^{18}F-FDG PET/CT in treatment response evaluation of Burkitt lymphoma: complete remission of a peritoneal super scan

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Abstract
Peritoneal lymphomatosis, defined as the disseminated intraperitoneal lymphomatous infiltration, is a rare presentation usually of non-Hodgkin lymphoma and is associated with aggressive histological subtypes of the malignancy. Recently, the term 'peritoneal super scan' has been introduced in positron emission tomography/computed tomography (PET/CT) in a patient with Burkitt lymphoma to describe hypermetabolic lymphomatous involvement of the entire peritoneum, leading to suppression of tracer uptake in organs with otherwise normally increased fluorine-18-fluorodeoxyglucose (^{18}F-FDG) uptake. Herein, we report on a patient with Burkitt lymphoma, initially presenting with a peritoneal super scan in PET/CT demonstrating complete metabolic response to R-CHOP (rituximab, cyclophosphamide, adriamycin, vincristine, and prednisolone) therapy.

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Introduction

Peritoneal lymphomatosis is a rare entity, associated with high-grade non-Hodgkin lymphoma (NHL) like diffuse large B-cell lymphoma (DLBCL) and Burkitt lymphoma, usually originated from the gastrointestinal tract. More rarely, the entity can also occur in indolent NHL, such as follicular lymphoma [1]. Peritoneal lymphomatosis can mimic peritoneal carcinomatosis, causing an important delay in diagnosis, thus, posing a significant impact on patient therapy and outcome. We report on a case of sporadic Burkitt lymphoma, initially presenting as a peritoneal super scan in fluorine-18-fluorodeoxyglucose positron emission tomography/computed tomography (^{18}F-FDG PET/CT) and demonstrating complete metabolic response (CMR) to R-CHOP (rituximab, cyclophosphamide, adriamycin, vincristine, and prednisolone) therapy.

Case Report

A 65 year old male underwent gastroscopy because of a diarrheic syndrome, anemia and weight loss. Gastroscopy revealed an extensive ulcerative lesion of the lesser curvature of the stomach. A stomach biopsy was performed for evaluation of the gastric ulcer and histopathologic examination showed a Burkitt lymphoma. For staging purposes the patient underwent ^{18}F-FDG PET/CT, which revealed diffuse, intense ^{18}F-FDG uptake in the stomach and the entire peritoneum, as well as lymph node involvement in supradiaphragmatic areas along with focal sites of osseous involvement. This intense peritoneal ^{18}F-FDG accumulation led to a suppression of the normal tracer distribution in the brain, heart, liver, spleen and kidneys, giving PET/CT the appearance of a "peritoneal super scan" (Figure 1a, 2a). The patient underwent six cycles of R-CHOP (rituximab, cyclophosphamide, adriamycin, vincristine, and prednisolone) therapy and was re-examined with ^{18}F-FDG PET/CT one month after the end of treatment. The follow-up scan revealed CMR with disappearance of the pathological uptake in the stomach, peritoneum, supradiaphragmatic sites as well as the osseous lesions. Furthermore, an increase of ^{18}F-FDG uptake was observed in the -previously suppressed- organs, which show normally high glucose consumption in PET/CT. At the same time a diffuse, intense tracer uptake in the bone marrow in conjuction with a, diffuse, moderately enhanced metabolism in the spleen were demonstrated, corresponding to reactive, therapy-related changes (Figure 1b, 2b) [2].

