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Cancer in Women: Using PET/CT

Breast cancer remains the leading cause of death in women and the most common cancer in women. Early and accurate diagnosis remains a challenge.

Mammograms are used most commonly to x-ray the breast. During a mammogram, the breast is pressed between two plates for a few seconds while images are taken. Although this may cause some discomfort, it is necessary to obtain a good picture. Very low levels of radiation are used. The current standard of care relies on physical examination, mammography and/or ultrasound, and fine needle aspiration to diagnose a breast cancer. Positron Emission Tomography (PET) using 18F-fluorodeoxyglucose (FDG) can show whether or not a lump in the breast is benign or malignant. PET may prove to be a very useful addition to mammography. For 70% of all women with suspicious mammograms, the expense and trauma of a breast biopsy for their final diagnosis may be unnecessary. Specifically, patients with breast implants, dense breasts, and others may benefit from having a PET scan to help look for a lesion in the breast ^{1,2,6}.

Once doctors diagnose the cancer they determine what kind it is by looking at the tumor sample under a microscope. This alone does not determine the treatment plan. Before treatment starts, the oncologist must determine if or how much the breast cancer has spread. This is called staging the cancer. Treatment options, including whether surgery, radiation therapy, or chemotherapy is the best option, as well as the outlook for your recovery depends on the stage of the cancer. If breast cancer is found and treated before it has spread to lymph nodes or other organs, the five-year survival rate is extremely high. Early diagnosis and treatment is critical in beating breast cancer ¹.

The benefits of PET include:

- Accurately staging axillary and mammary lymph node involvement. Axillary lymph node dissection is currently a routine part of breast surgery, since it is the only way doctors with no access to PET have of staging breast cancer. A complication of this procedure can be restricted movement of the arm, stiffness, swelling and pain. In the future, a PET scan may make this procedure unnecessary for patients who show no lymph node involvement.
- PET detects distant metastasis resulting in more accurate treatment. PET evaluates response to therapy. Treatment can be altered, if necessary, for better results.
- PET shows recurrent disease. Finding recurrent cancer early prolongs the patient's life and increases the chances of beating the disease.
- PET is the most useful test available for the patient when doctors are staging or re-staging breast cancer because it is more accurate than any other test in finding local or distant disease. Although PET cannot see microscopic disease, it can detect clusters of tumor cells that have taken hold in other tissues or organs in the body ^{1,4,6}.

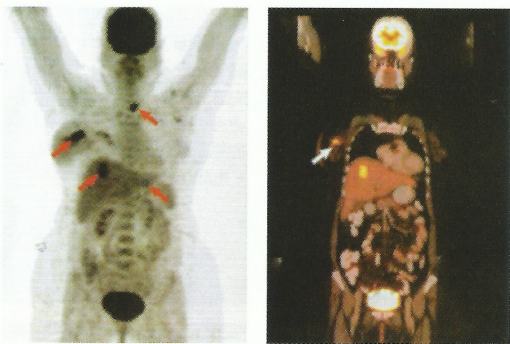
Cervical cancer is the second most common cancer in women when assessed worldwide. In locally advanced cervical cancer, FDG PET has become important in the initial evaluation of disease extent. It is superior to other imaging modalities for lymph node status and distant metastasis. PET-defined cervical tumor size predicts progression-free and overall survival. Higher FDG uptake in both primary and regional lymph nodes is strongly predictive of worse outcome. FDG-PET is useful for assessing treatment response 3 months after completing concurrent chemo-radiotherapy (CRT) and predicting long-term survival, and in suspected disease recurrence.

In the era of image-guided adaptive radiotherapy, accurately defining disease areas is critical to avoid irradiating normal tissue. Based on

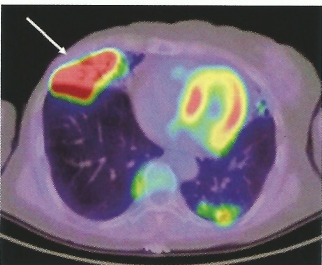
additional information provided by FDG-PET, radiation treatment volumes can be modified and higher doses to FDG-positive lymph nodes safely delivered. FDG-PET/CT has been used for image-guided brachytherapy (internal radiation therapy) of FDG-avid tumor volume, while respecting low doses to bladder and rectum. Despite survival improvements due to CRT in cervical cancer, disease recurrences continue to be a major problem. Biological rationale exists for combining novel non-anti-cancer drugs with CRT, and drugs targeting specific molecular pathways are under clinical development.

The integration of these new targeted therapies in clinical trials, and the need for accurate predictors of radio-curability is essential and PET with FDG and newer tracers will help this processes towards more personalized treatment of women's cancer ^{3,5,6}.

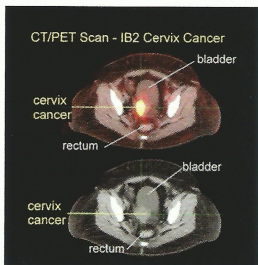
FDG PET/CT: 62 Yr old female presenting with malignant right breast lump for primary staging



WITHOUT PET/CT: This patient would need to undergo a series of tests (CT chest, CT/USG abdomen, mammogram and bone scan) for staging the malignancy
WITH PET/CT: Single PET/CT scan shows the malignant breast mass with spread of disease to the liver, thyroid and normal sized left axillary nodes. Hence accurate disease staging is possible with single noninvasive test.



3D dynamic PET scan



PET/CT fused static scan

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Source:
1. Breast Cancer and PET/CT | University of Maryland Medical Center <http://umm.edu/programs/petct/health/breast-cancer#ixzz341zG5xIV>
2. <http://www.cancer.org/research/cancerfactsstatistics/index>
3. The role of PET/CT in cervical cancer. Herrea, F.G and Prior, J.O. Frontiers in Oncology 2013;3, 34.
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5. The role of PET/CT in the management of cervical cancer. Mirpour, S et al. The American Journal of Roentgenology 2013; 201, 2.
6. 18F-FDG PET and PET/CT practice guidelines in oncology, April 2013. http://www.snm.org/docs/PET_PROS/OncologyPracticeGuidelineSummary.pdf