MECHANISMS OF ACUPUNCTURE INTERVENTION IN RATS OF POST-STROKE DEPRESSION

XIAO WEI¹, ZHANG XIANBAO¹, WANG ZHEN¹, GUO XIAOLI¹, HE LING², WANG YAN³
¹Second Affiliated Hospital of Anhui University of Chinese Medicine, Hefei 230001, (China) - ²Anhui University of Chinese Medicine, Hefei 230001, (China) - ³Anqing Municipal Hospital, Anqing 246000, (China)

ABSTRACT

Objective: To observe the effect of Jieyuan Shen acupuncture on brain neurotransmitters in post-stroke depression (PSD) rats, and to explore the mechanism by which acupuncture improves PSD.

Methods: Rats were randomly divided into normal, model, drug, and acupuncture groups. A post-stroke depression model was made by middle cerebral artery occlusion and chronic unpredictable mild stress. The acupuncture group was treated at Baihui, Fengfu, Shenmen and Taichong points for 20 min. The rats in the treatment group were treated with fluoxetine (2 mg/kg) once a day for 7 days. 3 courses, each course of rest between 1 day. Pathological changes in the hippocampal CA1 region were observed by light microscopy. Ultrastructural changes of the hippocampus were observed by electron microscopy. Levels of serotonin (5-HT), norepinephrine (NE), acetylcholine (Ach), γ-aminobutyric acid (γ-GABA) and glutamate (Glu) were measured in the cerebral cortex. 5-HT transporter (5-HTT), 5-HT1A receptor (5-HT1A R), NEα2 receptor (NEa2R) mRNAs and proteins were detected by RT-PCR and immunoblotting, respectively, in the hippocampus and raphe nucleus.

Results: Compared with the model group, the acupuncture group had a lower Zea Longa score, higher sugar consumption, higher exercise level and greater number of vertical movements in the open field test (P < 0.01 or P < 0.05). The ultrastructural changes of hippocampal neurons were obvious and the damage to neurons was severe. There were fewer ultrastructural changes in hippocampal neurons in the acupuncture and drug groups compared with those in the model group. After treatment, levels of 5-HTT and 5-HT1A R mRNA and protein in the brain tissue of PSD model rats were decreased, and levels of Ach, γ-GABA, and Glu, and 5-HTT and 5-HT1A R mRNA and protein were significantly higher in the cortex of the acupuncture group compared with those in the untreated group (P < 0.01). The mRNA and protein levels of NEa2R mRNA and protein in the hippocampus, (P < 0.01). The mRNA and protein levels of Ach, γ-GABA, Glu and NEa2R were decreased (P < 0.01 or P < 0.05).

Conclusion: Jieyuan Shen acupuncture can significantly improve the behavioral changes of post-stroke depression rats, and may up-regulate the levels of 5-HT and NE in the cerebral cortex, down-regulate the expression of Ach, γ-GABA and Glu, and promote hippocampus, 5-HTT, 5-HT1A R, NEa2R, inhibit the expression of NEa2R, reduce the organic damage of hippocampus, and provide neuroprotective effect.

Keywords: post-stroke depression, acupuncture, neurotransmitter, neurotransmitter receptor.

DOI: 10.19193/0393-6384_2018_2_82

Received November 30, 2017; Accepted January 20, 2018

Introduction

Post-stroke depression (PSD) directly affects the rehabilitation of patients who have suffered stroke and increases the morbidity and mortality of stroke. This leaves patients, their families and society with a heavy burden. PSD has an incidence of 20% to 60% among stroke patients, and PSD is divided into mild and severe depression types.

