Diagnostic Pitfall in [^{18}F] FDG PET-CT: A Case Report on Transient Inflammatory Lung Uptake Mimicking Metastatic Rectal Cancer

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ABSTRACT

^{18}F-FDG PET-CT is widely used in oncology for staging, treatment-response assessment and detection of recurrent or metastatic disease. However, its diagnostic specificity has limitations specially both infectious and inflammatory lesions may also demonstrate increased glucose uptake, thereby mimicking malignancy.

We report a case of a 34-year-old man with rectal carcinoma who underwent ^{18}F-FDG PET-CT after chemotherapy for response evaluation. The scan revealed a large glucose avid soft tissue density lesion in the right lung, raising strong suspicion for pulmonary metastasis or a second primary malignancy. Based solely on the image without the correlation of history, malignant aetiology was more likely. However, after clinical correlation further assessment suggested an infectious process. The patient was then treated with intravenous antibiotics and underwent follow up imaging. ^{18}F-FDG PET-CT demonstrated complete resolution of the initial lesion confirming that the abnormality was actually infective consolidation rather a metastatic disease.

This case highlights a significant challenge of interpretation of ^{18}F-FDG PET-CT which is the distinction between malignant lesions and infectious or inflammatory processes. It shows the importance of careful clinical correlation, consideration of alternative aetiologies and follow-up imaging after a interval before confirming that diagnosis of metastasis. This approach is essential to avoid misdiagnosis, unnecessary invasive procedures, inappropriate treatment escalation, and incorrect staging of the cancer. The case also describes that ^{18}F-FDG PET-CT is an essential tool not only for treatment monitoring but also for guiding clinical decision-making when interpreted along with full clinical correlation.

Keywords: Rectal carcinoma, ^{18}F-FDG PET-CT, pulmonary consolidation, false-positive uptake, infection, metastasis.

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INTRODUCTION

Rectal cancer is one of the major clinical problems. Even after surgery, chemotherapy and radiotherapy long-term survival is hindered by recurrence and distant metastasis. As a result, accurate post-treatment evaluation has become crucial. Early detection of recurrence and metastatic disease can have direct impact on subsequent management, can save treatment delays and enhance prognostic evaluation. In day-to-day clinical oncological trend, imaging therefore plays a key role not only in initial staging, but also during surveillance and treatment-response assessment (1,2).

Among available imaging procedures, ^{18}F-fluorodeoxy-glucose Positron Emission Tomography and Computed Tomography (^{18}F-FDG PET-CT) is now a gold standard hybrid modality among existing imaging techniques because it integrates structural data from CT with metabolic data from PET in a single test. It is particularly effective in selected patients for analysing the likelihood of suspected locoregional recurrence, distant metastasis and unclear findings on conventional imaging. A significant number of patients in the single-institute study in Bangladesh had metastatic illness with the lung being the most common metastatic site among those who had metastases according to follow-up by ^{18}F-FDG PET-CT. Because of this any newly detected FDG-avid pulmonary lesion in a patient with rectal cancer is clinically important and potentially management changing (2,3).

Most malignant cells have elevated glucose metabolism, which is the basis for ^{18}F-FDG PET-CT diagnosis. Tissues that have significant glycolytic activity can be seen once FDG enters the cell via glucose transporters, is phosphorylated by hexokinase and becomes

biologically trapped. One of the most fundamental mistakes made in routine nuclear medicine practice is due to this limitation (4,5).

As pulmonary lesions may lead to immediate fear of hematogenous spread, this scenario is especially relevant to the follow-up of rectal cancer. However, being detected as positive lesion on PET-CT alone cannot be clear evidence of malignancy. Several studies demonstrated that FDG-avid nodal lesions could point to inflammatory reactive change rather than metastases even in rectal cancer staging, stressing the limited specificity of metabolic imaging when viewed individually. Comparatively, the larger portion of PET-CT studies has stressed that in order to differentiate between benign and malignant hypermetabolic lesions, CT morphology, clinical history, laboratory results and interval follow-up are often necessary. Because they illustrate both the strengths and limitations of 18FFDG PET-CT in current cancer treatment, circumstances in which inflammatory lung uptake resembles metastatic rectal cancer are therefore highly informative (1,5).

