



Malignant Tumors with Low FDG-PET Uptake: A case Report and Review of the Literature

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Abstract

Fluorine 18-fluorodeoxyglucose (FDG) positron emission tomography (PET) is a well-accepted examination for diagnosis, staging, and monitoring in clinical oncology. According to the higher glucose metabolism rate, malignant tumor cells have higher FDG uptake, besides higher FDG uptake is strictly correlated with poor prognosis in various types of cancer. However, FDG-PET has limitations associated with some of the cancer types that have low FDG uptake, even high metabolism. Low cellularity, low glucose metabolism, inadequate patient preparation, small-sized tumor, and cellular mucin might be cause to low FDG uptake. Low FDG uptake frequently presented in lepidic growth adenocarcinoma (formerly defined as bronchoalveolar adenocarcinoma), renal cell cancer, and mucinous neoplasms.

We report on a case of 57-year-old female biopsy proven Signet Ring Cell Carcinoma (SRCC) patient without FDG-PET uptake in the evaluation for staging. The patient admitted to hospital with massive ascites and dyspeptic complaints. Further evaluation revealed the existence of SRCC with no FDG-PET uptake.

FDG-PET reveals valuably findings in clinical oncology for diagnosis, staging, and monitoring. Although FDG-PET uptake is correlated with most of the malignant tumors' activity, some aggressive malignancies may have no/low FDG uptake and FDG uptake is not predictive of survival.

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Keywords: FDG-PET, malignant tumors, signet cell.

Introduction

Fluorine 18-fluorodeoxyglucose(FDG)positron emission tomography (PET) has established the usefulness in clinical oncology for diagnosis, staging, and monitoring.¹ According to the higher glucose metabolism rate, malignant tumor cells have higher FDG uptake, besides higher FDG

uptake is strictly correlated with poor prognosis in various types of cancer.² However, FDG-PET has limitations associated with some of the cancer types that have low FDG uptake, even high metabolism, and poor prognosis or high FDG uptake of benign tumors related to the high



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inflammatory process.³ Likewise, studies revealed that low cellularity, low glucose metabolism, inadequate patient preparation, small-sized tumor, and cellular mucin might be cause to low FDG uptake.⁴ As mentioned in the literature before, low FDG uptake frequently presented in lepidic growth adenocarcinoma (formerly defined as bronchoalveolar adenocarcinoma), renal cell cancer, and mucinous neoplasms.⁴⁻⁵ Mucinous carcinoma defined as an epithelioid neoplasm that contains clear, gelatinous fluid called mucin and has low cellularity leading to low FDG uptake.² Clinical studies revealed that the presence of mucin is highly correlated with lower survival rates except for colorectal carcinomas.⁶ Signet ring cell carcinoma (SRCC) is a rare mucinous adenocarcinoma, affects the stomach predominantly and occasionally ovary, colon, rectum, prostate, and bladder.⁷ Although gastric cancer incidence is decreasing, recent studies showed the increasing incidence of gastric SRCC.⁸ Approximately 15-28% of gastric carcinomas are SRCC, characteristically infiltrates the gastric wall diffusely, and associated with poor prognosis.⁹ According to studies, SRCC patients have poor outcomes such as an inclination for metastasis and a reduced response to chemotherapy.^{10,11}

In this case report, we are presenting a 57-year-old female biopsy proven SRCC patient without FDG-PET uptake in the evaluation for staging. The purpose of this report is to remind the limitations of FDG-PET usage in certain malignancies.

Case Report

A 57-year-old female patient admitted to internal medicine outpatient clinic with the complaints of severe abdominal distention and dyspepsia. The patient had history of admission to Ob/Gyn outpatient clinic with the same complaints three months ago. Gastric wall thickening was reported in abdominal computerized tomography (CT). Gastroscopic evaluation reveals no abnormal findings. Evaluation of gastric wall biopsy specimen shows chronic inactive gastritis. Proton pump inhibitor (PPI) therapy was prescribed.

In current admission patient admitted with massive ascites which aggravates dyspeptic complaints. Patient was hospitalized for further evaluation and paracentesis was performed. Macroscopically, the sample was hemorrhagic, and serum ascites albumin gradient was measured under 1.1 mg/dL (0.1 mg/dL). Tuberculosis or bacterial pathogens were not detected in ascitic fluid culture. CT scans showed diffuse gastric wall thickening, a decrease in gastric volume, and heterogeneous density areas on the mucosal faces of the stomach. Edematous, erythematous and fragile gastric corpus mucosa was observed in gastroscopic evaluation, and multiple site biopsy was performed. Pathological evaluation was reported as signet ring cell carcinoma (Figure 1). No significant metabolic activity was observed in any area, including the gastric region in FDG-PET evaluation (Figure 2).