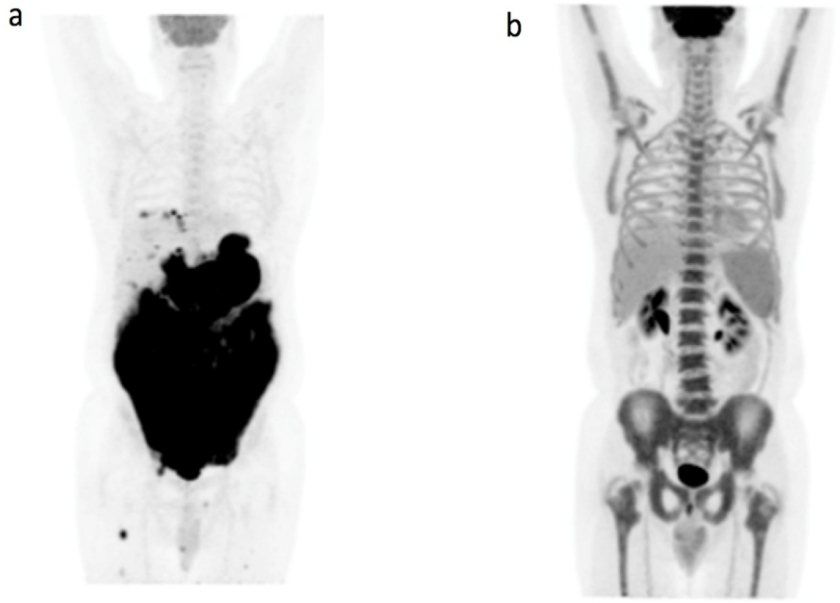

Figure 1. Maximum intensity projection (MIP) images of baseline PET/CT at the time of diagnosis demonstrates an extensive, intensive ^{18}F-FDG accumulation predominantly in the stomach and the entire peritoneum. Supradiaphragmatic lymph node infiltration as well as involvement of the right femur can be also observed. The intense peritoneal ^{18}F-FDG accumulation leads to suppression of the normal tracer distribution in the brain, heart, liver, spleen and kidneys, giving PET/CT the appearance of a 'peritoneal super scan' (a). MIP image of follow-up PET/CT after six cycles of R-CHOP therapy demonstrates complete remission of the peritoneal super scan as well as CMR of the supradiaphragmatic and osseous lesions. Moreover, the previously suppressed metabolic activity in the organs with normally high glucose consumption is restored, while reactive, therapy-related, diffusely increased tracer uptake in the bone marrow and the spleen is demonstrated (b).

