

CASE REPORT

Open Access



# Signet cell rectal carcinoma with prostatic involvement detected by FAPI-04 PET-MRI fusion

K. Arun Prashanth<sup>1\*</sup>, Deepti Jain<sup>2</sup>, R. Manikandan<sup>3</sup>, Suman Kalyan<sup>4</sup>, Vimalraj Velayutham<sup>5</sup> and R. Surendran<sup>5</sup>

\*Correspondence:  
dr.arunprashanth@gmail.com

<sup>1</sup> Department of Nuclear  
Medicine, MIOT International  
Hospital, Chennai, India

<sup>2</sup> Department of Lab Services,  
MIOT International Hospital,  
Chennai, India

<sup>3</sup> Department of Urology, MIOT  
International Hospital, Chennai,  
India

<sup>4</sup> Department of Medical  
Oncology, MIOT International  
Hospital, Chennai, India

<sup>5</sup> Department  
of Hepato-Pancreato-Biliary  
Centre for Surgery  
and Transplantation, MIOT  
International Hospital, Chennai,  
India

## Abstract

A 60-year-old male patient diagnosed with mucinous adenocarcinoma of lower third of rectum underwent abdominoperineal resection and permanent colostomy followed by adjuvant chemotherapy. Response evaluation with F-18 FDG PET-CT showed a complete metabolic response. After 6 months, CEA levels started increasing and clinically a recurrence was suspected. A restaging FDG PET-CT showed no obvious malignant disease. Patient presented again within a month with complaints of urinary retention and haematuria. CEA levels were further elevated, and Ga-68 FAPI-04 (FAPI) PET-CT was performed. FAPI PET-CT revealed prostatic and seminal vesicle disease involvement. Additionally, an MRI of pelvis was done and fused with FAPI PET for confirmation of prostatic involvement.

## Key message

FAPI PET-CT can help diagnose clinically challenging difficult cases.

**Keywords:** Signet cell adenocarcinoma, FAPI, Rectal adenocarcinoma, Prostate secondaries, FAPI MRI fusion, Fibroblast activation protein inhibitor PET-CT

## Background

Primary signet ring cell carcinoma of rectum was a rare malignancy contributing about less than 1% of colon cancers with aggressive behaviour (Morales-Cruz et al. 2019). Presentation usually occurs at an advanced stage, and the tumour has a distinctive molecular pattern and poor prognosis (An et al. 2021). Signet cell adenocarcinoma was diagnosed based on the presence of 50% extracellular mucin by volume in tumour.

Prostatic involvement as metastasis by colon malignancies has been sparse in the literature (Schips et al. 2002; Youssef et al. 2011; Gupta et al. 2004; Berman et al. 1993) limited to case reports. FDG PET-CT and MR imaging has been utilised for the diagnosis of prostatic involvement by colorectal malignancies (Kang et al. 2013).

### Case presentation

A 61-year-old male presented with fistula and diagnosed to have mucinous adenocarcinoma of lower third of rectum 2 years back. Examination under anaesthesia and fistulectomy was performed. FDG PET-CT showed metabolic activity in the fistulous tract and lower rectum with no nodal or distant metastasis. He was started on capecitabine and external beam radiotherapy by IGRT technique.

After chemoradiotherapy, he underwent abdominoperineal resection (APR) with permanent colostomy surgery. Adjuvant chemotherapy with oxaliplatin and irinotecan regimen was administered after surgery. A response evaluation FDG PET-CT demonstrated a complete metabolic response. On follow-up, he was asymptomatic but CEA was 17.0 ng/ml. FDG PET-CT images did not reveal any obvious malignant disease and no definite recurrence. He presented again within a month with complains of urinary retention and haematuria. The CEA value was also increased to 68.7 ng/ml. Since no malignant disease was detected in the recent FDG, a Ga-68 FAPI-04 (FAPI) PET-CT was performed instead of FDG PET-CT. FAPI PET-CT demonstrated intense tracer uptake in prostate and seminal vesicles. Since prostatic involvement is extremely rare, additionally an MRI of prostate was done for confirmation. The FAPI PET-MRI fusion images revealed the prostatic and seminal vesicle involvement. A transurethral resection of prostate (TURP) confirmed the presence of signet cell carcinoma in the prostatic parenchyma.

Haematuria was not resolved, and he developed hydronephrosis due to base of bladder involvement. A bilateral PCN procedure to relieve obstruction and chemotherapy (bevacizumab and gemcitabine) for palliation was initiated. However, he further deteriorated a few months later with sepsis, bilateral metastatic pleural effusion, and ascites due to peritoneal deposits and succumbed.

