

# Relationship between Fazekas scores of White Matter Hyperintensity (WMH) and quantitatively analyzed volumes using fluid-attenuated inversion recovery (FLAIR) images

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## Abstract

The Fazekas scoring system is a common qualitative tool used to evaluate the severity of white matter hyperintensity (WMH). However, Fazekas scores are subjective and low agreement among evaluators remains a concern. Therefore, quantitative analysis of WMH volume is important. In this study, we compared the severity classification of WMH using the Fazekas score and the quantitative value of WMH volume to investigate the usefulness of quantitative evaluation of the WMH volume. We analyzed fluid-attenuated inversion recovery (FLAIR) images obtained from 500 patients with suspected cognitive impairment, and a radiologist performed the Fazekas scoring (Scores:0-3). WMH volumes were analyzed using automatic analysis software. Subsequently, we calculated the WMH volume range, mean, and standard deviation for each Fazekas score. The multiple comparisons test was used for statistical analysis to compare whether there was a difference in the average of WMH volume between each Fazekas score. We used the Spearman's

rank correlation test to investigate the association between the Fazekas score and WMH volume. Of the 500 patients included in this study, Fazekas scores were 0, 1, 2, and 3 in 35, 102, 123, and 240 patients, respectively. The multiple comparisons test showed no significant difference in mean WMH volume between scores 0 and 1; however, significant differences were observed with regard to all other scores ( $p < 0.05$ ). We also observed a significantly positive correlation between Fazekas scores and the WMH volume, ( $R = 0.926$ ,  $p < 0.01$ ). Our results highlight that quantitative evaluation of the WMH volume corresponds to Fazekas scores; therefore, it may be useful for severity classification of WMH, as well as Fazekas scores. It is necessary to evaluate the usefulness of advanced lesion stratification (Fazekas Score 3) using quantitative analysis of WMH volume.