Whole Body PET/PET-CT for Oncologic Imaging

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Determining if tumors are present and where they are located are two key factors for precisely planning the treatment of cancers. Knowledge of additional characteristics of the tumor functional phenotype can additionally provide useful information to plan treatment. A wide variety of positron emitter labeled tracers have been evaluated in patients with known or suspected cancer, but the most widely used to date has been 18 F fluoro 2 deoxy D glucose, FDG. This tracer targets the very commonly accelerated glucose metabolism of a diverse array of cancers. "FDG PET" whole body scans, especially when displayed on the anatomic context of a CT scan, as PET/CT, can provide a sensitive survey of the presence/location and glycolytic metabolic activity of cancers at most any location in the body. The vast majority of common cancers can be imaged quite well with PET and in many instances PET and especially PET/CT techniques are more accurate than CT and often more accurate than MRI. Thus, PET has commonly been used in characterizing pulmonary nodules as malignant or benign, in staging lung cancer, as well as in colorectal cancer, lymphoma, head and neck cancers, breast cancers, esophageal cancers, melanomas, ovarian cancers among many others. FDG uptake is often lower in renal cancers, hepatomas, neuroendocrine tumors and many prostate cancers. Thus, other PET tracers can have an important role. The quantitative aspects of PET can allow early and quantitative assessments of tumor response to therapy often at earlier times than is feasible with anatomic imaging. This lecture will review the biological rationale for FDG PET, the typical instrumentation for PET and PET/CT, the performance characteristics of PET in common cancers, the role of PET in treatment response assessment and will briefly review newer PET tracers assessing other important aspects of tumor physiology. While PET is a very sensitive method, it can fail to detect small tumors under 5 mm (and sometimes larger) so is still limited especially for microscopic and low volume disease. PET is one of the fastest growing tumor imaging methods. This lecture will try to provide a snapshot of this rapidly changing and improving method.