ORIGINAL ARTICLE

Annals of Nuclear Medicine Vol. 20, No. 2, 123–130, 2006

Usefulness of FDG-microPET for early evaluation of therapeutic effects on VX2 rabbit carcinoma

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Purpose: The aim of this study was to determine the potential use of high-resolution FDG-microPET for predicting the primary effects of radiotherapy and/or hyperthermia on tumor-bearing rabbits. ***Methods:*** Twenty-eight VX2 xenografts in the thighs of rabbits were divided into the following 5 treatment groups: radiotherapy at a single dose of 10, 20 or 30 Gy, hyperthermia (43 degrees Celsius, 1 hour), and the combination of radiotherapy and hyperthermia (10 Gy + 43 degrees Celsius, 1 hour). FDG-microPET images were obtained by using a microPET P4 system at pretreatment and at 24 hours and 7 days after treatment. For the evaluation by FDG-microPET, tumor/muscle (T/M) ratios, retention index [RI = (T/M ratio at 120 min – T/M ratio at 60 min) / T/M ratio at 60 min], and time activity curve (TAC) were acquired. ***Results:*** We divided the xenografts into a responder group (partial response + stable disease, n = 14) and a non-responder group (progressive disease, n = 14). The T/M ratio at 24 hours after the treatment in the responder group was decreased remarkably with that at pre-treatment ($p < 0.05$), while in the non-responder group it showed no significant change between the time points. The RI and TAC patterns were comparable to T/M ratios in each treatment group. T/M ratios, RI, and TAC indicated marked changes at the time point of 24 hours in the responder group, although the tumors did not show any significant change in volume at that time. Photomicrographs of sections showed that the number of viable tumor cells in the responder group decreased at 24 hours after treatment and that inflammatory cell infiltration was marked and almost all viable tumor cells had disappeared by day 7 after treatment. ***Conclusion:*** These results suggest that early evaluation by FDG-microPET, especially 24 hours after treatment, is useful to predict the primary effects of the treatment. Histological analysis showed that inflammatory cell infiltration at 7 days after treatment was considered to be a cause of accumulation of FDG in the tumors that showed a significant decrease in tumor cell number. This false-positive should be noted when predicting tumor response by FDG accumulation.

Key words: FDG, microPET, radiotherapy, hyperthermia