Accurate Correlation Between Apparent Diffusion Coefficient (ADC) Value And Brain Lesions: A New Diagnostic Criteria And Guidance For Pre-Surgical Planning

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Purpose
ADC is an effective parameter to analyze intra-tumoral heterogeneity. Previously, histopathological diagnosis has been correlated with the average ADC value of the whole lesion, which is of low specificity and accuracy due to the heterogeneity of glioblastoma and other lesions. For example, ADC value was found to be a wide range and substantially overlapping was found between high grade glioma and low grade glioma. Therefore, new method should be introduced to improve the accuracy.

Materials and Methods
We retrospectively reviewed 181 patients who had image guided needle biopsies with pre and intra/post-operative T1 weighted images with DWI-ADC. 3D Slicer was used for the co-registration of pre-operative T1/DWI and post-operative T1. This allowed us to ascertain the specific site of the biopsy and thus calculate the ADC value for that particular site, which was then correlated with the final histopathological diagnosis.

Results
Accurate ADC values of gliomas (WHO grade II-IV), meningioma, schwannomas, inflammation, abscess, and lymphoma were calculated. Our results indicated gliomas were inversely proportional to the mean ADC values. In addition, we found that for patients with glioblastomas, the mean ADC value was higher in IDH (+) group than that in IDH (-) group. The ADC values for B cell lymphoma was similar to that of glioma (grade III).

Conclusion
Accurate diagnostic criteria of brain lesions based on ADC value is established. Besides, combined with other radiological features, pre-operative ADC values may help to improve the accuracy of pre-surgical planning and sensitivity of image guided needle brain biopsies.