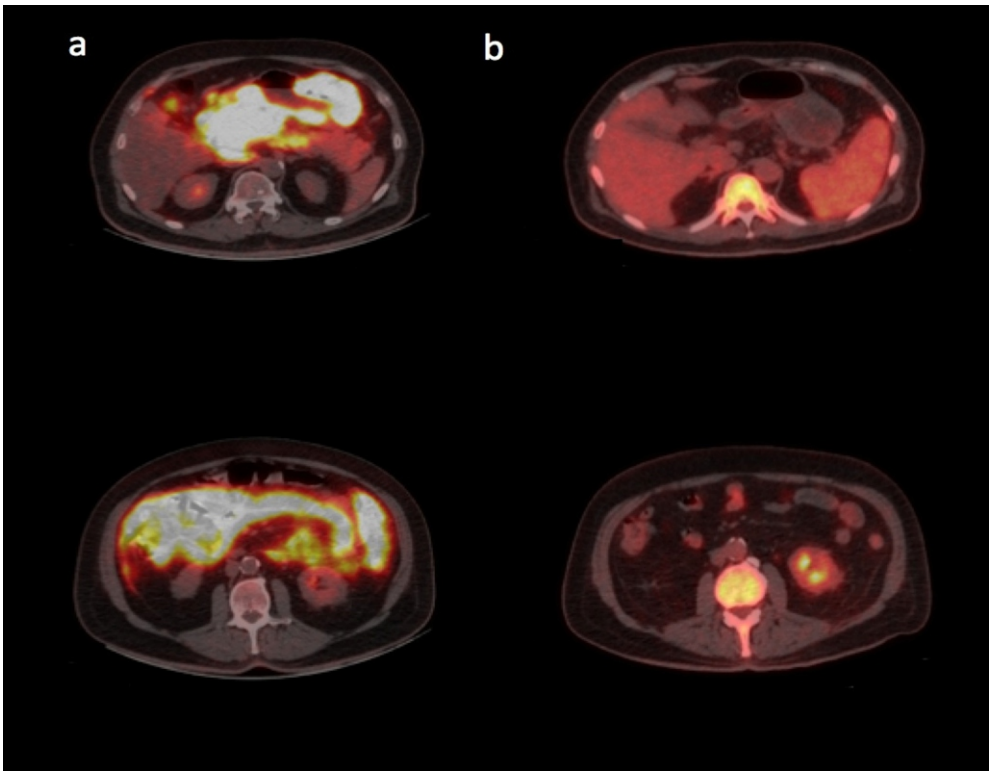

Figure 2. Transaxial, baseline PET/CT images before treatment at the upper abdominal level demonstrate intensive ^{18}F-FDG uptake in the thickened stomach (SUVmax 27.3) and duodenum along with hypermetabolic nodular masses in the peritoneum, while tracer uptake is suppressed in the liver, spleen and kidneys (a, upper row). PET/CT images at a lower abdominal level reveal diffuse, intensive ^{18}F-FDG accumulation in almost the entire omentum, mesentery (SUVmax 25.3) and thickened small bowel, consistent with extensive lymphomatous involvement (a, lower row). After treatment, the respective PET/CT images at the upper and lower abdominal levels reveal CMR of the previously infiltrated organs, normalization of the ^{18}F-FDG activity in the liver, spleen and kidneys as well as diffuse enhanced uptake in the bone marrow and the spleen (b).

Discussion

Diffuse peritoneal disease is an entity of miscellaneous causes. The most prevalent one is peritoneal carcinomatosis usually involving metastases from ovarian and colonic cancer rather than primary peritoneal neoplasms, such as malignant peritoneal mesothelioma [3]. More rare causes of diffuse peritoneal disease include sarcomatosis-involving gastrointestinalstromal tumors (GIST), leiomyosarcoma and liposarcoma [4], tuberculous peritonitis -especially in cases with no pulmonary involvement [5]- and some aggresive features of pseudomyxoma peritonei, characterized by a vast amount of neoplastic cells invading the great omentum and secreting mucin in the peritoneal cavity [6]. Another cause of the entity, often confused with carcinomatosis, is peritoneal lymphomatosis, defined as the disseminated intraperitoneal spread of lymphoma. It represents a rare presentation of the disease and is usually associated with aggressive histological subtypes of high-grade NHL, like the Burkitt lymphoma presented here [7, 8]. The peritoneum is not commonly involved in lymphoma, because it does not contain lymphoid tissue. Therefore, the route of dissemination in peritoneal lymphomatosis is unclear and presumed to occur via pathways like the visceral peritoneal surfaces, the gastrocolic ligament or the transverse mesocolon [8, 9]

Positron emission tomography/CT has shown increased ^{18}F-FDG uptake in several cases of peritoneal lymphomatosis [3, 10-12]. Recently, the term 'peritoneal super scan' has been introduced in a patient with Burkitt lymphoma, to describe involvement of the entire peritoneum depicted with an intense ^{18}F-FDG accumulation in the entire abdomen, leading to suppression of ^{18}F-FDG uptake in organs with normal tracer biodistribution [13]. The herein presented case confirms the presence of this PET/CT finding in a patient with Burkitt lymphoma. Furthermore, it represents the first reported complete remission of a peritoneal super scan after completion of the R-CHOP therapy, which is particularly important in the management of the malignancy. According to the International Harmonization Project (IHP) and the Lugano recommendations, ^{18}F-FDG PET/CT should be routinely performed in tracer avid lymphoma like Hodgkin lymphoma and DLBCL [14, 15]. However, the role of the PET/CT in treatment response assessment of Burkitt lymphoma is not yet established, although the malignancy is ^{18}F-FDG avid in almost all cases, and the modality has shown very encouraging results in prediction of patient outcome after application of the Deauville and the IHP criteria for metabolic response [16, 17]. Our case provides further evidence for the usefulness of ^{18}F-FDG PET/CT in the management of Burkitt lymphoma.

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