ABSTRACT

Great variability is seen in the clinical manifestation and recovery from stroke. Structural abnormalities often extend beyond the infarction site, indirectly affecting nonlesioned areas which can further contribute to motor deficits. Advances in neuroimaging have enabled the examination of the white matter integrity and anatomical connectivity within the brain. Evidence is limited, however, regarding the relationship between the structural integrity and connectivity of primary and secondary motor tracts/brain regions and chronic upper and (especially) lower extremity motor impairments post-stroke. Therefore, the current study examined the relationship between upper/lower extremity motor impairments and structural integrity (Aim 1) and connectivity (Aim 2) of motor-relevant brain regions in individuals with chronic stroke. Forty-three participants completed a comprehensive motor assessment, with MRI scanning performed within two days of behavioral testing. Nonparametric analyses were performed to examine the relationship between structural integrity and connectivity of motor-relevant brain regions and motor function. Regression analyses were performed to assess the amount of variance in upper/lower extremity motor performance explained by ipsilesional corticospinal tract (CST) and red nucleus (RN) integrity, as well as cortical connectivity of the three main brain regions of motor control [primary motor cortex (M1), premotor cortex, and supplementary motor area]. Results indicate that ipsilesional CST and RN structural integrity (as assessed by fractional anisotropy values) are both associated with chronic upper/lower extremity motor function.
Ipsilesional CST integrity, however, is a stronger predictor of chronic upper extremity motor function and grip strength post-stroke. Furthermore, cortical integrity and connectivity of ipsilesional M1 is associated with upper extremity motor function of the affected extremity and gait speed, with cortical disconnection of M1 being an independent predictor of chronic motor function. These findings highlight the importance of examining structural changes and cortical disconnection beyond the lesion site post-stroke. Such insight could enhance our understanding of the underlying factors contributing to motor impairments, and improve motor recovery prognosis and help with targeting therapeutic interventions.