and inflammatory disease show high radioactivity at the lesion site, while in other cases, tumor lesions and inflammatory lesions show mild or normal uptake of radioactivity in the involved organs. This makes differential diagnosis difficult for neoplastic diseases and inflammatory disease. For instance, when autoimmune pancreatitis appears to be hypermetabolic in a focal area, it can be mistaken for pancreatic malignancy [1, 2].

Radiolabelled FAPI is a newly developed tumor imaging tracer which targets fibroblast activation protein (FAP) [3, 4]. The specificity of FAPI imaging in tumor is better than FDG, and in some specific inflammations (such as IgG4-RD, rheumatoid disease, etc.), FAPI also has a better effect than FDG due to the active fibrogenic reaction [5]. Therefore, when FDG imaging is limited in differentiating inflammation from tumor lesions, FAPI imaging can provide important clue and yield more accurate diagnosis.

Case Description

A 62-year-old man who had diffuse discomfort in middle upper abdomen, accompanied by brown urine. Blood test showed abnormal liver function, with IgG4 4.830g/L \uparrow . Ultrasound gastroscopy showed uneven internal high-low echo and poor internal blood signal in pancreatic neck lesion, (size about 2.0 \times 2.5 cm 2) with clear boundary. The lesion was located adjacent to the portal vein and superior mesenteric vein. No obvious expansion of the main pancreatic duct in the body and tail pancreas was found. Possible malignancy was considered.

MRCP (Magnetic Resonance Cholangiopancreatography) showed that the intrahepatic bile duct was slightly dilated, common bile duct was dilated, inflammation of lower segment of common bile duct was possible, and the malignancy could not be excluded.

Thin-slice enhanced CT scan of pancreas showed the uncinate process of pancreatic head lesion, suggesting possible malignancy with intrahepatic and extrahepatic bile duct dilatation.

In order to identify the nature of pancreatic lesions, further PET/CT scanning was performed. ^{18}F -FDG PET/CT showed the uncinate process of pancreas was mildly enlarged with bile duct tree dilated, the FDG metabolism was slightly increased in uncinate process and head of pancreas ($\text{SUV}_{\text{max}}=4.07$, $\text{SUV}_{\text{mean}}=2.25$, $2.4\text{cm}\times 1.8\text{cm}$), the possibility of malignant tumor was considered. (Fig. A–D).

After two weeks of symptomatic treatment, the liver function improved significantly. However, as the above modalities could not exclude the possibility of pancreatic malignancy, ^{68}Ga -FAPI PET/MR scanning was recommended.

According to the PET/MR scan (Fig. E–H), ^{68}Ga -FAPI uptake was evenly elevated in the entire pancreas ($\text{SUV}_{\text{max}}=11.04$, $\text{SUV}_{\text{mean}}=6.15$). Increased ^{68}Ga -FAPI uptake was also found around dilated intrahepatic and extrahepatic bile duct ($\text{SUV}_{\text{max}}=3.61$, $\text{SUV}_{\text{mean}}=1.92$). PET/MR diagnosed unequivocally IgG4-RD that involved pancreas and intrahepatic and extrahepatic bile duct.

Discussion

^{18}F -FDG PET has many advantages over other imaging modalities (such as CT, MR, B-ultrasound), but there are still challenges in differentiating autoimmune pancreatitis from pancreatic cancer [5], especially in focal autoimmune pancreatitis when there is no indication of inflammation involved in other related organs (such as salivary glands, orbit, thyroid, lung, retroperitoneal, kidney, lymph node, etc) [6]. ^{68}Ga -FAPI is a radiolabelled agent targeting the inhibitor of fibroblast activation protein (FAP), which is often present in tumor stroma [3, 4], in addition to inflammatory tissue with prominent fibroblast proliferation as plasma cell mediated sclerosing inflammation [5, 7]. The sensitivity of ^{68}Ga -FAPI to IgG4-RD is significantly higher than that of ^{18}F -FDG. In this case, ^{68}Ga -FAPI PET showed the inflammation involving the whole pancreas and bile duct tree, which could not be detected by ^{18}F -FDG. This demonstrated that ^{68}Ga -FAPI was not more tumor-specific than ^{18}F -FDG, but it may be more sensitive than FDG in detecting prominent fibroblast mediated inflammation as IgG4-RD.

