Differentiation of Radiation-Injuries and Tumor Recurrence Using ADC value

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The differentiation of progressive or recurrent brain tumor from radiation injury after radiotherapy is difficult using conventional MR imagings(MRI) [1]. Accurate diagnosis of tumor recurrent or radiation injury is critical to determining therapy [2]. Diffusion-Weighted imaging(DWI), which has made it possible to obtain measurements of apparent diffusion coefficient(ADC), may be useful in differentiation of tumor recurrence within irradiated lesions and radiation necrosis [3]. Our aim was to evaluate the DWI in the characterization of newly developed enhancing lesions within irradiated regions after the treatment of brain tumor.

Methods: The DWI were obtained with an axial echo-planar SE sequence, one average,diffusion gradient encoding in three orthogonal directions, acquisition matrix = 160 x 192, slice thickness = 6mm, FOV = 24cm, TR = 5000ms, TE = 64.9ms, b=1000s/mm^2, 23 patients with previously resected and irradiated glioma were included whose final determination was decided either histologically or clinicoradiologically(10 recurrence and 13 irradiated necrosis). Calculate the apparent diffusion coefficient (ADC) value, the region of interest(ROIs) consisting of 20-40 pixels were drawn manually onto the obtained ADC maps in the region corresponding to the enhancing areas on the contrast-enhanced T1-weighted images. Mann-Whitney test was used to determine whether there was a difference in the apparent diffusion coefficient(ADC) between the patients with tumor recurrence and iradiated necrosis. Significance was set to a *P* value of < 0.05.

Results: The (ADC) value of tumor recurrence group and iradiated necrosis group are different. the average ADC values of tumor recurrence group is $1.33\pm0.55\times10^{-3}$mm^2/s, while the iradiated necrosis group is $1.36\pm0.34\times10^{-3}$mm^2/s. the tumor recurrence group showed lower ADC values. The minADC values of tumor recurrence group is $0.82\pm0.35\times10^{-3}$mm^2/s, and the iradiated necrosis group is $1.14\pm0.23\times10^{-3}$mm^2/s. The maxADC values of tumor recurrence group is $1.46\pm0.65\times10^{-3}$mm^2/s, and the iradiated necrosis group is $1.60\pm0.40\times10^{-3}$mm^2/s.(Fig.1/2/3). The differences of minADC values between tumor recurrence group and iradiated necrosis group are reached statistical significance(P=0.016).

group		Average ADC	Min ADC	Max ADC
recurrence	Mean	1.33	0.82	1.46
	Std.	0.55	0.35	0.65
necrosis	Mean	1.36	1.14	1.60
	Std.	0.34	0.23	0.40

Fig.1 two groups DWI parameters Mean and Std. Deviation.(10^{-3}mm^2/s)

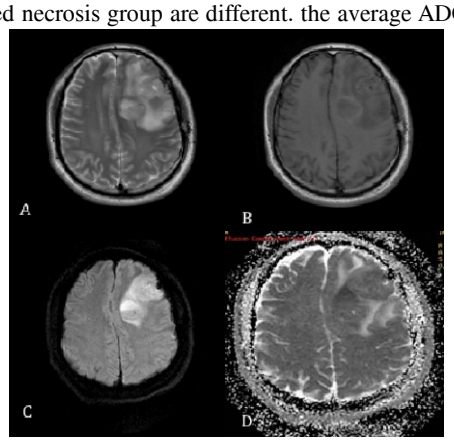

Fig.2 37-year-old man with recurrent glioma verified by surgical resection. A-B, Conventional MR scan showed left frontal lobe patchy higy signal, and DWI(C)shows obviously high signal while ADC maps(D) shows low signal (ADC value is 0.82×10^{-3}mm^2/s)

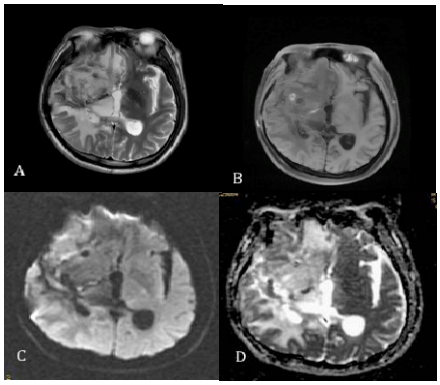

Fig.3 32-year-old man with radiation necrosis verifred by follow up. A-B, Conventional MR scan showed right frontal lobe patchy higy signal, and DWI(C)shows obviously low signal while ADC maps(D) shows high signal (ADC value is 1.60×10^{-3}mm^2/s)

Conclusions: The ADC values of tumor recurrence group is lower than the radiation-injuries group. significant difference was found in the minimal ADC values between the umor recurrence group and the radiation-injuries group. this indicate that the minimal ADC values may be useful to distinction of radiation-injuries and tumor recurrence.

References:

[1] Schlemmer HP, *et al*. Neuroradiology, 2002, 44: 216-222.
[2] Soonmee Cha. TMRI, 2004, 15: 279-289.
[3] Takeshi S. AJNR, 2000, 21: 901-909.