Mild depression manifests as sadness, sleep disorders, mental activity decline, inattention, introversion, and decreased interest. In addition to these symptoms, severe depression includes, anxiety, early awakening, weight loss, loss of appetite, slow thinking, delusion and fantasy, despair and suicidal thoughts. PSD with mild to moderate depression is more common than severe PSD. PSD pathogenesis is complex, involving biological mechanisms,
behavioral psychology and social factors. The primary endogenous theory is thought to explain the pathogenesis of PSD<sup>6-10</sup>. Changes to neurotransmitters can lead to functional changes in neuronal pathways of the brain, leading to depressive mood disorders<sup>8-9</sup>. With a change in emphasis from a purely biomedical model to a bio-psycho-social model, post-stroke depression and post-stroke antidepressant treatment are being actively investigated. PSD treatment using anti-depressants of Western medicine have a certain clinical efficacy; however, compliance with the long-term use of anti-depressants is affected by side effects, poor tolerance, and the burden of cost for patients. Chinese medicine plays an important role and has advantages for the treatment of PSD<sup>10-11</sup>. Clinical studies have shown that acupuncture treatment has a good effect on PSD, with minimal side effects, indicating the advantages of traditional Chinese acupuncture for treating cerebrovascular disease<sup>12-14</sup>. We treated PSD model rats with acupuncture and assayed changes to brain neurotransmitters. Changes in brain histomorphology and ultrastructure of the hippocampus were observed and changes to monoamine neurotransmitters were detected. (5-HTT), 5-HT1A receptor (5-HT1A R), NEα2 receptor (NEα2R) in hippocampus, nucleus raphe, nucleus locus coeruleus and explore the possible role of acupuncture in improving PSD Mechanism for the clinical treatment of PSD to provide scientific basis for acupuncture.

**Materials and methods**

**Experimental materials**

Specific-pathogen-free male SD rats, weighing 200-250 g were obtained from the Anhui Medical University Experimental Animal Center (experimental animal license number: XCKX (Anhui) 2011-002), and were housed at 20-25°C, in relative humidity 40-75%, with alternating 12/12 h light and dark periods.


Drugs and reagents. Fluoxetine hydrochloride capsules, provided by Suzhou Pharmaceutical Co., batch number: Zhunzi J20080016. GABA (batch number: 14100212), and in the presence of a mixture of 5-HT (Lot No. 14031506), norepinephrine (NE) (lot # 14112105), acetylcholine (ACh) (batch number: 14052510) and gamma-aminobutyric acid, glutamic acid (Glu) (Lot No. 14110205) Standard: supplied by Sigma. 5-HT1A receptor (5-HT1A R), NEα2 receptor (NEα2R) primers Synthesis: Invitrogen; Reverse transcription kit (RevertAid first Strand cDNA Synthesis Kit): Thermo, Lot No.: 00145205; Nucleic Acid Dye: Parkson GoldView, lot number: 130618.

**Experimental methods**

A Rat PSD model was produced as previously described using the middle cerebral artery occlusion model of stroke<sup>15-16</sup>. Rats were anesthetized with 10% chloral hydrate (0.35 ml/100 g) by intraperitoneal injection. The right carotid artery, external carotid artery, internal carotid artery and its branching pterygopalatine artery were dissected under a microscope. One end of the internal carotid artery was sutured to the proximal end of the internal carotid artery. The external carotid artery was ligated, Department of cut a small gap, the diameter of 0.25 mm carbon fish line into the light push the end of the carotid artery through the carotid artery into the skull, insert the plug line length of about 18 mm ~ 20 mm, causing focal cerebral ischemia; Ligation of internal carotid artery line; disinfection of cotton ball clean surgical field, layer by layer suture; intraperitoneal injection of penicillin 4 million U, to prevent postoperative infection. The PSD model was based on the procedure of Werheid<sup>17</sup>.

On the 7th day after surgery, the tail of stroke model rats was clamped for 1 min, water 24 h, fasting 24 h, restraint 5 min, day and night reversed 24 h, foot shock (30 min, 1 mA, Continuous 1 s, the average 1 / min), 4°C ice water swimming 5 min seven kinds of stimulation methods. At different times of each day, rats were randomly assigned to a frequency of 24 h for 3 w.
Grouping and intervention methods. PSD model of rat reproduction after adaptive breeding 1w, after the first open-box experiments were screened, selected scores between 30-120 points in rats 40, according to the score using the random number table. The rats were randomly divided into normal, model, drug and acupuncture groups. The rats in the model group were treated with fluoxetine (2 mg/kg) and normal saline (1 mg/kg) once a day for 7 days. There were three courses of treatment, 1 day; acupuncture group selected Baihui, Fengfu, Shenmen, Taichong, the choice of stainless steel needle Baihui Baijian obliquely into the needle, the remaining points are vertical needle, needle depth of about 2 mm, mild twist, needle 20 min. During the line needle once a day, 7 days for a course of treatment, a total of three courses, 1 day between each treatment break.

Rat neurological deficits were scored using the Zea Longa score method(18) 22 days after intervention. The right forelimb resistance decreased, the right side of the walk, turn to the right; to the right side of the dumping, unable to walk; the right side of the forearm, Loss of consciousness, not spontaneously walking. Were recorded as 0,1,2,3,4 points.

