Title

Improving Motor Evoked Potential as preclinical marker of cortico-spinal conduction

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Abstract

Background

In preclinical research involving murine models of Multiple Sclerosis, Motor Evoked Potentials (MEPs) can detect pathological alterations in nerve conduction throughout the cortico-spinal tract. In mice, MEPs elicited by electrical stimulation of the motor cortex can be performed with epicranial or subdermal electrodes, such as implanted screws or removable needles, which are associated with invasive surgery and variability in placement of the stimulating electrodes, respectively.

Methods

We compared MEPs induced by epicranial or subdermal stimulation with a non-invasive epidermal cup electrode over five recording sessions in healthy C57BL/6 mice. Additionally, using epidermal stimulation, we examined the recordings obtained with intramuscular needles or surface electrodes to understand if MEP reproducibility could be improved.

Results

Resting motor threshold (RMT), MEP latency and amplitude were comparable among the different stimulation methods. Epicranial, subdermal, and epidermal stimulation techniques presented good repeatability over time, with epidermal stimulation showing a significantly reduced inter-session variability. Compared with intramuscular needles, MEPs recorded with surface electrodes showed reduced peak-to-peak amplitude at all timepoints. RMT and MEP latency were comparable with both

recording methods. On the other hand, amplitudes recorded with surface electrodes presented a significantly lower inter-session variance, resulting in improved repeatability.

Conclusion

Overall, there is evidence for highly reproducible results using different stimulating methods, with an indication for reduced inter-session variability for epidermal stimulation. Moreover, MEP recording with surface electrodes provided a decrease in amplitude variability over time, indicating improved measurement stability when considering amplitude as functional outcome in longitudinal studies.