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From tumor biology to clinical PET: A review of positron emission tomography (PET) in oncology*

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Cancer cells show increased metabolism of both glucose and amino acids, which can be monitored with ^{18}F-2-deoxy-2-fluoro-D-glucose (FDG), a glucose analogue, and ^{11}C-L-methionine (Met), respectively. FDG uptake is higher in fast-growing than in slow-growing tumors. FDG uptake is considered to be a good marker of the grade of malignancy. Several studies have indicated that the degree of FDG uptake in primary lung cancer can be used as a prognostic indicator. Differential diagnosis of lung tumors has been studied extensively with both computed tomography (CT) and positron emission tomography (PET). It has been established that FDG-PET is clinically very useful and that its diagnostic accuracy is higher than that of CT. Detection of lymph node or distant metastases in known cancer patients using a whole-body imaging technique with FDG-PET has become a good indication for PET. FDG uptake may be seen in a variety of tissues due to physiological glucose consumption. Also FDG uptake is not specific for cancer. Various types of active inflammation showed FDG uptake to a certain high level. Understanding of the physiological and benign causes of FDG uptake is important for accurate interpretation of FDG-PET.

In monitoring radio/chemotherapy, changes in FDG uptake correlate with the number of viable cancer cells, whereas Met is a marker of proliferation. Reduction of FDG uptake is a sensitive marker of viable tissue, preceding necrotic extension and volumetric shrinkage. FDG-PET is useful for the detection of recurrence and for monitoring the therapeutic response of tumor tissues in various cancers, including those of the lung, colon, and head and neck. Thus, PET, particularly with FDG, is effective in monitoring cancer cell viability, and is clinically very useful for the diagnosis and detection of recurrence of lung and other cancers.

Key words: positron emission tomography, tumor diagnosis, lung cancer, autoradiography, ^{18}F-fluorodeoxyglucose, ^{11}C-methionine, radiotherapy monitoring, tumor hypoxia, ^{18}F-fluoromisonidazole