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# Quantification of the Effect of Repeated Botulinum Toxin Type A Injections on Post-Stroke Spastic Calf Muscles Structure With MRI

**Topic:** Complications/Sequelae (ie Spasticity, Immobilization and Frailty)

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## BACKGROUND

Hyper-resistance to passive stretch is one of the clinical features of muscle overactivity (MO). Botulinum toxin type A (BoNT-A) injections are the first line recommended treatments to manage focal MO after stroke. Evidence supports the effectiveness of a single BoNT-A injection in reducing lower-limb hyper-resistance, but long-term impact on muscle structure is controversial.

The aim of this study was to quantify the following muscle tissue changes following repeated BoNT-A Injections using magnetic resonance imaging (MRI): muscle volume, fat content, T2 relaxation time (T2-RT) (assessing inflammation/edema) and apparent diffusion coefficient (ADC) in the BoNT-A injected muscles and in their homologue muscles of the less-affected limb. The findings of this study could contribute to a deeper understanding of the physiological and therapeutic effects of BoNT-A injections on muscles in patients with MO.

## METHODS

Participants received three cycles of BoNT-A at three months intervals. The primary impairment targeted was pes equinus, focusing on gastrocnemius and soleus muscle. Participants were evaluated immediately before and one month after first and third BoNT-A injections, resulting in three MRIs and clinical evaluations. A paired-sample T test was performed to search for differences between the affected and less-affected muscles. A one-way repeated measures analysis of variance was performed to compare the different parameters between the different visits. Correlations between the different parameters of MRI and impairments were evaluated.

## RESULTS

We included 12 chronic stroke participants. Five patients (42%) had already received past BoNT-A injection in the gastrocnemius and/or soleus muscle with a mean duration since last BoNT-A injection of 6.4 ± 3 months. The gastrocnemius and soleus muscle of the affected side had a significantly smaller muscle volume, higher hat fraction, and increased T2-RT compared to the less-affected side, at the three visits. Fat fraction increased between V1 and V3 in the affected limb for all muscles, in all patients. However, this increase was not statistically significant. T2-RT significantly increased between the different timepoints and V3 in the gastrocnemius muscle of the affected limb. No correlations were found between the different MRI outcomes of the affected limb and other impairments.

## CONCLUSION

Repeated BoNT-A injections in chronic stroke patients may increase muscle fat content and T2-RT, suggesting progressive muscle alterations. This highlights the need for tailored rehabilitation to mitigate potential muscle deterioration following BoNT-A treatment. Further studies with larger samples should assess the long-term impact of repeated BoNT-A injections on muscle structure.

**Statement of Disclosures**

None

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