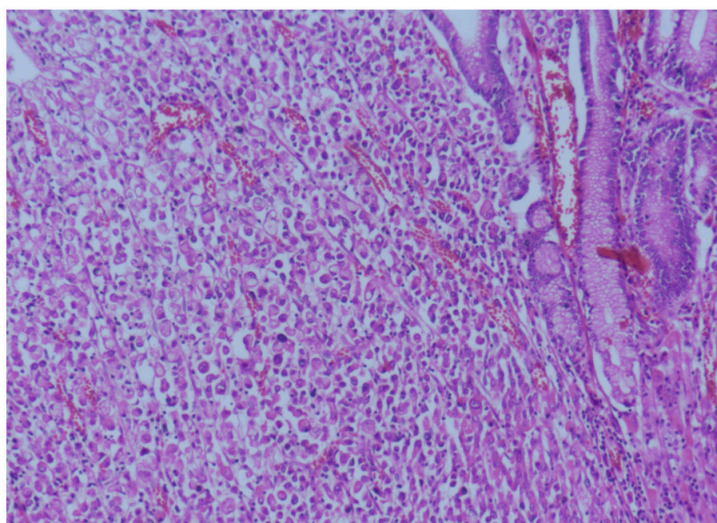


Figure 1. Gastric Signet Ring Cell Carcinoma at higher magnification (Hematoxylin & Eosin x100)

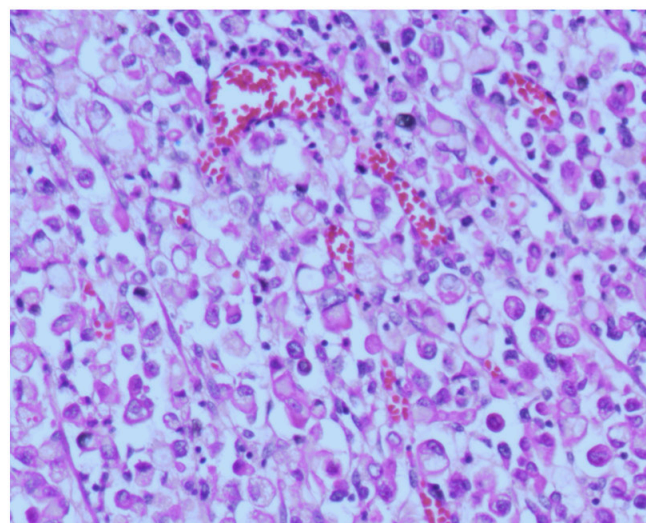


Figure 2. Gastric Signet Ring Cell Carcinoma at higher magnification (Hematoxylin & Eosin x200)

The patient had consulted to gastroenterological surgery and medical oncology. Chemotherapy has planned due to diffuse tumor spread. The patient assigned to the oncology service for chemotherapy. Docetaxel, Oxaliplatin, Leucovorin, and 5-fluorouracil (FLOT) chemotherapy were applied for eight cures. After the chemotherapy regimen, the patient underwent surgery six months after diagnosed with gastric SRCC.

Discussion

SRCC is a rare mucinous adenocarcinoma, mainly affects stomach.⁷ Nearly 15-28 % of gastric carcinomas are SRCC, and recent studies revealed that the incidence of gastric SRCC is increasing.^{8,9} Gastric SRCC is encountered frequently in the female and at a relatively younger age. SRCC has a worse prognosis compared to other advanced gastric cancers.^{5,12} SRCC contains high levels of mucin and has a diffuse spreading pattern; therefore, has a low FDG uptake, notwithstanding high glucose metabolic activity.⁹ Mucin is considered as an indicator for the aggressiveness of gastrointestinal tumors except colorectal tumors.^{2,12,13} Baldus et al.¹⁴ examined the correlation between mucin core peptide antigens (MUC) and TNM, as well as prognosis, in gastric carcinomas by immunohistochemistry studies. The study

showed that the presence of MUC1 mucin is indicating increasing invasion and related to poor prognosis. Reversely, MUC2 mucin is indicating low metastasis potential.^{2,14}