### Discussion

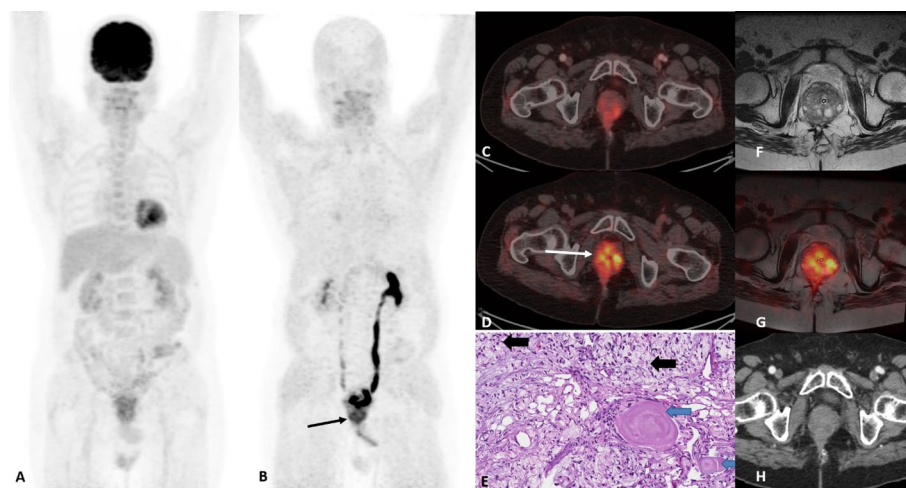
Signet cell adenocarcinoma, an aggressive variant, has poor prognosis than other subtypes of colorectal cancers (An et al. 2021). A case series of colorectal primary locally invading prostate had only one signet cell adenocarcinoma patient (Osunkoya et al. 2007). Our patient also presented with unusual symptoms and FAPI PET-CT helped us to diagnose prostatic involvement of signet cell adenocarcinoma of rectum. In a meta-analysis, FAPI PET-CT has shown substantially greater sensitivity for the detection of peritoneal metastatic disease (Gege et al. 2023).

Signet ring cell colorectal carcinoma comprised less than 1% of colorectal and 1.4% of rectal cancers (Hyngstrom et al. 2012). The aggressive nature of signet cell morphology resulted from its predilection for intramural spread and subsequent delay in diagnosis. Primary rectal signet cell carcinoma has an average age of 48.1 years (Chen et al. 2004) in males. According to a large database analysis, signet cell ring cell adenocarcinoma of colon rectal regions was associated with 57% higher risk of death compared to other morphologies. They also have high-grade lesions compared to non-signet variants (77.2% vs 20%).

Signet colorectal carcinoma characteristic had peritoneal seeding and less hepatic metastasis. Specifically, rectal signet carcinoma has 83% peritoneal metastasis. The postulated reason was reduced expression of E-cadherin which leads to loss of epithelial differentiation and invasion. Peritoneal involvement leads to rapid progression, poor prognosis despite systemic and intraperitoneal chemotherapy (Khan et al. 2017).

Metastatic disease to the prostate was by contiguous spread and rarely by haematological dissemination. There were very few case reports for involvement of prostate by colorectal malignancies (Khan et al. 2017; Seog et al. 2022; Park et al. 2020). Few patients also presented with rising PSA triggering suspicion of secondary prostatic malignancy and masquerading the locoregional prostatic involvement.

FAPI, a fibroblast activation protein inhibitor, was shown to be superior compared to conventional modalities for colorectal malignancies (Seog et al. 2022). FAPI was able to detect tiny peritoneal metastases which can be missed by FDG PET-CT. In our experience, use of FAPI PET in domains where FDG is known to have lesser sensitivity yielded better results like in gastrointestinal malignancies (Prashanth et al. 2023). In this case, FDG was negative despite rise in tumour markers. FAPI PET-CT resulted in the diagnosis of prostatic involvement which was the cause of haematuria. TURP biopsy and MRI fusion confirmed the findings of FAPI PET-CT, and patient was initiated on chemotherapy. In conclusion, FAPI PET-CT and PET-MRI fusion helped to diagnose an extremely rare involvement of prostate by signet cell rectal adenocarcinoma (Fig. 1).



**Fig. 1** **A** FDG MIP, **B** MIP image of FAPI shows focus of uptake below the bladder (slender black arrow). **C** and **D** are axial fused images of FDG and FAPI PET-CT, respectively. The fused axial images of FAPI clearly show increased uptake (SUVmax-6.8) in prostate compared to FDG which shows only mild uptake. **E** H & E at 200 $\times$  magnification image revealed normal prostate gland with corpora amylacea highlighted by blue arrows and tumour cells with signet ring morphology highlighted by bold black arrows, thus confirming the prostatic involvement by signet cell adenocarcinoma. **F** axial MRI and **G** FAPI MRI fusion images which show involvement of prostate. Seminal vesicles and base of bladder were also involved; (not shown **H**) contrast-enhanced diagnostic CT image which shows no significant abnormality

### Abbreviations

FAPI	Ga-68—fibroblast activation protein inhibitor-04
PET	Positron emission tomography
CT	Computed tomography
SUV	Standardised uptake value
FDG	18-F fluorodeoxyglucose
MRI	Magnetic resonance imaging
H & E	Haematoxylin and eosin
CEA	Carcinoembryonic antigen
HPE	Histopathological examination
PCN	Percutaneous nephrostomy
IGRT	Image-guided radiotherapy

### Acknowledgements

Not applicable.

