The clinical application of 3T PROPELLER DUO MRI quantitative analysis of extraocular muscle in Graves¡¯ophthalmopathy

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Introduction: Graves' ophthalmopathy (GO) is known as an organ-specific autoimmune disease which is influenced by multifactor. It's the most common cause for eyes prominent clinical lesions. The course of disease is divided into activity and non-activity phase. It's correctly diagnose GO and judge the clinical phase that we can choose an appropriate treatment, then predict curative effect. CASis a common and widely used measure for evaluation of disease activity, However, CAS is a subjective measure whose result is highly dependent on the acumen of the examiner, and it doesn't sufficiently detect changesof clinical manifestation [1]. On the other hand, DWI is very sensitive to edema and exudation of GO's extraocular muscle,It can judge the disease whether be in active phase or non-active phase. Influenced by magnetic sensitive artifact, conventional DWI can't take a valuable imaging (Figure 1), However PROPELLER DUO MRI has been shown to helpful to diagnose intraorbit disease, because it offers better image quality, including the part of the eyes located near the skull or the sinuses, and can take imaging by any direction, especially for the orbital coronal view[2].ADC values is raised when the extraocular muscles is more edematous than controls. Therefore，raised ADC values is believed to represent active inflammation and PROPELLER DUO MRI can sensitively detect and objectively quantify the activity of inflammation by ADC map.Our objective was to prospectively investigate extraocular muscle in patients with GO utilizing 3T PROPELLER DUO MRI and determine whether apparent diffusion coefficients(ADC)parameters correlate with disease severity.

Methodand Materials: 34 patients with known GO and 34 age&sex-matched healthy volunteers were examined.Disease severity was clinically assessed with use ofthe clinical activity score(CAS).All subjects underwent imaging on a 3T MR system utilizing a PROPELLER DUO sequence to provide a coronal structural view for ADC imaging(Figure 2).Choose the maximum section of each extraocular muscle and measure ADC values of region of interest. In vivo data of PROPELLER DUO were acquired using 8-channel receiver coil with ETL 22, BW +/-50 kHz, NEX 12, matrix size 128 x 128, b-value 700 s/mm.t tests were used for the group analyses. Analysis of correlations was by Pearson correlation.

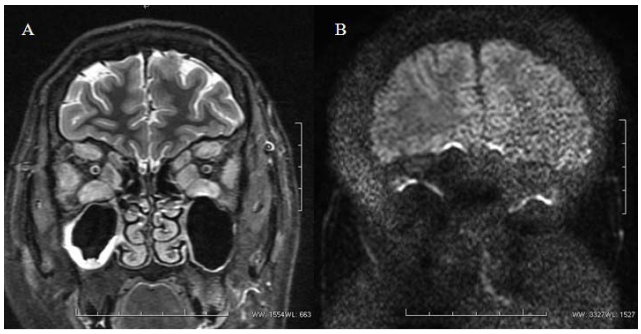

Figure 1.A coronal STIR image(A) and a conventional DW image(B) for a 32 years old patient.

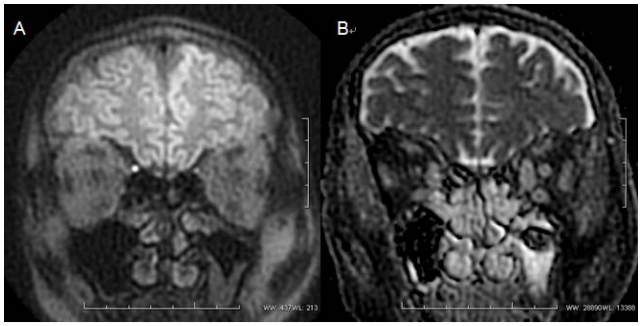

Figure 2. A coronal DWPROPELLER DUO image (**A**) and its ADC map (**B**).

Results: The ADC values of internal rectus in diseased group (0.001473 ±0.000233)was higher than control group(0.001187±0.000144，p=0.000), The ADC values of inferior rectus in diseased group (0.001496 ±0.000247)was higher than control group(0.001209±0.000120，p=0.000), The ADC values of lateral rectus in diseased group (0.001419 ±0.000240)was higher than control group(0.001224±0.000148，p=0.001), The ADC values of superior rectus in diseased group(0.001426 ±0.000227)was higher than control group(0.001210±0.000146，p=0.000)(Table 1).The maximum of ADC values of extraocular muscles(maxADC) were evaluated by ADC map, A significant correlation between maxADC and CAS in diseased group(r=0.555, p=0.001).

Discussion and Conclusions: In the ADC imaging of PROPELLER DUO sequence，there is significant difference between diseased group and control group，and the difference will be conducive to diagnose GO. A significant positive correlation between maxADC and disease severity was observed.We can judge patients whether in active phase or not by measuring the ADC values of extraocular muscle, to guide clinical treatment and predict the responsiveness to immunosuppressive therapy.PROPELLER DUO MRI has been shown to helpful to diagnose intraorbit disease, because it can inhibit magnetic sensitive artifact, especially in the part of the eyes located near the skull or the sinuses,and can take imaging by any direction. Measuring ADC values can further increase confidence of its detection.

Table 1.**Comparison of ADC value in GO Patients and Controls**

	internal rectus	inferior rectus	lateral rectus	superior rectus
controls	0.001187±0.000144	0.001209±0.000120	0.001224±0.000148	0.001210±0.000146
patients	0.001473±0.000233	0.001496±0.000247	0.001419±0.000240	0.001426±0.000227
p value	0.000	0.000	0.001	0.000

Reference[1] Bartalena L, Baldeschi L, et al. Eur J Endocrinol2008,158:173-285. [2] Zhao, X. etc. 17thISMRM,P3517(2009).