

False Positive F-18 Fluorodeoxyglucose Combined PET/CT Scans from Suture Granuloma and Chronic Inflammation: Report of Two Cases and Review of Literature

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Abstract

Introduction: F-18 fluorodeoxyglucose (FDG) combined positron emission tomography (PET)/computed tomography (CT) imaging is often used in the surveillance of recurrent colorectal cancers after curative resections. We report 2 patients where FDG combined PET/CT imaging produced false positive results due to chronic inflammation and suture granuloma. **Clinical Picture:** Case 1 is a patient with a curative anterior resection done 10 months ago. Serial surveillance carcinoembryonic antigen (CEA) showed a marginal elevation. A solitary "hot spot" on combined PET/CT imaging was seen at the level of the previously resected inferior mesenteric vein. Case 2 is a patient with a positive solitary lesion on combined PET/CT imaging 16 months after a curative right hemicolectomy for colorectal cancer. The serum CEA was within normal limits. **Treatment:** Both patients had undergone exploratory laparotomy with complete resection of the solitary lesions. **Outcome:** The histology of Case 1 was reported as a suture granuloma while the histology of Case 2 was reported as an inflammatory nodule related to the previous suture pedicle, both with no malignant tissues identified. **Conclusions:** False positives on combined PET/CT imaging may result from inflammatory granulomas months after surgery.

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Key words: Carcinoembryonic antigen, Colorectal cancer, Recurrence, Surveillance

Introduction

Postoperative surveillance for recurrence after curative colorectal cancer surgery has been enhanced with the use of F-18 fluorodeoxyglucose (FDG) combined positron emission tomography (PET)/computed tomography (CT) imaging that detect metabolic anomalies via differences in tissue glucose uptake and thus metabolic activity.¹⁻³ This may occasionally pose a problem in distinguishing malignant from inflammatory tissue.^{4,5} We report 2 cases of histologically proven false positive results on FDG combined PET/CT imaging after resection laparotomy as a result of chronic inflammation and a suture granuloma.

Case 1

A 61-year-old female presented with a history of a curative right mastectomy and axillary clearance performed 2 years ago for ductal carcinoma in-situ of the right breast. She was diagnosed with distal sigmoid colon cancer and a

curative high anterior resection was performed. The histology was reported as a well circumscribed, T4, moderately differentiated adenocarcinoma measuring 3.5 x 3 cm with 7 of 9 lymph nodes biopsied showing metastasis, including the apical node (N2). Serum carcinoembryonic antigen (CEA) level fell from a preoperative level of 39.5 µg/L to 9.7 µg/L one month after surgery, and to a low of 0.6 µg/L four months post-surgery. She had completed 6 months of adjuvant chemotherapy. During a routine follow-up 10 months post-surgery, the CEA level was noted to have risen to 5.4 µg/L. The patient remained asymptomatic throughout the follow-up period.

A FDG combined PET/CT scan was performed to evaluate for occult recurrence. 13.4 mCi of FDG was administered with attenuation-corrected PET/CT imaging performed from the base of the skull to the upper thighs 60 minutes after injection of the tracer. This revealed a solitary small focus of increased FDG activity in the abdomen, to the left

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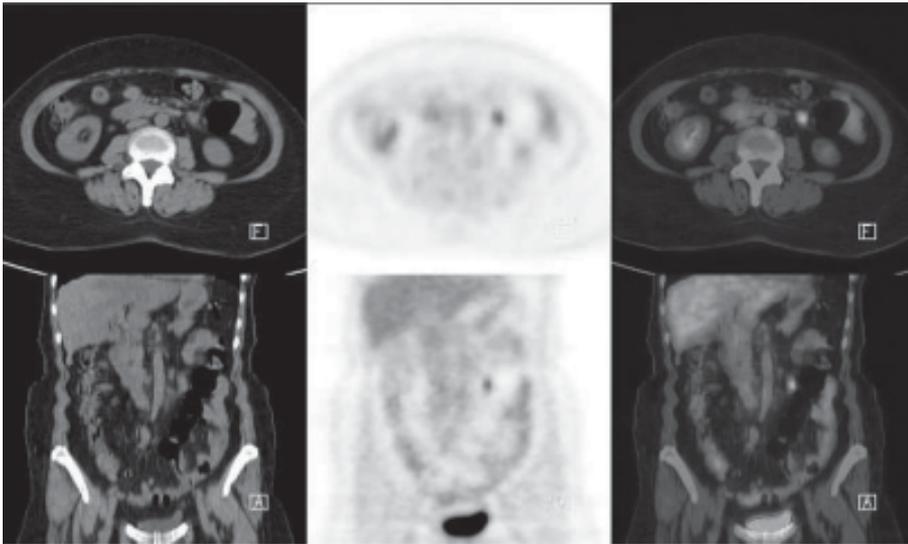


Fig. 1. Combined PET/CT scan of Case 1. A bright spot in the left hypochondrial area corresponding to the region near the ligament of Treitz indicative of a solitary recurrence.