Behavioral observations of rats. The sugar consumption test(19) was conducted 22 days after treatment intervention. Water and sugar water (10g/L) was freely available to rats for 24 hours. The sugar water consumption ratio = sugar water consumption/total liquid consumption. Rats were observed 22 d after treatment in the open field experiments. The rats in the central grid to stay time, the number of erection. The number of horizontal activities, and vertical activities. Observation of rat cerebral cortex. After acupuncture intervention, rats in each group were sacrificed by cervical dislocation at the end of the experiment. The hippocampus was dissected on an ice tray, cut into small pieces of approximately 1 mm3, fixed in 2.5% glutaraldehyde at 4°C for 4-6 hours. Tissues were then washed in PBS (pH 7.2) for 2-12 hours and then post-fixed in 1% osmium acid for 1 hour. Tissues were then incubated in the following solutions: 50% ethanol for 15 minutes, 70% acetic acid uranium ethanol saturated solution for 6-12 hours, 80% then 95% ethanol for 15 minutes, anhydrous ethanol twice for 40 minutes, and epoxy resin (1: 2) for 1 hour; (6) impregnation and embedding: immersion epoxy resin (1: 1) for 2 hours, (7) slice: take out the embedded tissue for ultra-thin section (slice thickness 70nm); (8) to remove the embedded tissue; (3) to remove the embedded tissue; (2), 2 hours after the epoxy resin embedded into the oven at 45 ℃ 12 hours, 65 ℃ oven 48 hours; Sections were then washed and placed in a saturated aqueous solution of uranyl acetate for 30 minutes, then washed three times for 15 minutes in double distilled water, placed in lead citrate dye solution for 15 minutes, and then washed three times for 10 minutes in double distilled water. Sections were observed with a Nissan JEM-1230 transmission electron microscope.

Determination of neurotransmitters in the rat cerebral cortex. After acupuncture intervention, rats in each group were immediately sacrificed and the brain dissected onto an ice tray. The cerebral cortex was removed and placed in dihydroxybenzoic acid. The 5-HT, NE, ACh, γ-GABA and Glu contents in the supernatant were measured by high-performance liquid chromatography (HPLC) at 30°C and 15000 r/min.

Determination of 5-HT1A R, 5-HTT and NEa2R mRNA in brain tissue. After experimental intervention, rats in each group were sacrificed by rapid cervical dislocation. The raphe nucleus, locus coeruleus and hippocampal CA1-4 region were then dissected according to the “Stereotaxic Rat Atlas of Rat” Baoxin et al. Total RNA was extracted by the Trizol method and total RNA content determined. Reverse transcription reaction conditions were 42°C for 30min, 99°C for 5min, and 5°C for 5min. The primer sequences were: 5-HTT: Forward primer 5′-GAT TCC GAC CAC TTC TTT C-3′, Reverse primer 5′-CCT CCT TCC ACT CCC <RTIgt; GGA CCA CGG CTA CAC CAT CTA CT-
3', Reverse primer 5'-CCT GCT CCC TTC TTT TCC ACC T-3', product length: 101 bp; 5-HT1A R Primer sequence: Forward primer 5'- product length: 144 bp; NEa2R: Forward primer: 5'-GTA GG GGA GAA TTG GTG TT-3', Reverse primer 5'-AAA TTC ACC ATC ATG AGC AA-3', product length: 128 bp; β-actin Fluorogenic primers: Forward primer 5'-CCC ATC TAT GAG GGT TAC GC-3', Reverse primer 5’-TTT AAT GTC ACG CAC GAT TTC-3', product length: 150 bp. PCR reaction conditions: 95°C for 5min, 95°C for 10s, 60°C for 30s, 40 cycles. can be the number of template cycle and fluorescence intensity of the relationship between the abscissa represents the cycle of the PCR reaction, the Ct value, the vertical axis represents the double- Fluorescence intensity after conjugation with SYBR Green fluorescent dye. The Ct value of each target gene was normalized against that of the internal reference gene, β-actin. The Ct value was calculated using the 2^{-ΔCt} method to determine the relative expression of the target gene.

