Change of apparent diffusion coefficient in hepatocellular carcinoma treated by concurrent chemotherapy and radiation therapy: Correlation with change in size, 2-dimentional measurement vs 3-dimentional measurement

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Introduction: To evaluate the correlation of change in ADC value with that in size, whether 2-dimentional or 3-dimentional measurement in hepatocellular carcinoma (HCC) with 5-FU based concurrent chemotherapy and radiation therapy (CCRT).

Methods: This study was retrospective nature. The institutional review board approved this study and informed consent was waived. The study included 13 patients (F : M=3 : 10 , mean ages, 56 years old) with HCC who had no previous treatment before 5-FU based CCRT and underwent MRI before CCRT and second MRI after one cycle of CCRT using 3T system (Magnetom Trio Tim, Siemens Medical Solutions, Erlangen, Germany). The time interval between MRI before CCRT and after CCRT was about 2 month. Diffusion-weighted images (TR/TE, 7000 ms/69 ms; slice thickness 0.5mm; Flip angle 90; band width 1736 Hz/Px) for b values of 50, 400 and 800 were also acquired using ecoplanar imaging (EPI) sequence and ADC map was made automatically. Hepatobiliary phase images were acquired with a fat-suppressed T1-weighted gradient echo (GRE) sequence (TR 2.54; TE 0.92; slice thickness, 2 mm; flip angle, 12.8606°; ETL, 1; matrix, 256 × 192) 10 – 20 minutes after gadoxetate disodium (Primovist, Bayer Schering Pharma, Berlin, Germany). Changes of ADC values, 2D-maximum diameter, and 3D- volumes before and after CCRT were evaluated by using the semiautomatic software (MR OncoTreat, Simens Medical Solutions). Tumors were selected on the basis of ADC map and hepatobiliary phase images of MRI before and after CCRT. Changes of ADC value, 2D-maximum diameter, and 3D-tumor volume were determined using the equation, $\Delta ADC = (ADC_{pre} - ADC_{post})$, Δ3D-tumor volume = (3D-tumor volume$_{pre}$ – 3D-tumor volume$_{post}$), and Δ2D-maximum tumor diameter = (2D-maximum tumor diameter$_{pre}$ – 2D-maximum tumor diameter$_{post}$). The correlation between ΔADC and Δ3D-tumor volume and between ΔADC and Δ2D-maximum tumor diameter were assessed with Spearman's correlation.

Results: Mean value of ΔADC, Δ2D-maximum tumor diameter, and Δ3D-tumor volume is -87.8 ± 337.7, 29.3 ± 21.1 and 226.2 ± 208.2, respectively. A negative correlation was observed between ΔADC and Δ3D-tumor volume. The spearman correlation coefficient between ΔADC and Δ3D-tumor volume was – 0.64 (p = 0.019). But ΔADC was not correlated to Δ2D-maximum tumor diameter.

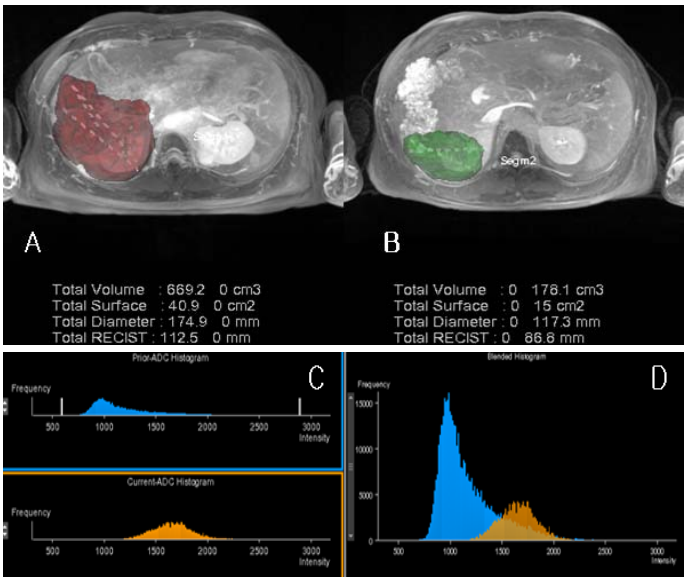

Fig 1. 48 years old man with HCC. Δ 3D-tumor volumes (491 cm3) and 2D- maximum diameter (26mm) of HCC before and after CCRT calculated using OncoTreat are visualized on the bottom of figures (A, B). Histogram for ADC values before and after CCRT was displayed (C, D). The mean ADC value was increased after CCRT compared with ADC values before CCRT (ΔADC = -579).

Discussion and conclusion: Change of ADC value in HCC treated by CCRT was correlated with change of 3D-tumor volume. However, it was not correlate with the change of 2D-maximum tumor diameter.