The current case is used to illustrate this diagnostic difficulty. It shows how an FDG-avid lung lesion in a patient with rectal carcinoma may at first point to metastatic illness, but additional investigation reveals a benign inflammatory lesion. These examples are significant because they serve as an example to physicians that although PET-CT is a very sensitive diagnostic tool, its specificity is largely dependent on meticulous diagnostic-radiologic concordance (2,4).

CASE REPORT

A 34-year-old man with a history of rectal carcinoma was suffering from cough and chest pain. He had previously been diagnosed with rectal cancer on by histopathology report (Adenocarcinoma, grade II biopsy specimen) and had already received chemotherapy 06 cycle & radiotherapy 28 fractions. The patient was referred for ^{18}F-FDG PET-CT to assess treatment response and to find the possibility of recurrent or metastatic disease in view of his ongoing symptoms.

The patient was suffering from cough and chest pain for 1 month. Associated symptoms such as fever, sputum production, dyspnea, anorexia, and weight loss were also present. On physical examination, the patient was ill-looking with temperature 101°F, pulse 90 b/min, blood pressure 115/75 mmHg, respiratory rate 22br./min, and oxygen saturation 95 % on room air. Chest examination revealed crepitations and bronchial breath sounds.

Baseline laboratory investigations demonstrated with haemoglobin 10.5 g/dL, total white blood cell count 15,800/mm^3, neutrophils 70%, lymphocytes 10% and inflammatory markers including C-reactive protein (CRP) 50 mg/L and erythrocyte sedimentation rate (ESR) 78 mm in 1st hour. These laboratory abnormalities with elevated CBC, CRP, and ESR, supported the possibility of an infectious or inflammatory pulmonary process. Renal And Liver function tests were normal.

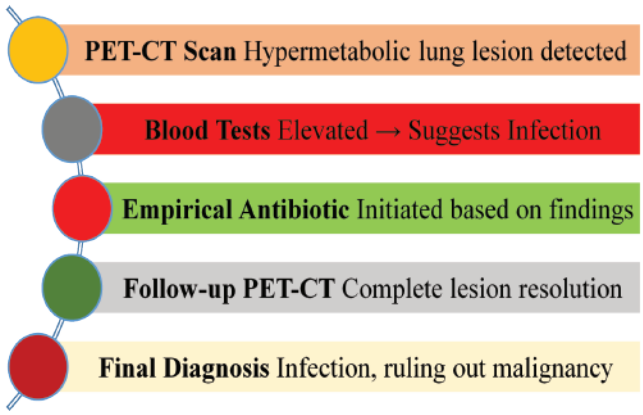

Figure 1: Overview of the case

Whole-body ^{18}F-FDG PET-CT performed on 05 February 2024 demonstrated a hypermetabolic right lung lesion, described on the low-dose CT component as a soft-tissue density lung consolidation, which raised suspicion for pulmonary metastasis or a second primary lung malignancy. In day-to-day oncology practice, such a finding was clinically significant and initially concerning. However, when the PET-CT findings were interpreted in context with the patient's respiratory symptoms and elevated inflammatory markers, an infective cause became an important part of the differential diagnoses. The provided image set includes the pre-treatment PET-CT (Figure 2).