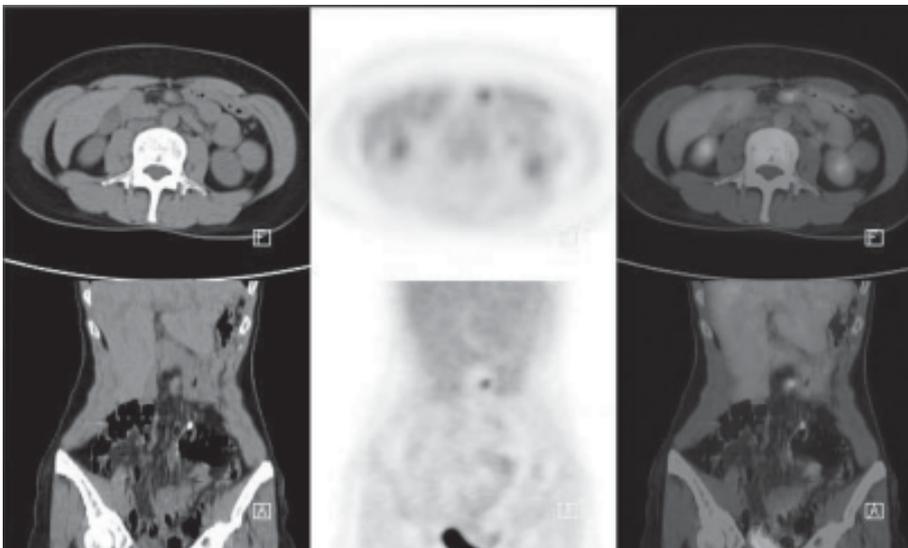


Fig. 2. Combined PET/CT scan of Case 2. A solitary area of increased uptake of FDG is noted in the area anterior to the head of the pancreas. This corresponds to a similar area, seen on the CT scan of the abdomen, which has increased intravenous contrast uptake.

of the midline (Fig. 1). The focus corresponded to a possible small serosal deposit noted on the non-enhanced correlative CT scan, measuring 1.5 x 1.2 cm, 3 cm inferior to the ligament of Treitz. Maximum standardised uptake value (SUV) at the focus was 3.9. A small left para-aortic lymph node measuring 1.5 x 0.8 cm was also noted, but lacked any significant FDG activity and was deemed a reactive lymph node. A repeat serum CEA level done late in the same month showed a further increase to 9.6 µg/L. Exploratory laparotomy was performed on the patient, with the aim of resecting the solitary metastasis.

Intraoperatively, the deposit was identified in the mesentery around the inferior mesenteric vein. This was resected with a segment of the adjacent colon. Histology revealed mesenteric fibrosis with a suture granuloma and chronic inflammation present in the nodule. Extensive fibrosis with focal giant cell reaction containing refractile,

polarisable suture material was identified. There was no evidence of malignancy.

The serum CEA level continued to rise to 72.4 µg/L four weeks after the surgery. A CT scan of the chest, abdomen and pelvis showed interval new hypodense lesions suspicious for metastases in segments 5, 6, 7 and 8 of the liver. The patient was started on palliative chemotherapy.

Case 2

A 37-year-old female with a history of subclinical hepatitis C infection was diagnosed with distal transverse colon cancer after an episode of subacute intestinal obstruction secondary to intussusception of the tumour. A curative extended right hemicolectomy was performed and the histology showed a poorly circumscribed, T3, moderately differentiated adenocarcinoma measuring 4 x 5 cm. All 17 lymph nodes biopsied were free of tumour (N0).

Sixteen months later, a routine surveillance CT scan revealed an enhancing nodule measuring 1 x 0.6 cm, compatible with a peritoneal metastatic recurrence within the small bowel mesentery at the peri-pancreatic area. Serum CEA level was noted to be 2.4 µg/L (normal laboratory reference range is 0.5 µg/L to 3.5 µg/L).

A confirmatory combined PET/CT scan was performed with 10.4 mCi of FDG administered intravenously with the scans obtained from the base of the skull to the upper thighs 85 minutes after injection of the tracer. PET findings indicated a solitary peritoneal metastasis in the small bowel mesentery. The focus of the low-grade FDG uptake measured 1.5 x 1 cm (Fig. 2). This corresponded to the enhancing nodule seen on the follow-up CT scan. Maximum SUV at the focus was 3.4. No other FDG-avid lesion was seen on the rest of the body.