Conclusion

This case demonstrated that ^{68}Ga -FAPI PET is more sensitive to IgG4-RD compared with ^{18}F -FDG, and thus could be helpful in improving the differential diagnosis of pancreatitis and pancreatic cancer.

List Of Abbreviations

IgG4-RD

immunoglobulin G4 related disease; MRCP:magnetic resonance cholangiopancreatography; PET/CT:positron emission tomography/computed tomography; PET/MR:positron emission tomography/magnetic resonance; FDG:fluorodeoxyglucose; FAP:fibroblast activation protein; FAPI:FAP-specific enzyme inhibitor.

Declarations

Author contributions

YS, JZ have made substantial contributions to conception and design of the case. YS, JZ and QX are involved in drafting the manuscript. JY and QX are responsible for the layout and the images. JZ had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. All authors read and approved the final manuscript.

Conflict of interest

The authors declare that they have no conflict of interest.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the principles of the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Consent for publication

Informed consent was taken from the patient for the publication of this case report and related imaging.

Availability of data and material

The datasets used or analyzed during the current study are available from the corresponding author on reasonable request.

References

1. Nguyen VX, Nguyen CC, Nguyen BD. 18FDG PET/CT imaging of the pancreas: Spectrum of diseases. *Journal of the Pancreas* (2011) Nov 1;12(6):557–566
2. Zheng L, Xing H, Li F, Huo L (2018 Jan) Focal Autoimmune Pancreatitis Mimicking Pancreatic Cancer on FDG PET/CT Imaging. *Clin Nucl Med* 43(1):57–59. doi:10.1097/RLU.0000000000001901

3. Loktev A, Lindner T, Mier W et al (2018) A tumor-imaging method targeting cancer-associated fibroblasts. *J Nucl Med* 59:1423–1429. doi:10.2967/jnumed.118.210435
4. Lindner T, Loktev A, Altmann A et al (2018) Development of quinoline-based theranostic ligands for the targeting of fibroblast activation protein. *J Nucl Med* 59:1415–1422. doi:10.2967/jnumed.118.210443
5. Luo Y, Pan Q, Yang H, Peng L, Zhang W, Li F (2020 Jun) Fibroblast activation protein targeted PET/CT with 68Ga-FAPI for imaging IgG4-related disease: comparison to 18F-FDG PET/CT. *J Nucl Med* 8:jnumed. . doi: 10.2967/jnumed.120.244723
6. Zhang J, Chen H, Ma Y et al (2014) Characterizing IgG4-related disease with 18F-FDG PET/CT: a prospective cohort study. *Eur J Nucl Med Mol Imaging* 41(8):1624–1634. doi:10.1007/s00259-014-2729-3
7. Röhrich M, Naumann P, Giesel FL et al (2020 Oct) Impact of 68Ga-FAPI-PET/CT imaging on the therapeutic management of primary and recurrent pancreatic ductal adenocarcinomas. *J Nucl Med* 23:jnumed. . doi: 10.2967/jnumed.120.253062