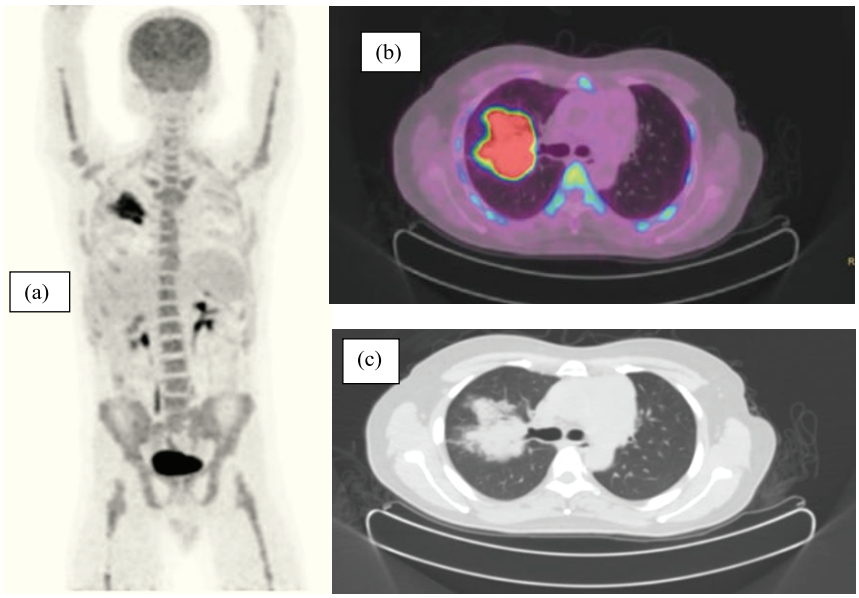

Figure 2: (a) Pre treatment MIP view on 05 Feb 2024 showing hyopermetabolic focus on right Lung (b) Pre treatment PET CT showing hypermetabolic lesion in the right lung, (c) axial CT of the corresponding hyperdense lesion in right upper lung

In view of the clinical and biochemical evidence suggestive of infection, the patient was started on empirical antibiotic therapy with Intravenous Meropenem for 14 days. Symptomatic improvement during treatment occurred along with the laboratory parameters.

A follow-up ^{18}F-FDG PET-CT on 27 March 2024 showed complete resolution of the previously noted hypermetabolic right lung lesion, with corresponding disappearance of the pulmonary abnormality on the low-dose CT images. This interval resolution strongly favoured the diagnosis of infection rather than metastasis. The imaging response after antibiotic therapy, together with the elevated inflammatory markers and clinical presentation, confirmed that the lesion represented an infectious pulmonary process mimicked malignancy on initial PET-CT rather than pulmonary metastasis from rectal carcinoma.

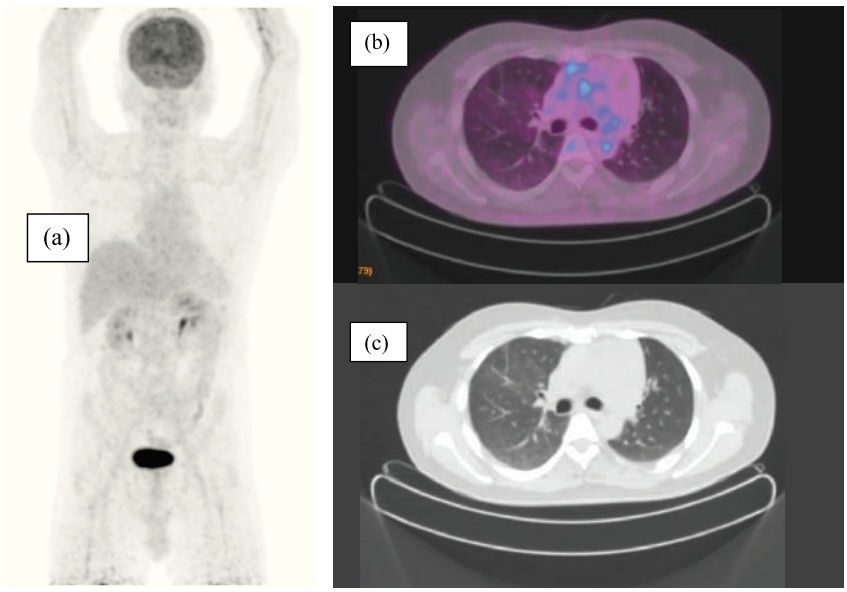

Figure 3: (a) Post treatment MIP image of the same patient done on on 27 march 2024 showing no hypermetabolic focus, (b) Post treatment axial fused PET CT image showing absence of hyperdense area in follow up PET CT, (c) Post treatment axial CT showed no hyperense lesion in the right lung.

The final diagnosis was therefore infective pulmonary consolidation in a patient with rectal carcinoma, initially masking as a malignant hypermetabolic lesion on ^{18}F-FDG PET-CT

DISCUSSION

The findings of this case are that intense pulmonary FDG uptake on PET-CT is not metastatic disease. The biologic basis of FDG imaging explains this limitation accurately. FDG accumulates in cells where glucose utilization is high and this includes not only malignant cells but also activated inflammatory cells such as neutrophils, macrophages, and lymphocytes. As a result, infectious and inflammatory lesions may show increased radiotracer uptake and closely mimic malignancy on PET-CT. Infection and inflammation are well-recognized causes of false-positive uptake in oncology PET-CT, while further noted that these conditions often produce overlapping uptake patterns and therefore reduce specificity (4,5).