FDG-PET is a well-accepted examination for diagnosis, staging, and monitoring in clinical oncology. Even high FDG uptake is frequently correlated with malignancy and poor prognosis, studies have shown limitations of FDG-PET.^{1,3} Particularly, mucin involving gastrointestinal tract carcinomas, lung carcinomas, and some of the malignant tumors have low FDG-PET uptake.^{1,3} Also, studies claimed that FDG-PET may not guide to asses recurrent or metastatic disease in mucinous carcinoma.² Berger et al.² investigated FDG-PET detection of locally advanced gastric carcinoma in 40 patients and reported the sensitivity of FDG PET less than 60% (24/40). The rate of detection of tumors of the non-intestinal growth type was 41% (9/22). Furthermore, the study revealed that gastric carcinoma FDG uptake is not related to tumor aggressiveness.²

As mentioned in previous studies, low FDG-PET uptake is encountered in renal cell carcinomas (RCC) due to increased activity of healthy renal tissue, and FDG excretion to urine. Mutual findings of several studies claim that FDG- PET have a limited role in the evaluation of primary or metastatic RCC.¹⁵

In conclusion. we need to keep in mind that

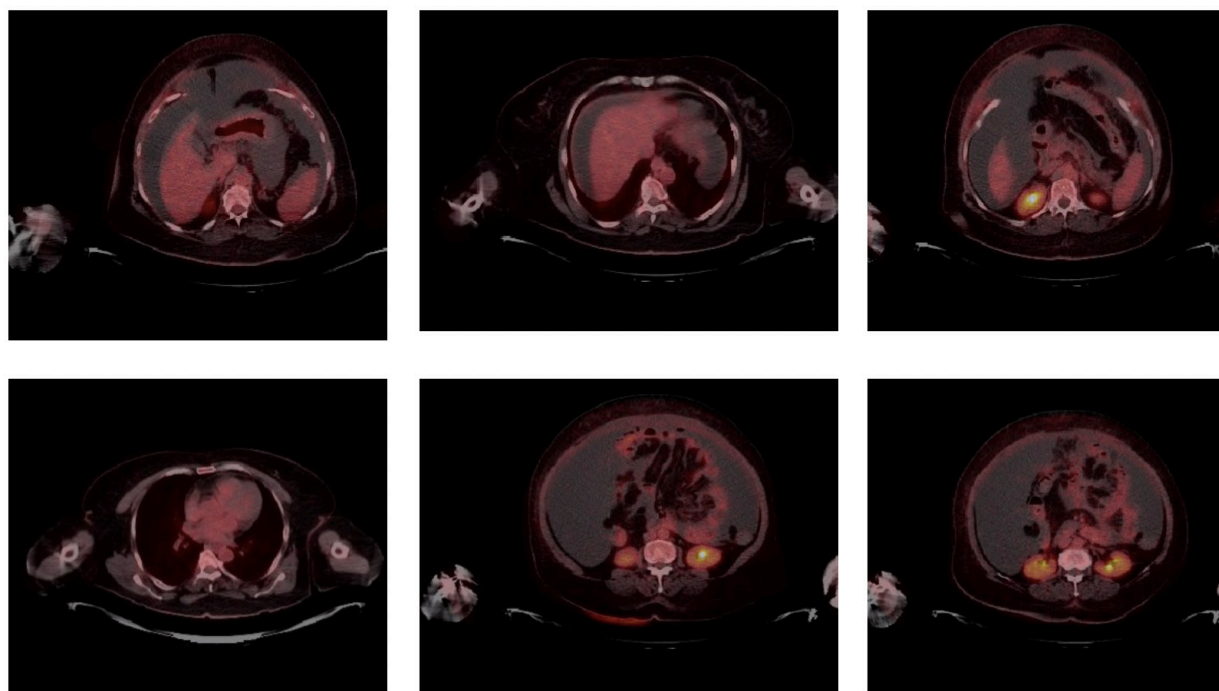


Figure 3. FDG-PET CT evaluation shows no significant uptake

although FDG-PET uptake is correlated with most of the malignant tumors' activity, some aggressive malignancies may have no/low FDG uptake. This report aimed to give rise to consider the limitations of FDG-PET in mucin involving tumors such as SRCC, lepidic growth adenocarcinoma, and renal cell cancer tumors. Additionally, to remind FDG uptake is not predictive of survival.

Conflict of interest

The authors declared that there are no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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