Correlation between MRI cerebral white matter changes, muscle structure and/or muscle function: a pilot study.

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Abstract

Objective: Assess the correlation between muscle structure/function and global cerebral white matter abnormalities.

Methods: Classical DM1 subjects were compared to healthy age-matched controls. Disease duration (DM1), muscle impairment using scale (MIRS) were obtained. A CT MRI was used to assess muscle cross-sectional area (CSA). Signal intensity was assessed using the block-echo technique with the normal muscle used as a control. A 3 Tesla MRI was used to assess the structural organization of white matter tissue in the brain. Fat fraction (FF) quantification was performed to evaluate the normal/fat tissue ratio. CT and MRI were used to compare muscle CSA in DM1 subjects with controls.

Results: DM1 CSAs (11.12 ± 2.7 vs 10.06 ± 1.4 mm², p = 0.037) were lower than controls. Muscle CSA was negatively correlated with FF (R = -0.537, p = 0.039). FF was positively correlated with MIRS (R = 0.20 0.22 0.24 0.26 0.28, p = 0.007). These findings suggest an inverse relationship between muscle CSA and FF in DM1.

Conclusions: Correlations observed in this pilot study were significant and suggest that muscle CSA decreases as FF increases in DM1. Further evaluation of these findings is necessary to understand the relationship between muscle CSA and FF in DM1.

References


Table 1: Age matched controls were used.

Table 2: The table shows the correlation between muscle function and MRI measurements (muscle volume, T2, and Fat fraction) and brain FA.

Table 3a: Muscle Function and Physiology Measures

Table 3b: Single Leg Squat Weight Bearing Task (LETT)

Figure 1: Brain MRI images were obtained using a 3 Tesla MRI scanner. Muscle CSA was measured using a previously reported standard technique. Global brain FA was significantly lower in DM1 (p = 0.004) compared to controls. Box = SEM, *p < 0.004.

Figure 2: Lower leg MRI was performed on Siemens 3T scanner using an acquisition protocol previously reported. MRI-based assessment included: T1 for volume measures, T2, and FF quantification with 3-point Dixon imaging. For muscle CSA, the standard deviation was used to trace the surface of a standardized slice then multiplied by the slice thickness. (A) Regions of Interest (ROI). (B, C) Ellipsoid ROI were used to T2measure.

Figure 3: Linear regression analysis comparing gastrocnemius muscle volume to global brain FA. Brain FA (greater abnormality) highly correlates with lower muscle volume.

Figure 4: Linear regression analysis comparing gastrocnemius muscle volume to global brain FA. Brain FA (greater abnormality) highly correlates with lower muscle volume.

Figure 5: Linear regression analysis comparing brain FA to muscle functional measures. Brain FA (lower abnormality) highly correlates with lower muscle strength and higher error rate.