

18F-FDG Uptake in an Ovary Containing a Hemorrhagic Corpus Luteal Cyst: False-Positive PET/CT in a Patient with Cervical Carcinoma

Jennifer Ames1
Todd Blodgett1
Carolyn Meltzer1,2,3

PET with 18F-FDG combined with CT (PET/CT) enables precise localization of FDG uptake to particular structures and is useful for the detection and staging of several malignancies [1–3]. However, benign processes also can result in false-positive 18F-FDG uptake [4, 5]. We report the case of a 31-year-old woman with cervical carcinoma who underwent PET/CT that showed 18F-FDG uptake in an ovary that was misinterpreted as metastatic disease. At surgery 12 days later, the ovary contained a hemorrhagic corpus luteal cyst that was the likely cause for the 18F-FDG accumulation.

Case Report

A 31-year-old woman with a history of normal annual Pap smears presented with irregular vaginal bleeding. On pelvic examination, a cervical mass was palpable. Endocervical curettage revealed moderately differentiated invasive squamous cell carcinoma, clinical stage IB. The patient was referred for a staging PET/CT examination, which was performed 22 days after her last menstrual period. Imaging was performed using a commercial PET/CT scanner that combines a septa-less PET scanner (EXACT HR+, CPS Innovations) operated in 3D mode only with a helical CT scanner (Somatom Emotion, Siemens Medical Solutions). PET/CT from the neck through the pelvis was performed approximately 1 hr after the IV injection of 8.41 mCi (311 MBq) of 18F-FDG and soon after the IV injection of 125 mL of ioversol (Optiray 350, Mallinckrodt).

The PET/CT image at the level of the coccyx showed a large area of increased 18F-FDG uptake corresponding to a pelvic mass and a smaller, less intense area of increased 18F-FDG uptake corresponding to the left ovary (Fig. 1). The standardized uptake values (SUVs) of the pelvic mass and the ovary were 9.3 and 4.6, respectively. These findings were interpreted initially as stage IV cervical carcinoma. There were also multiple small areas of increased 18F-FDG uptake in the chest that exhibited fatty attenuation on CT and were diminished or absent on restaging PET/CT performed 5 months later, consistent with 18F-FDG uptake in muscle and brown fat.

The left ovary was surgically removed 12 days after PET/CT to provide accurate staging. Surgical pathology revealed a normal ovary containing a hemorrhagic corpus luteal cyst without evidence of malignancy. The patient was diagnosed with stage IB cervical carcinoma and treated with pelvic radiation. Restaging PET/CT performed 5 months later showed no evidence of 18F-FDG uptake to suggest malignancy in the pelvis.

Discussion

PET with 18F-FDG is useful for the detection of malignancies [1–3]. It has been used to differentiate benign from malignant lesions, to determine the stage of malignancy, and to evaluate response to treatment regimens. In the simplest terms, its power to discriminate malignant from normal tissue derives from the fact that metabolism in most malignant cells is higher than that in normal tissue. A drawback is that 18F-FDG uptake by physiologically normal structures can lead to misdiagnosis. For example, myocardium, thyroid, and skeletal muscle can show variable physiologic 18F-FDG uptake [4, 5]. PET/CT enables precise localization of 18F-FDG uptake to particular structures and thus improves differentiation of normal physiologic uptake from disease. Physiologic 18F-FDG uptake can be challenging particularly in the abdomen and pelvis because of multiple structures with variable physiologic 18F-FDG uptake (e.g., bowel) and because 18F-FDG is excreted through the urinary collecting system [4, 5].
We present a case in which $^{18}$F-FDG uptake in a normal ovary was misinterpreted initially as a metastatic lesion. Cervical cancer stage is determined by the amount of invasion into adjacent structures and usually is assessed using CT or MRI. Stage I is confined to the cervix. Stage II extends beyond the cervix but not to the pelvic sidewalls or to the lower third of the vagina. Stage III extends to the pelvic sidewalls or lower third of the vagina. Stage IV disease shows bladder, rectal, or distal involvement. In this case, $^{18}$F-FDG accumulation in the ovary with an SUV of 4.6 suggested ovarian involvement by the cervical carcinoma, or stage IV disease.

Ovarian metastases in patients with squamous cell carcinoma of the cervix have been estimated to occur in approximately 1% of patients [6, 7]. In truth, the ovary was not involved and the correct stage was IB. The prognoses and treatments for these two stages are quite different: Stage IB disease can be treated with radical hysterectomy to preserve ovarian function in a young woman and has a cure rate of approximately 80% [8], whereas stage IV treatment consists of radiation therapy and adjuvant cisplatin and has a cure rate of only 10% [9]. Fortunately, cautious physicians called for pathologic evidence of ovarian involvement before assigning a definitive stage.

Change in the ovary associated with ovulation is the likely explanation for the increased $^{18}$F-FDG accumulation in the ovary of our patient. In support of this hypothesis, the left ovary was found to contain a hemorrhagic corpus luteal cyst at surgery 12 days after PET/CT. Artifact due to IV contrast administration during the CT portion of the examination was not responsible for our findings because images without CT attenuation correction also showed $^{18}$F-FDG uptake in the ovary [10].

Lerman et al. [11] observed increased $^{18}$F-FDG uptake in the ovaries of 21 of 112 premenopausal patients without known gynecologic malignancy using PET/CT. Fifteen of these patients were imaged near the time of ovulation as judged by the presence of functional ovarian cysts. Our case supports the observation that events around the time of ovulation may lead to increased $^{18}$F-FDG uptake in the normal ovaries of premenopausal women.

In conclusion, benign ovarian $^{18}$F-FDG uptake misinterpreted as a malignancy can have significant clinical consequences. This pitfall may be avoided in future patients by being aware of the possibility of $^{18}$F-FDG uptake by the normal ovary, by taking the pretest probability of malignancy into account, and possibly by performing repeat imaging 2 weeks later at a different point in the cycle of the ovary.
False-Positive PET/CT in Cervical Carcinoma

References