Determination of 5-HT1A R, 5-HTT and NEa2R protein in brain tissue: Tissue samples weighing approximately 100 mg were homogenized in RIPA buffer containing 1 ml 1 mM PMSF and centrifuged at 12,000 rpm for 10 min. The supernatant containing the total tissue protein was collected. (5-HTT, 5HT1A, NEa2R for the rabbit anti-1: 500 dilution; dilution of the 8th, the first anti-rabbit anti- % Separation gel) and incubated overnight at 4 °C with slow shaking. The gel was then washed in TBST Washing solution three times for 10 minutes. Second antibody incubation: refer to the instructions of the secondary antibody, dilute the horseradish peroxidase (HRP) labeled secondary antibody with secondary antibody dilution at a ratio of 1: 10000. And blocked at room temperature for 2 hours. Washing solution (TBST) was added and washed 3 times for 10 minutes. An ECL luminescence kit was used to detect protein. Image J software was used for analysis, the 5-HTT, 5HT1A, NEa2R and Actin gray value ratio as protein relative expression.

**Statistical methods**

The SPSS 18.0 statistical package was used to analyze the data. Data are expressed as the mean ± standard deviation (SD). The mean of all samples in the normal distribution was compared by one-way ANOVA. The t-test was used to compare the differences between groups. P <0.05 was considered statistically significant.

**Results**

Compared with the normal group, the Zea Longa score of the model group was increased, while the consumption of sugar water, the level of exercise and the number of vertical motions in the open field test were decreased (P <0.01). Compared with the model, the acupuncture (P <0.01 or P <0.05). Behavioral changes were not significantly different between the acupuncture and drug groups (P> 0.05) (Figure 1).

Fig. 1: Behavioral changes in rats. A: Zea Longa scores; B: sugar consumption; C: the number of horizontal movements in the open field; D: the number of vertical movements in the open field. Compared with the model group, ** P <0.01, * P <0.05, compared with the normal group, ▲ ▲ P <0.01

HE staining of the hippocampal CA1 area showed that post-stroke chronic stress caused morphological damage. Acupuncture and fluoxetine partially reduced the hippocampal nerve damage. The effect of acupuncture was comparable to that of fluoxetine (Figure 2).

The blank group nerve cell morphology is normal with no deformation and cell bodies are densely arranged with complete membranes and normal nuclear morphology (A). (B). Compared with the model group, the arrangement of neurons in the acupuncture group was more orderly, the cell layer was more abundant, although a few neurons were damaged (C). In the drug group, neurons were arranged in a more regular pattern, and the cell layer was more abundant compared with the model group; however, some neurons were shrunken (D).
Ultrastructural observation of hippocampal neurons showed significant damage to neurons in the model group. However, in the acupuncture and drug groups ultrastructural changes to hippocampal neurons were relatively moderate. The degree of damage in these two groups was significantly less than in the model group (fig. 3).

Blank group neurons have a normal neuronal cell size, with nuclei that are oval, have clear inner and outer membrane structure, a smooth edge, and uniform perinuclear space. The rough endoplasmic reticulum was arranged parallel to the perinuclear space, which was in the form of a sulcus (pool), ribosome distribution. The distribution of mitochondria was similar. The cytoplasmic structures were intact. The mitochondria were round and oval (A). In the model group, cytoplasmic edema and nuclear chromatin margination were seen. Most organelles had disappeared, with only a small number of degenerated mitochondria (showing focal cavitation) being present (B). The drug group was normal. The perinuclear space was normal and the nucleus margin was smooth. The rough endoplasmic reticulum was mildly dilated and a few mitochondria showed rupture of the inner cristae. The Golgi complex and ribosomes were seen in the cytoplasm, the perinuclear space was normal and the nuclear margin was smooth (D). The acellular neurons in the acupuncture group were normal and the amount of heterochromatin in the nucleus was significantly decreased compared with the model group (D).

Compared with the normal group, the levels of 5-HT and NE in the cerebral cortex of rats in the model group were significantly decreased, and the levels of ACh, γ-GABA and Glu were increased (P <0.01). Compared with the model group, the levels of 5-HT and NE in the cerebral cortex of the acupuncture group were significantly increased, and the levels of ACh, γ-GABA and Glu were decreased (P <0.01 or P <0.05) (Table 1).

The levels of 5-HTT mRNA and protein in the hippocampus, nucleus raphe and locus coeruleus were decreased in the model group compared with the normal group (P <0.01). Compared with the model group, the level of 5-HTT mRNA in the locus coeruleus was significantly increased (P <0.05). Levels of 5-HTT mRNA and protein were increased in the nucleus raphe and nucleus raphe magnus (Figures 3-4).