### Author contributions

AP had the idea for FAPI MRI fusion and prepared the manuscript including PET and fusion images; patients were clinically examined and procedures by SK, MR, VV, SR, and DJ examined histopathology slide and provided H&E image. All authors read and approved the final manuscript.

### Funding

No source of funding for any of the authors for any of the steps in manuscript preparation.

### Availability of data and materials

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

### Declarations

#### Ethics approval and consent to participate

Ethics approval waived for case report.

#### Consent for publication

Written informed consent was obtained from the patient before the scan procedure for use of the same in research purposes. Written consent was also obtained from the legal heir for publication.

#### Competing interests

The authors declare that they have no competing interests.

Received: 23 August 2023 Accepted: 10 October 2023

Published online: 01 December 2023

### References

- An Y, Zhou J, Lin G, Wu H, Cong L, Li Y, Qiu X, Shi W (2021) Clinicopathological and molecular characteristics of colorectal signet ring cell carcinoma: a review. *Pathol Oncol Res* 26(27):1609859
- Berman JR, Nunnemann RG, Broshears JR, Berman IR (1993) Sigmoid colon carcinoma metastatic to prostate. *Urology* 41(2):150–152
- Chen JS, Hsieh PS, Hung SY, Tang R, Tsai WS, Changchien CR, Lin PY, Wang JY, Yeh CY (2004) Clinical significance of signet ring cell rectal carcinoma. *Int J Colorectal Dis* 19(2):102–107
- Gege Z, Xueju W, Bin J (2023) Head-to-head comparison of 68Ga-FAPI PET/CT and FDG PET/CT for the detection of peritoneal metastases: systematic review and meta-analysis. *AJR Am J Roentgenol* 220(4):490–498. <https://doi.org/10.2214/AJR.22.28402>
- Gupta T, Laskar SG, Thakur M, Desai S, Shrivastava SK, Dinshaw KA, Agarwal JP (2004) Isolated prostatic metastasis from primary sigmoid colon carcinoma. *Indian J Gastroenterol* 23(3):114–115
- Hyingstrom JR, Hu CY, Xing Y, You YN, Feig BW, Skibber JM, Rodriguez-Bigas MA, Cormier JN, Chang GJ (2012) Clinicopathology and outcomes for mucinous and signet ring colorectal adenocarcinoma: analysis from the National Cancer Data Base. *Ann Surg Oncol* 19(9):2814–2821
- Kang A, Lee JH, Lin E, Westerhoff M (2013) Metastatic colon carcinoma to the prostate gland. *J Comput Assist Tomograph* 37(3):463–465
- Khan M, Korphaisarn K, Saif A, Foo WC, Kopetz S (2017) Early-onset signet-ring cell adenocarcinoma of the colon: a case report and review of the literature. *Case Rep Oncol Med* 2017:2832180. <https://doi.org/10.1155/2017/2832180>
- Morales-Cruz M, Salgado-Nesme N, Trolle-Silva AM, Rodríguez-Quintero JH (2019) Signet ring cell carcinoma of the rectum: atypical metastatic presentation. *BMJ Case Rep* 12(4):e229135
- Osunkoya AO, Netto GJ, Epstein JI (2007) Colorectal adenocarcinoma involving the prostate: report of 9 cases. *Hum Pathol* 38(12):1836–1841
- Park JJ, Snow ZA, Lurz KL, Edwards DC, Belkoff LH, Cahn DB (2020) A rare case of signet ring cell carcinoma of the colon with selective metastasis to the prostate. *Urology* 143:e17–e19

- Prashanth A, Kumar Ravichander S, Eswaran P, Kalyan S, Maheswari BS (2023) Diagnostic performance of Ga-68 FAPI 04 PET/CT in colorectal malignancies. *Nucl Med Commun* 44(4):276–283
- Schips L, Zigeuner RE, Langner C, Mayer R, Pummer K, Hubner G (2002) Metastasis of an ascending colon carcinoma in the prostate 10 years after hemicolectomy. *J Urol* 168(2):641–642
- Seog WJ, Dhruv S, Atodaria KP, Polavarapu A (2022) An extremely rare case of rectal signet ring cell carcinoma. *Gastroenterol Res* 15(2):106–111
- Youssef FR, Hunt L, Meiring PD et al (2011) Metastasis of a cecal adenocarcinoma to the prostate five years after a right hemicolectomy: a case report. *J Med Case Reports* 5:223

### **Publisher's Note**

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

**Submit your manuscript to a SpringerOpen<sup>®</sup> journal and benefit from:**

- ▶ Convenient online submission
- ▶ Rigorous peer review
- ▶ Open access: articles freely available online
- ▶ High visibility within the field
- ▶ Retaining the copyright to your article

---

Submit your next manuscript at ▶ [springeropen.com](https://www.springeropen.com)

---