

Correlation of apparent diffusion coefficients measured by standard (1000 s/mm²) and high b-value (2000 s/mm²) diffusion MR imaging and SUV from FDG PET/CT in head and neck cancer

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Purpose: Water diffusion in biologic tissues is commonly described in terms of fast equilibration between slow-diffusing and fast-diffusing water molecules. It has been shown in vitro that the diffusion of water molecules in the intracellular compartment is an order of magnitude smaller than that in the extracellular space and that the MR signal from the two classes of water molecules may be differentiated by using high-*b*-value diffusion weighting. The aim of the present study was to evaluate the correlation between ADC values obtained by both standard (1000 s/mm²) and high b-value (2000 s/mm²) diffusion MR imaging and SUV in head and neck cancer.

Materials and methods: Patients with documented primary head and neck cancer were enrolled (n = 54). All participants underwent standard (1000 s/mm²) and high b-value (2000 s/mm²) diffusion MR imaging and FDG PET/CT within 2 weeks. For each tumor, both mean ADC₁₀₀₀ and ADC₂₀₀₀ values were measured within tumors by standard and high b-value diffusion MR imaging, respectively, and maximum SUVs (SUV_{max}) were also evaluated by FDG PET/CT. The ADC₁₀₀₀ and ADC₂₀₀₀ values, ratio of ADC₂₀₀₀ to ADC₁₀₀₀ value, and difference of ADC₁₀₀₀ and ADC₂₀₀₀ values were correlated with SUV_{max} of the tumor region.

Results: Measured ADC₁₀₀₀, ADC₂₀₀₀, and SUV_{max} were 983.7 ± 374.5 (10⁻⁶ mm²/s, mean \pm standard deviation), 732.0 ± 269.6 (10⁻⁶ mm²/s), and 11.1 ± 5.4 , respectively. There was no significant correlation either between ADC₁₀₀₀ and SUV_{max} or between ADC₂₀₀₀ and SUV_{max}. The ratio of ADC₂₀₀₀ to ADC₁₀₀₀ value defined as ADC₂₀₀₀/ADC₁₀₀₀ was significantly correlated with the SUV_{max} ($r=0.526$, $P=0.0001$) in all study patients. In each patient, in addition, the difference between ADC₂₀₀₀ to ADC₁₀₀₀ value calculated by ADC₁₀₀₀ - ADC₂₀₀₀ was significantly inversely correlated with the SUV_{max} ($r=-0.3898$, $P=0.0023$).

Conclusion: The significant correlation between the ratio of ADC₂₀₀₀ to ADC₁₀₀₀ value and SUV_{max}, and the difference between ADC₂₀₀₀ to ADC₁₀₀₀ value and SUV_{max} in primary head and neck cancer suggests that DWI and FDG PET/CT might play a complementary role for the clinical assessment of this cancer type.