Compared with the normal group, the levels of 5-HT1A R mRNA and protein in the hippocampus, raphe nuclei and locus coeruleus of the model group were decreased (P <0.01). Compared with

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>5-HT (ng/ml)</th>
<th>NE (ng/ml)</th>
<th>ACh (ng/ml)</th>
<th>γ-GABA (ng/ml)</th>
<th>Glu (ng/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>normal group</td>
<td>1</td>
<td>180.86±39.38</td>
<td>98.16±25.31</td>
<td>8.86±2.64</td>
<td>4.97±1.63</td>
<td>4.46±1.24</td>
</tr>
<tr>
<td>model group</td>
<td>1</td>
<td>97.25±28.48</td>
<td>54.51±15.87</td>
<td>15.48±3.05</td>
<td>7.78±3.48</td>
<td>7.62±2.39</td>
</tr>
<tr>
<td>acupuncture group</td>
<td>1</td>
<td>138.74±36.47</td>
<td>84.21±18.28</td>
<td>9.05±4.06</td>
<td>5.77±1.87</td>
<td>5.57±2.67</td>
</tr>
<tr>
<td>Drug group</td>
<td>1</td>
<td>142.24±24.69</td>
<td>86.67±26.69</td>
<td>10.12±3.45</td>
<td>5.82±1.34</td>
<td>5.68±2.87</td>
</tr>
</tbody>
</table>

Table 1: Changes of 5-HT, NE, ACh, γ-GABA and Glu levels in rat cerebral cortex (ng/ml).
the model group, the acupuncture (P <0.01 or P <0.05). Compared with the acupuncture group, the levels of 5-HT1A R mRNA and protein in the hippocampus, raphe nuclei and locus coeruleus of the rats in the acupuncture group were significantly higher (P > 0.05) (Figure 4).

Compared with the model group, the NEα2R mRNA and protein in the hippocampus, raphe nuclei and locus coeruleus of the model group were increased (P <0.01). Compared with the model group, the acupuncture group’s hippocampus, (P <0.01). NEα2R mRNA and protein levels were not significantly different between the acupuncture and drug groups (P > 0.05) (Figure 4).

Compared with the model group, the levels of NEα2R mRNA and protein in the hippocampus, raphe nuclei and locus coeruleus of the model group were increased (P <0.01). Compared with the model group, the acupuncture group's hippocampus, (P <0.01). NEα2R mRNA and protein levels were not significantly different between the acupuncture and drug groups (P > 0.05) (Figures 4-5).

Fig. 4: The mRNA levels of 5-HTT, 5-HT1A R and NEα2R in rat brain. A: hippocampus, B: nucleus raphe magnus, C: locus coeruleus. a: 5-HTT, b: 5-HT1A R, c: NEα2R. Compared with the normal group, * P <0.05, ** P < 0.01. Group, * P <0.05, ** P <0.01. Compared with the drug group, P <0.05. 5-HTT: 5-serotonin transporter, 5-HT1A R: 5-serotonin 1A receptor, NEα2R: norepinephrine α (2A) receptor compared with the drug group, P <0.05.

Fig. 5: The levels of 5-HT1AR, 5-HTT and NEα2R in brain tissue. A: hippocampus, B: raphe nuclei, C: locus coeruleus; 1 blank group, 2 model group, 3 acupuncture group, 4 drug group. Compared with the normal group, ▲ P <0.05, ★ ★ P <0.01. Group, * P <0.05, ** P <0.01. Compared with the drug group, ▲ P <0.05. 5-HTT: 5-serotonin transporter, 5-HT1A R: 5-serotonin 1A receptor, NEα2R: norepinephrine α (2A) receptor.
Discussion

PSD is Chinese medicine “depression”, “dirty dry” and other areas. Qi Yu Sheng wet, wet phlegm, phlegm stops, God disorders as the main cause of post-stroke depression. TCM pathogenesis to emotional uncomfortable, qi stagnation-based.

Qi stagnation, phlegm and blood loss, blood loss, so that the brain of God dystrophy, God lost the possession of this disease-based. Governance is to liver and qi. The use of body acupuncture treatment of patients with PSD can not only stroke caused side limb dysfunction, but also balance the yin and yang, qi nourishing, tonic diarrhea, PSD patients in order to promote the recovery of mental disorders(21). Therefore, in the treatment of phlegm from the argument, select the Xing Shen Jieyu phlegm point group.

