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Effects of electroacupuncture in a mouse model of fibromyalgia: role of N-methyl-D-aspartate receptors and related mechanisms.

Abstract

OBJECTIVE:

N-methyl-D-aspartate receptor (NMDAR) activation and downstream transduction pathways are crucial for pain signalling.Fibromyalgia (FM) is a common pain syndrome of unclear aetiology that is often drug-refractory but may benefit from treatment with electroacupuncture (EA). We examined the contributions of NMDAR signalling to FM pain and EA responses in a mouse model.

METHODS:

A model of FM was established by acid saline injection in 32 mice and subgroups (n=8 each) were treated with EA (2 Hz, 15 min daily for 4 days) or minimal acupuncture (MA). Expression of NMDAR subunits, calmodulin-dependent protein kinase II (CaMKII), cyclic AMP response element binding protein (pCREB) and their corresponding phospho-activated forms were measured by Western blotting and immunohistochemistry.

RESULTS:

Acid saline injection induced significant mechanical hyperalgesia (paw withdrawal threshold 2.18±0.27 g, $p<0.05$ vs controls), which was reversed by EA (4.23±0.33 g, $p<0.05$ vs FM group) but not by MA (2.37±0.14 g, $p<0.05$ vs EA group). Expression levels of phosphorylated N-methyl-D-aspartate receptor (pNR)1 and pNR2B were significantly increased in the dorsal root ganglion of FM model mice (132.21±14.4% and 116.69±3.22% of control values), whereas NR1 and NR2B levels were unchanged (97.31±3.79% and 97.07%±2.27%, respectively). Expression levels of pCaMKIIα and pCREB were also higher in the FM group, and these changes were reversed by EA but not by MA. Similar changes in expression were observed in spinal cord neurons.

CONCLUSIONS:

Reduced NMDAR-CaMKIIα-pCREB signalling is implicated in the positive effects of EA in FM. NMDAR signalling components may represent promising therapeutic targets for FM treatment.