The cerebellum is involved in a wide range of integrative functions, but its role in pain experience and in the nociceptive information processing is poorly understood. In healthy volunteers we evaluated the effects of transcranial cerebellar direct current stimulation (tcDCS) by studying the changes in the perceptive threshold, pain intensity at given stimulation intensities (VAS:0-10) and laser evoked potentials (LEPs) variables (N1 and N2/P2 amplitudes and latencies).

Materials and Methods

Fifteen healthy subjects were enrolled. LEPs were obtained using a neodymium:yttrium–aluminium–perovskite (Nd:YAP) laser and recorded from the dorsum of the left hand. The main Aδ-LEP vertex complex, N2–P2, and the lateralised N1 component were recorded through standard disc, non-polarizable Ag/AgCl surface electrodes. N2 and P2 components were recorded from the vertex (Cz) referenced to the earlobes; the N1 component was recorded from the temporal leads (T4) referenced to Fz. VAS was evaluated by delivering laser pulses at two different intensities, respectively two and three times the perceptible threshold. After the PT assessment, participants were instructed to pay attention to incoming laser nociceptive stimuli in order to verbally rate the perceived intensity about 2-3 seconds after each laser stimulation, which was performed before tcDCS (T0), immediately after its termination (T1) and 60 min later (T2).

Anodal, cathodal and sham tcDCS stimulations were administered in three different sessions and separated by at least 1 week to avoid possible carry-over effects.

Results

Our study shows that cerebellar direct current polarization modulates nociceptive perception and its cortical correlates in healthy humans.

Discussion and Conclusions

- Our study shows that cerebellar direct current polarization modulates nociceptive perception and its cortical correlates in healthy humans.
- Cathodal suprathreshold tcDCS increases pain perception, increases amplitudes and decreases LEPs latencies, likely though reduction of the inhibitory tone exerted by the cerebellum on brain targets. Anodal polarization elicits opposite effects producing analgesia.
- As tDCS is effective on both N1 and N2/P2 components, we speculate that the cerebellum engagement in pain processing modulates the activity of both somatosensory and cingulate cortices.
- Non-invasive cerebellar current stimulation may modulate pain experience and the associated cortical activity through many, not alternative mechanisms. In particular, changes in N1 reflects the modulation of the sensory component of pain, while the vertex N2/P2 represents the neural correlate of affective aspects of pain experience (Garcia-Larrea et al. 1997; Valeriani et al. 2007).

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