The characteristics of ^{18}F-FDG and ^{11}C-choline uptake by proliferating tumor cells in vitro

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Abstract

Positron emission tomography using fluorine-18 fluoro-deoxyglucose (^{18}F-FDG) and ^{11}C-choline are useful for the detection of malignant tumor recurrences and for the evaluation of a therapeutic response to these; including ones found in the lung, colon, head and neck regions. The experimental study demonstrated ^{18}F-FDG uptake was higher in faster-growing rather than in slower-growing tumors. These findings show ^{18}F-FDG accumulation exhibits cell cycle dependency. However, the precise mechanism remains to be elucidated. In this study, the relationship between ^{18}F-FDG uptake and the cell cycle phase in HeLa S3 cells, as well as how they compare to the other tracer ^{11}C-choline was assessed.

Synchronization of HeLa S3 cells was accomplished via a double thymidine block. The uptake of ^{18}F-FDG and ^{11}C-choline was determined after cell cycle synchronization. The glucose transporter or choline transporter was independently evaluated for the level of its Glut 1 or CTL1.

Flow cytometry findings confirmed that the cells were well synchronized. ^{18}F-FDG uptake in HeLa S3 cells was significantly higher in the early S phase compared to the G1 phase. In addition, ^{11}C-choline uptake was higher in the G2/M phase. Immunochemical assays for the Glut 1 and CTL1 showed an increase in membrane expression within S phase and G2/M phase respectively.

It has been concluded cell cycle dependency is reflected in the uptake of ^{18}F-FDG and ^{11}C-choline, seen during PET imaging of tumor tissue. These results reveal tumor proliferative activity, and can assist in evaluating a therapeutic response.