The short-term impact of Botulinum Neurotoxin type A injections on lower-limb muscle morphology in children with spastic Cerebral Palsy

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Introduction:
Muscle hyperactivity is a common problem in spastic Cerebral Palsy (SCP) with Botulinum Neurotoxin type-A (BoNT-A) widely used to reduce the hyperactive stretch reflex. Yet, the immediate impact of BoNT-A on this stretch reflex and the impact on the morphology of muscles remains unknown.

Objective:
What are the short-term effects of BoNT-A injections on muscle morphology of the medial gastrocnemius (MG) and semitendinosus muscles (ST) in children with SCP?

Material and Methods:
Of twenty-six children, median age 6.3 years (4.6 – 8.2), gross motor function classification level (GMFCS) I/II/III (15/8/3), the morphology of the MG and distal compartment of ST muscle of the most affected leg was assessed by 3D-freehand ultrasound.
A subset of participants (n=14) underwent an instrumented spasticity assessment, expressing the change in the hyperactive stretch reflex post-BoNT-A by the difference in EMG response on passive muscle stretch. Wilcoxon signed rank tests were used to evaluate treatment effects (alpha = 0.05).

Results:
Twenty-five children received BoNT-A (Botox®) in the MG (median dose 2.7 units/kg (2.2–3.0)) and 21 children received BoNT-A in the ST (median dose 1.8 units/kg (1.6–2.0)). The median interval between pre- and post-treatment evaluation was 2.1 months (1.9–2.4). The results of the different outcome parameters are presented in Table 1.

Conclusions
These results indicate that BoNT-A treatment does successfully reduce the hyperactive stretch reflex, but negatively affects muscle volume of the MG and distal compartment of the ST during the first months after injection. No harmful effects on muscle lengths were found. These results confirmed that there is need for close monitoring during the post-treatment follow-up and accurate treatment selection. Future studies should investigate long-term effects, include microscopic and molecular analyses of muscle properties, functional evaluations and explore strategies to accelerate muscle recovery post-BoNT-A, to critically appraise the benefit-harm balance of BoNT-A treatment.