In this study, the middle cerebral artery occlusion method was combined with the chronic unpredictable mild stress (CUMS) model to establish a PSD rat model. The Zea Longa score of the acupuncture group was lower than that of the normal, untreated group. Indicating that rats in the surgical anesthesia awake after the contralateral limb mild functional disorder. The consumption of sugar syrup in the acupuncture group was lower than that of the normal group. These results showed that acupuncture at Baihui, Fengfu, Shenmen and Taichong points had significant effects on improving the behavior of PSD model rats. The PSD primary endogenous mechanism theory is mainly based on changes in brain neurotransmitters(22-23). Nerve regeneration in the hippocampus is thought to be closely associated with depression(24-26). PSD rats have post-stroke hippocampal nerve regeneration disorder(27-28).

The study found that(29-30), depression, hippocampal cells in the number of modeling decreased arrhythmias, cell gap increases. Long-term chronic stress-induced depression in the rat model produces changes in neuronal cell structure: the nucleus show shrinkage changes and an uneven nuclear membrane, mitochondrial swelling and cristae disappearance and other pathological changes. Acupuncture, to a certain extent, improves the damage to hippocampal cells(31-33). The results of this study show that acupuncture and fluoxetine can reduce to some extent the damage to hippocampal CA1 nerves in PSD rats. The neuronal cell bodies and organelles in the acupuncture and the drug groups were normal. These results showed that acupuncture and fluoxetine could decrease apoptosis of hippocampal neurons and promote the repair of damaged cells. Therefore, acupuncture can reduce the injury of hippocampal neurons induced by stress and promote the repair of injured cells, thus reducing organic damage to the hippocampus.

This may a mechanism by which acupuncture improves the depression behavior of PSD rats. Further observation revealed that the levels of 5-HT and NE in the cerebral cortex of PSD rats were significantly decreased, while levels of ACh, γ-GABA and Glu were increased. This indicates that monoamine neurotransmitters, such as 5-HT, NE, ACh, γ-GABA and Glu may be involved in PSD mood changes. In this study, levels of 5-HTT and 5-HT1A R were decreased and levels of NEα2R were increased in the hippocampus, raphe nuclei, and locus coeruleus. This indicates that a reduction in the 5-HT-HT1 receptor, and presynaptic membrane 5-HT1A receptor hypo-sensitivity may be related to PSD(34-35).

Brain for the House of God, mind and brain are closely related to acupuncture treatment of the disease first to focus on adjusting the brain function of God, on the basis of normal air, it is possible to improve the symptoms of depression(23-24). This study through acupuncture Baihui, wind House, Shenmen, Taichong, you can play Shugan Qi, the role of brain nerves. Acupuncture can significantly improve the Zea Longa score, sugar consumption, open-field horizontal movement and the number of vertical movements in the PSD rats. The mechanism of these actions may be through upregulating 5-HT and NE levels in the cerebral cortex, down-regulating ACh, γ-GABA, Glu levels in the hippocampus, mesencephalic nucleus and locus coeruleus and inhibiting the expression of NEα2R. Baihui for the hand-foot-three Yang and Du and foot Jueyin liver by the meeting, as a meeting of the Lotus. Acupuncture Baihui adjustable fill in the gas, Jiannao rather God, is the heart of the main points of God. Wind House for the Ministry of days important source of germinal, with scattered wind Xifeng, customs resuscitation effect. Acupuncture This point has the role of Shufengluo. Shenmen is one of the acupoints of hand-shaoyin heart sutra. It can help to sleep, regulate autonomic nerves, and replenish the nerves. It can be used to treat heart disease, upset, fright, palpitations, forgetfulness, insomnia, epilepsy, Heart gas, calm mind. Taichong for the liver by the original point, functional Kuanxie Jie Yu, acupuncture Taichong point of liver.
qi stagnation caused by the disease have a good effect.

ACh, γ-GABA, glu, hippocampus, nucleus raphe magnus, hippocampus, nucleus raphe magnus, hippocampus, nucleus raphe magnus, The expression of 5-HTT, 5-HT1AR and NEα2R protein in locus coeruleus decreased the damage of hippocampus tissue and provided neuroprotective effect.

References


Fund Project: National Natural Science Foundation Project: Study on the Mechanism of Acupuncture Intervention on Post-stroke Depression by Using Neurotransmitter Receptor PCR Chip Technology (81273857)

Corresponding author
PROF. LIU JIAN
E-mail: liujianahzy@126.com
Department of Rheumatology, The First Affiliated Hospital of Anhui University of Chinese Medicine, Hefei (230031) (China)