REGIONAL DELTA-DIFFUSION ANALYSIS OF THE BRAIN DURING CARDIAC CYCLE IN IDIOPATHIC NORMAL PRESSURE HYDROCEPHALUS

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INTRODUCTION:

There have been many unsolved problems with this syndrome in terms of the diagnostic criteria and selection of appropriate patients for shunt surgery [1]. To evaluate the intracranial condition of the brain in idiopathic normal-pressure hydrocephalus (I-NPH), we determined the change in the apparent diffusion coefficient of the brain during the cardiac cycle (delta-ADC).

METHODS:

On a 1.5-T MRI, ECG-triggered single-shot diffusion echo planar imaging (b = 0 and 1000 s/mm^2) was used with sensitivity encoding and half-scan techniques to minimize the bulk motion, i.e., data sampling window of approximately 3 ms [2]. Then the delta-ADC image was calculated from maximum minus minimum ADC value of all cardiac phase images (20 phases) on a pixel-by-pixel basis. We assessed delta-ADC and ADC in white matter (except periventricular high intensity area on T2-weighted image) in patients with I-NPH (n=8), brain atrophy or asymptomatic ventricular dilation (VD; n=4), and in healthy volunteers (control group; n=12).

RESULTS AND DISCUSSION:

Delta-ADC values in I-NPH were significantly higher than those in the control and VD groups (Fig. 1 and 2). ADC values in I-NPH, which increased in the amount of water in the extracellular space [3], were also significantly higher than those in the control group. However, there was no significant difference in ADC between I-NPH and VD groups (Fig. 3), indicating the diagnostic utility of the delta-ADC analysis more than only ADC. In addition, there was no significant correlation between delta-ADC and ADC (Fig. 4). These results suggest that ADC and delta-ADC do not necessarily provide the same kind of information, i.e., ADC depends on the water amount in extracellular space whereas delta-ADC depends on the degree of the fluctuation (biomechanical property) and the water amount.

CONCLUSION:

Delta-ADC analysis makes it possible to noninvasively obtain new and more detailed information on the intracranial condition in I-NPH and thereby assist in the diagnosis.

REFERENCES:

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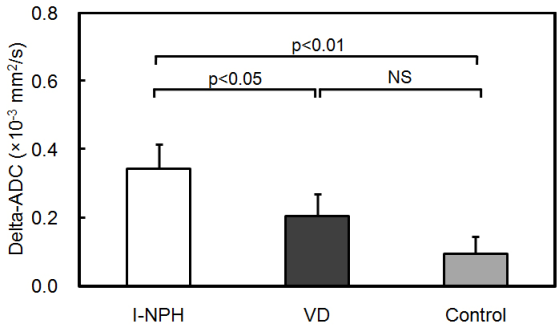

Figure 1. Delta-ADC values in each group. NS: not significant.

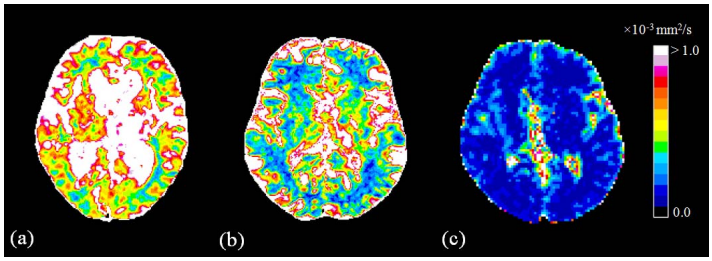

Figure 2. Typical examples of delta-ADC images in (a) a patient of I-NPH, (b) VD and (c) a healthy volunteer.

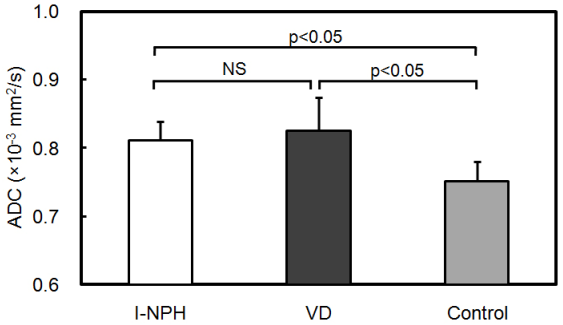

Figure 3. ADC values in each group. NS: not significant.

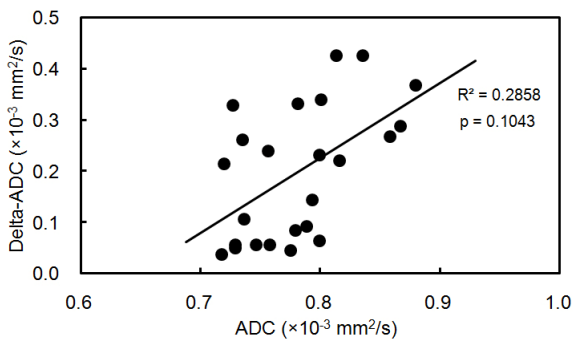

Figure 4. Relation between delta-ADC and ADC.