Although methods of target coverage on the computer for each imaging of nodal region for specific malignancy FDG uptake data were co-registered. A biopsy of the lower rectum's fixed mass reported as adenocarcinoma. This patient is a 72-year-old male who presented with anemia. Eosinophagastroduodenoscopy ("EGD") revealed esophageal tumor extending from 29.0cm to 38.0cm. Endosurgical ultrasound staged this as T3 N0 M0 carcinoma. CT scan revealed abnormality involving the distal esophagus. The plan was for radiation therapy combined with chemotherapy and then definitive surgery.

A radiation-planning whole body FDG PET/CT scan was ordered prior to onset of treatment. This revealed intense increased uptake of FDG in the distal esophagus and also two abnormal nodes in the anterior mediastinum superior to the primary mass. This was a surprise finding and valuable in changing the radiation treatment volume so as to include these nodes. Both tumor staging and radiation treatment volume were changed as a result of the PET/CT.

Benefits of Collaboration
PET/CT provides necessary anatomical information and electronic density mass for dose calculations and simultaneously provides more accurate staging and quantitative data for prognosis and therapeutic monitoring. With close collaboration between the Health Physics staff of Caritas Holy Family Hospital and the professionals of New England PET Imaging System, protocols have been developed that ensure the smooth flow of patients to derive accurate measuring and localization. The patient is simulated in the hospital Radiation Oncology department under the supervision of the radiation oncologist. The patient then receives a PET/CT scan, and precise localization and registration using a laser is reproduced. After the images are completed, chosen images are exported to the radiation therapy planning computer. These images are analyzed by the radiation oncologist and processed with the input of the radiologist. The target volume is drawn as well as vital structures for radiation therapy planning.


Case #1
This patient is a 52-year-old male who presented with rectal bleeding. A biopsy of the lower rectum's fixed mass reported as adenocarcinoma. This patient is a 72-year-old male who presented with anemia. Eosinophagastroduodenoscopy ("EGD") revealed esophageal tumor extending from 29.0cm to 38.0cm. Endosurgical ultrasound staged this as T3 N0 M0 carcinoma. CT scan revealed abnormality involving the distal esophagus. The plan was for radiation therapy combined with chemotherapy and then definitive surgery. A radiation-planning whole body FDG PET/CT scan was ordered prior to onset of treatment. This revealed intense increased uptake of FDG in the distal esophagus and also two abnormal nodes in the anterior mediastinum superior to the primary mass. This was a surprise finding and valuable in changing the radiation treatment volume so as to include these nodes. Both tumor staging and radiation treatment volume were changed as a result of the PET/CT.

Case #4
This patient is a 52-year-old male who presented with rectal bleeding. A biopsy of the lower rectum's fixed mass reported as adenocarcinoma. He was staged as T3 N0 M0 with CT. Subsequent radiation-planning whole body FDG PET/CT showed a large rectal mass with bilateral iliac nodal metastasis and also one liver metastasis. This staging was changed to T3 N2 M1, and the radiation treatment volume was altered.

Advantages of PET/CT in Radiation Oncology

For many tumor types, PET/CT offers better specificity and sensitivity in both diagnosis and staging compared with the use of CT alone. A recent article reports a 27% change in patient management due to changes in staging when PET/CT is included in radiation therapy planning. Precise delineation of target or tumor volume and vital structures is extremely important for the radiation oncologist to deliver precise radiation therapy to the malignancy with maximum protection of the vital structure. With the adjunct of PET/CT to radiation therapy...

Case #2

This patient is a 74-year-old female who is a heavy smoker presenting with pneumonia. After clearing of the pneumonia, a persistent right upper lobe nodule was noted. CT scan showed a 1.0 x 2.3cm right upper lobe nodule and nonspecific small paratracheal lymphadenopathy. Initially, she was staged as probable T1 N0 M0. CT-guided biopsy was consistent with non-small-cell carcinoma.

Subsequent radiation-planning whole body FDG PET/CT revealed intense uptake in the right upper lobe lesion but also noted intense uptake in the right hilar and paratracheal nodes and a left hilar node. Staging was changed to Stage 3B. She was not a surgical candidate and primarily she was offered a combination of radiation therapy and systemic chemotherapy. Both tumor staging and radiation treatment volume were changed as a result of the PET/CT.

Case #3

This patient is a 59-year-old male who presented with hoarseness. Endoscopy revealed a bulky laryngeal tumor. CT scan revealed a large laryngeal mass and left cervical node. He was staged as T3 N1 M0. Subsequent radiation-planning whole body FDG PET/CT demonstrated the large left-sided laryngeal mass and posterior cervical node seen on CT but also showed bilateral anterior cervical lymph node involvement and the stage was changed to T3 N2B M0 carcinoma. This also changed the radiation treatment field and the dose.

Recent reports indicate target volume changes as high as 62% due to improved display of local tumor extent and more accurate identification of local nodal area or skip areas that are not well visualized on CT alone. An additional significant benefit derived from the inclusion of functional PET images is a decrease in inter-observer variability in the definition of tumor contours by the radiation oncologist.

PET/CT and Radiation Therapy Planning

In a prospective study of 30 patients with non-small-cell lung cancer, more consistent definition of tumor target volume was possible with an improvement of cure rate and the reduction of side effects to the normal structures. Anatomic imaging as provided by CT is limited when distortion of normal anatomy occurs because of prior surgery, radiation, or other image artifacts such as a dental filling.