Cell cycle dependency of $^{18}$F-Choline uptake during proliferation of cultured human cancer cells

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Abstract

Recently $[^{18}\text{F}]$ labeled choline ($[^{18}\text{F}]$ Choline) has been developed as a promising tracer for cancer detection; including ones found in the lung, prostate gland, head and neck regions. The experimental study demonstrated $[^{18}\text{F}]$ Choline uptake was higher in faster-growing rather than in slower-growing tumors. However, the precise mechanism remains to be elucidated. In this study, the relationship between $[^{18}\text{F}]$ Choline uptake and the cell cycle phase in cultured human cancer cells (HeLa S3), as well as how they compare to the conventional tracer $[^{18}\text{F}]$ FDG with PET was assessed.

Synchronization of HeLa S3 cells was accomplished via a double thymidine block. Flow cytometry (FCM) was used to determine the relative DNA contents of cells to check the degree of cell synchronization. The uptake of $[^{18}\text{F}]$ Choline and $[^{18}\text{F}]$ FDG was determined after cell cycle synchronization. FCM findings confirmed that the cells were well synchronized.

$[^{18}\text{F}]$ Choline uptake was 87% of the peak level in the early S-phase immediately after release, gradually increased, and peaked in the G2/M phase. Subsequently, $[^{18}\text{F}]$ Choline uptake steeply declined over the late G2/M phase to 58% in the G1 phase. The results suggest that the uptake of $[^{18}\text{F}]$ Choline is cell cycle dependent, is associated with the proliferative activity of the tumor seen during PET imaging.