This is especially important in the follow-up of rectal cancer, where PET-CT is frequently used to detect recurrence, distant metastasis, and treatment response. In the Bangladesh single-institute study by follow-up ^{18}F-FDG PET-CT detected metastases in 9 of 26 patients, and among those metastatic cases, the lung was the most common site, being present in 4 patients (2). Therefore, in a patient with a history of rectal carcinoma, a new FDG-avid lung lesion raises a strong suspicion of pulmonary metastasis. However, the rectal cancer also warns that FDG-avid findings should not be interpreted alone. Although FDG PET-CT can contribute to rectal cancer staging, inflammatory reactive lymph nodes may be misinterpreted as metastatic disease, and FDG uptake by itself is an imperfect discriminator between benign and malignant nodal lesions (6).

In the present case, the initial PET-CT demonstrated a markedly hypermetabolic right upper lobe lesion, which could reasonably have been interpreted as metastatic disease or even a second primary lung malignancy in the setting of an underlying cancer history. The most decisive feature, however, was the short-interval follow-up scan, which showed marked morphologic regression on CT and near-complete disappearance of abnormal FDG uptake. From an imaging standpoint, such rapid interval resolution strongly argues against viable malignant disease and favours a transient inflammatory or infective pulmonary process. In practical terms, the post treatment disappearance of the lesion was more informative than the initial intensity of uptake. This interpretation is fully consistent with the published pitfall literature, which recommends correlation with CT findings, patient history, and when needed, interval imaging or further work-up before labelling a lesion as malignant.

Another important aspect is that metabolic intensity alone should not be taken as a surrogate for tumor aggressiveness or definite metastatic behaviour. Advanced PET parameters such as SUVmax, metabolic tumor volume (MTV), and total lesion glycolysis (TLG) are being investigated in rectal cancer, but their interpretation remains nuanced. It is established that combining primary tumor MTV with nodal SUVmax improved prediction of lymph node metastasis. In contrast, Ahmed et al. concluded that baseline ^{18}FFDG PET-CT parameters alone could not reliably assess aggressiveness or prognosis in primary rectal cancer. Taken together, these studies suggest that PET-derived metrics may add value, but they cannot replace integrated interpretation using morphology, clinical setting, pathology, and temporal evolution (7).

From a clinical management perspective, this case highlights the importance of a multidisciplinary and context-based reading of PET-CT. A newly detected FDG-avid pulmonary lesion in a cancer patient should prompt a differential diagnosis that includes metastasis, second primary lung cancer, infective consolidation, organizing pneumonia, granulomatous disease, and other inflammatory causes. Overcalling a benign inflammatory lesion as metastatic disease can lead to unnecessary upstaging, inappropriate systemic therapy, invasive biopsy, avoidable anxiety, and delay in correct treatment. Conversely, dismissing a true malignant lesion is equally hazardous. For this reason, the literature consistently supports a balanced approach combining PET findings with CT morphology, symptoms, inflammatory markers, recent infection history, treatment history, and short-term reassessment when indicated.

Overall, this case points out a well-known but extremely important flaw in the use of ^{18}F-FDG PET-CT. This metabolically active lung lesion in the patient with rectal cancer may appear to be metastatic disease on the first scan

but turn out to be benign due to its inflammatory nature. As a result, the case shows a crucial diagnostic principle that, although PET-CT is quite sensitive, its specificity is mostly dependent on serial interpretation and clinical correlation. In certain cases, like this, the final diagnosis may depend more on an overall pattern of change over time than on the precise level of FDG uptake.

CONCLUSION

This case highlights one of the most important limitations of ^{18}F-FDG PET-CT. Intense FDG uptake in a pulmonary lesion does not always indicate malignancy. In a patient with rectal cancer, a hypermetabolic lung lesion may strongly suggest metastatic disease on initial imaging, but follow-up imaging reveal a benign inflammatory or infective cause. The marked interval resolution seen in this case supports the theory that PET-CT findings should never be interpreted isolated. Careful correlation of CT image with clinical history and subsequent imaging is necessary to avoid false-positive interpretation, unnecessary upstaging, and inappropriate cancer management. Thus, while ^{18}F-FDG PET-CT remains highly valuable in the follow-up of rectal carcinoma, its greatest strength lies in integrated interpretation.

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