

Chinese Acupuncture: A Potential Treatment for Autism Rat Model via Improving Synaptic Function

Authors : Sijie Chen, Xiaofang Chen, Juan Wang, Yingying Zhang, Yu Hong, Wanyu Zhuang, Xinxin Huang, Ping Ou, Longsheng Huang

Abstract : Purpose: Autistic symptom improvement can be observed in children treated with acupuncture, but the mechanism is still being explored. In the present study, we used scalp acupuncture to treat autism rat model, and then their improvement in the abnormal behaviors and specific mechanisms behind were revealed by detecting animal behaviors, analyzing the RNA sequencing of the prefrontal cortex(PFC), and observing the ultrastructure of PFC neurons under the transmission electron microscope. Methods: On gestational day 12.5, Wistar rats were given valproic acid (VPA) by intraperitoneal injection, and their offspring were considered to be reliable rat models of autism. They were randomized to VPA or VPA-acupuncture group (n=8). Offspring of Wistar pregnant rats that were simultaneously injected with saline were randomly selected as the wild-type group (WT). VPA_acupuncture group rats received acupuncture intervention at 23 days of age for 4 weeks, and the other two groups followed without intervention. After the intervention, all experimental rats underwent behavioral tests. Immediately afterward, they were euthanized by cervical dislocation, and their prefrontal cortex was isolated for RNA sequencing and transmission electron microscopy. Results: The main results are as follows: 1. Animal behavioural tests: VPA group rats showed more anxiety-like behaviour and repetitive, stereotyped behaviour than WT group rats. While VPA group rats showed less spatial exploration ability, activity level, social interaction, and social novelty preference than WT group rats. It was gratifying to observe that acupuncture indeed improved these abnormal behaviors of autism rat model. 2. RNA-sequencing: The three groups of rats differed in the expression and enrichment pathways of multiple genes related to synaptic function, neural signal transduction, and circadian rhythm regulation. Our experiments indicated that acupuncture can alleviate the major symptoms of ASD by improving these neurological abnormalities. 3. Under the transmission electron microscopy, several lysosomes and mitochondrial structural abnormalities were observed in the prefrontal neurons of VPA group rats, which were manifested as atrophy of the mitochondrial membran, blurring or disappearance of the mitochondrial cristae, and even vacuolization. Moreover, the number of synapses and synaptic vesicles was relatively small. Conversely, the mitochondrial structure of rats in the WT group and VPA_acupuncture was normal, and the number of synapses and synaptic vesicles was relatively large. Conclusion: Acupuncture effectively improved the abnormal behaviors of autism rat model and the ultrastructure of the PFC neurons, which might worked by improving their abnormal synaptic function, synaptic plasticity and promoting neuronal signal transduction.

Keywords : autism spectrum disorder, acupuncture, animal behavior, RNA sequencing, transmission electron microscope

Conference Title : ICA 2024 : International Conference on Autism

Conference Location : Los Angeles, United States

Conference Dates : October 28-29, 2024