Figures

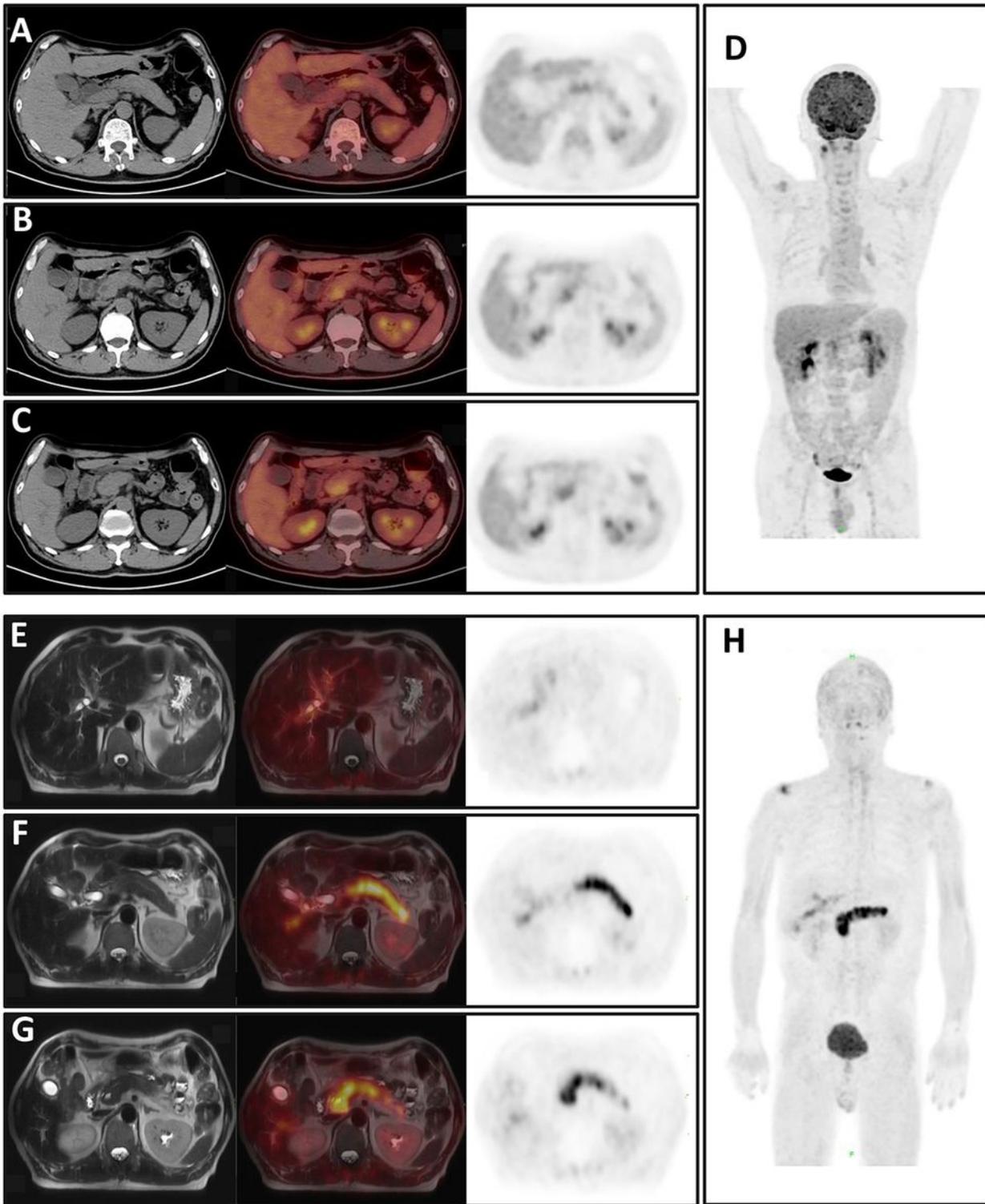


Figure 1

A-D. ^{18}F -FDG PET/CT images of IgG4-RD, the mild increase of FDG uptake in uncinata process and neck of pancreas was difficult to differentiate from pancreatic cancer. E-H. ^{68}Ga -FAPI PET/MR images of IgG4-RD, the intensely increased ^{68}Ga -FAPI uptake in the entire pancreas and dilated bile duct made unequivocally diagnosis of IgG4-RD.