History
A 44-year-old woman presented with a supraclavicular mass and left breast swelling. Mammogram was concerning for primary breast malignancy and core biopsies showed invasive carcinoma with strong HER2/neu expression and negative ER/PR. Chest CT and breast MR exams confirmed abnormal masses in the left breast as well as axillary and internal mammary lymphadenopathy.

Staging FDG-PET/CT scan in November 2009 revealed extensive bony metastases in addition to nodal metastases in the left axilla, mediastinum, left hilum, left neck, right pelvis, right inguinal region, and retroperitoneum (Figure 1). Based on imaging findings, the patient was staged as T4bN3cM1 stage IV invasive breast carcinoma. The patient was then enrolled in a clinical trial involving Avastin®, Navelbine®, and Herceptin® combination chemotherapy for HER2/neu positive breast cancer.

Restaging FDG-PET/CT scan in January 2010 showed excellent response to treatment, with complete resolution of abnormal hypermetabolic activity seen previously in the skeleton, breast, and lymphadenopathy consistent with response to treatment (Figure 2). Accompanying CT images showed marked interval decrease in size of lymphadenopathy.

Subsequent FDG-PET/CT scan in March 2010 (not shown) found no FDG-avid recurrent or metastatic tumor. The patient then encountered serious side effects and was withdrawn from the clinical trial. She underwent a left modified radical mastectomy. Histopathology showed residual neoplasm in lymphatic vessels in addition to ductal carcinoma in situ, lobular carcinoma in situ, and fibroadenomas. All 15 axillary lymph nodes were unremarkable. The patient remained on Herceptin® therapy for stage IV disease.

The most recent FDG-PET/CT scan in August 2010 showed a new focus of abnormal FDG uptake in the proximal right humerus suspicious for progression of metastatic disease. There was also new abnormal focal uptake in the anterolateral uterine fundus possibly associated with an exophytic uterine fibroid (Figure 3). No additional new or enlarging uptake abnormalities were seen.

Discussion
FDG-PET/CT played an important role in this case for initial staging of disease. The FDG-PET/CT detected widespread bony and nodal metastatic disease that was not seen on chest CT or breast MR. Additionally, FDG-PET helped in assessing response to chemotherapy over time—initially showing complete response to treatment, and later raising suspicion for progression of bony metastatic disease.

In their review article, Rosen et al concluded that, “FDG-PET and PET/CT have been shown to be particularly useful in the restaging of breast cancer, in evaluation of response to therapy, and as a problem-solving method when results of conventional imaging are equivocal. In these situations, FDG-PET often demonstrates locoregional or unsuspected distant disease that affects management. PET has demonstrated a particular capability for evaluation of chemotherapy response in both patients with locally advanced breast carcinoma and those with metastatic disease.”