An exploratory laparotomy, carried out with a view to resecting the recurrence, showed that the nodule was situated at the pedicle of the previously ligated middle colic vessels, anterior to the head of the pancreas. The histology was reported as 2 lymph nodes with mesenteric fibrosis and chronic inflammation. Reactive lymphoid hyperplasia and dense fibrosis of the surrounding adipose tissue, entrapping nerve bundles and thick-walled blood vessels, and patchy lymphoplasmocytic and histiocytic aggregates were present in the specimen. There was no evidence of metastatic disease or malignancy. The patient is currently well with no recurrent disease detected.

Discussion

Combined PET/CT imaging is a non-invasive nuclear medicine procedure that is gaining increasing application in oncology as a standard modality in the diagnosis of occult cancers, restaging and monitoring of therapeutic efficacy. Metabolic abnormalities detected on the PET images can be precisely localised anatomically by hardware fusion with the CT images obtained in the same sitting. FDG is the most common radiopharmaceutical tracer used in oncological PET imaging.⁴ Tissues with increased glucose metabolism, such as malignant lesions, appear as areas of increased activity on PET scans due to the trapped FDG within the cells. They are analysed semi-quantitatively using the SUV, which relates the activity concentration in a fixed volume of tissue to the amount of the injected dose and the patient's body weight.

Several studies evaluating the efficacy of PET compared to conventional CT scans in the follow-up of recurrent colorectal cancer have showed sensitivity and specificity of up to 100% and 83%, respectively.⁶⁻¹¹ It is particularly effective in the diagnosis and restaging of recurrent colorectal cancer and in the assessment of resectability.^{12,13} However, one of the problems of FDG PET is the false

positive results arising from inflammation.^{5,14} Acute or chronic inflammation, abscesses and inflammatory lymphadenopathy and non-specific reactions following radiotherapy may mimic tumour tissue in PET scans.^{14,15} This false positive finding has occurred a long 10 to 15 months after the primary resection. In one of the cases, foreign body material was found on microscopic examination and this is likely to be remnants of the silk sutures used during the initial surgery.

Serum CEA level is often used in surveillance after colorectal cancer resections.¹⁶ The utilisation of PET in the investigation of raised CEA levels has a positive predictive value of 89% and a negative predictive value of 100%.¹⁷⁻²⁰ Zervos et al²¹ reported that patients with normal CEA levels but positive PET scans frequently undergo non-therapeutic laparotomy in the absence of mass lesions on CT scans. They concluded that PET scans are more accurate in patients with elevated CEA levels, and should be interpreted with caution in patients with normal CEA levels. As Case 2 had a mass lesion on CT scan, laparotomy was inevitable.

It is interesting to note that in Case 1, a false positive was present despite a background of rising CEA levels. This may be the result of a lead-time in the diagnosis of any mass lesions.^{22,23} Haber et al²³ reported a similar case of raised CEA in a patient following colonic resection for sigmoid colon carcinoma. FDG combined PET/CT scans had shown increased uptake in a cystic mass present at the anastomotic site, but subsequent pathological examination of the resected mass revealed bowel sequestration with the formation of a mucocoele and no overlying defect at the mucosal anastomotic site. Case 1 eventually developed multiple liver metastases, seen on CT scan 2 months after the previous FDG combined PET/CT scan. This demonstrates similar limitations in the FDG combined PET/CT scans against a background of rising CEA levels.

False positives may be reduced with the use of multi-tracer studies and labelled amino acids PET scans instead of the FDG scan. A recent study compared the selectivity of radiolabelled nucleosides, 3-deoxy-3-18F-fluorothymidine (FLT) and FDG, in rats that bore glioma in the right shoulder and sterile inflammation in the left calf muscle. It was demonstrated that FLT had a higher tumour specificity than FDG.²⁴ However, a clinical trial conducted to assess the potential benefits of the 2 agents in PET imaging of colorectal cancer found that FLT had a poor sensitivity for colorectal liver metastases, despite a sensitivity similar to FDG in the detection of extra-hepatic disease. This made FLT unsuitable as a single, reliable diagnostic tracer, given its poor surveillance of recurrent metastatic disease, particularly those in the liver.²⁵

A different approach using dual time point imaging was capable of differentiating malignancy from inflammation

and normal tissue in the head and neck, particularly when separated by a sufficient time interval of more than 30 minutes.²⁶ This method has found application in head and neck tumours but more studies are required to investigate its effectiveness in recurrent colorectal cancer.

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