CORTICOSPINAL RESPONSES OF QUADRICEPS ARE ABNORMALLY COUPLED WITH HIP ADDUCTORS IN CHRONIC STROKE SURVIVORS.

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ABSTRACT

Stroke survivors often lose the ability to move their joints independently, which results in abnormal movement patterns when attempting to perform an isolated motion. For instance, many stroke subjects exhibit unwanted secondary knee extension movement when performing hip adduction. This study aimed at characterizing whether the neural substrates mediating abnormal activation patterns after stroke are of cortical origin. We developed a novel transcranial magnetic stimulation protocol to evaluate the extent of abnormal across-joint coupling of corticospinal responses in chronic stroke survivors. In stroke survivors, we found that the magnitude of motor evoked potentials of the vastus lateralis and vastus medialis during isometric hip adduction were significantly higher than those recorded during knee extension at similar background activity (P=0.03 and P=0.01). Moreover, motor evoked potential coupling ratios of the quadriceps muscles were significantly different than those observed in healthy controls (P=0.005 to P=0.037). No differences in motor evoked potential coupling ratios were observed between the younger and older adults (P=0.474 to P=0.919). These findings provide evidence for the first time that stroke subjects exhibit abnormal excitability of the quadriceps muscle corticospinal neurons when performing isometric hip adduction. Importantly, the abnormal corticospinal responses observed in stroke subjects were not mediated by aging. The results of this study provide new insights into the mechanisms underlying loss of independent joint control after stroke and have meaningful implications for post-stroke interventions. Moreover, the proposed 'motor evoked potential coupling ratio' may serve as an effective probe to evaluate cortical contributions to abnormal muscle synergy after stroke.