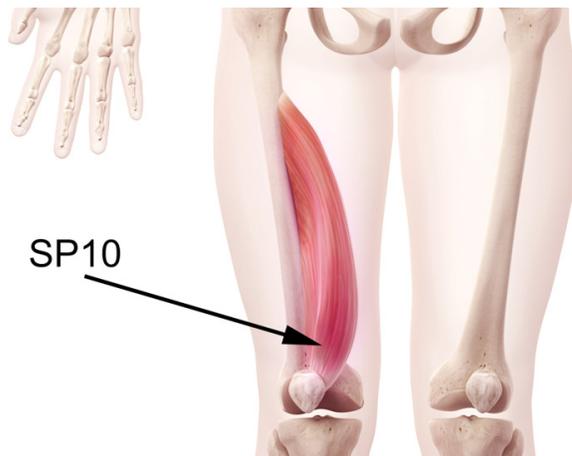


# Acupuncture Controls Hypertension, Provides Neuroprotection

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Researchers conclude that acupuncture reduces hypertension and prevents brain damage due to chronic high blood pressure. A controlled laboratory investigation finds acupuncture effective for the regulation of blood pressure while simultaneously preventing excessive cell death in the brain. In a quantification of acupuncture's effective mechanisms, researchers identified important biological responses elicited by acupuncture responsible for producing therapeutic benefits.



The research team of Lu et al. identified biochemical responses elicited by the application of three acupuncture techniques. Reinforcing twirling, reducing twirling, and needle retention techniques resulted in reduced blood pressure and downregulation of cell death in the brain when compared with a control group. All three manual acupuncture techniques prevented “target organ damage by increasing the Bcl-2/Bax ratio and inhibiting apoptosis of hippocampal neurons.”

## Liver Yang

According to Traditional Chinese Medicine (TCM) principles, the laboratory rats in this investigation had hypertension due to excessive liver yang uprising. Selective breeding produced this type of laboratory

rat. Consistent with the diagnosis of liver yang uprising, all rats were aggressive, easily irritated, and had red and protruding eyes, dry stools, and excessively yellow urine. According to TCM theory, reducing techniques applied to acupoint LV3 (Taichong) are indicated for liver yang uprising type hypertension. Although reinforcing twirling produced positive outcomes, reducing twirling produced the most significant results. The researchers note, “Reducing twirling significantly increased the mRNA and protein Bcl-2/Bax ratio compared with reinforcing twirling.” This is consistent with TCM principles indicating that reducing twirling is the correct needling method for this clinical scenario.

### **Neuroprotection**

The hippocampus is a part of the brain active in memory, emotions, and it plays an important role in the regulation of the autonomic nervous system. Acupuncture successfully inhibited pathological cell death (apoptosis) in the hippocampus caused by hypertension by regulating the ratio of Bcl-2 (an apoptosis inhibitor) to Bax (an apoptosis promoter). The researchers note “that reinforcing twirling, reducing twirling, and needle retaining methods all improve blood pressure and prevent target organ damage by increasing the hippocampal Bcl-2/Bax ratio and inhibiting cell apoptosis in the hippocampus.” The researchers add, “Bax and Bcl-2 promote or inhibit neuronal apoptosis by transducing the apoptosis signal,” and the “ratio of Bcl-2/Bax is regarded as an index of the overall trend of cell apoptosis.” In addition, “the reducing twirling group, reinforcing twirling group, and needle retaining group showed a significant decrease in Bax mRNA expression ( $P < 0.01$ ) and a marked increase in the Bcl-2/Bax mRNA ratio ( $P < 0.01$ ).”

The researchers provide insight into the importance of their findings. They note that the hippocampus is active in blood pressure regulation and hypertension “induces apoptosis in the brain neurons during the early stages of hypertension.” Consequently, hypertension may lead to cerebrovascular disease by activating excessive cell death in the brain. Notably, chronic hypertension is correlated with a gradual shrinking of the following areas of the brain: the hippocampal external capsule, dentate gyrus, corpus callosum, CA1, and CA3. This occurs, at least in part, because chronic hypertension increases Bax (an apoptosis promoter) expression thereby disturbing the homeostatic Bcl-2/Bax ratio.

## **Yin and Yang**

The researchers note that the balance inherent in the Bcl-2/Bax ratio reflects basic yin and yang theory. The dynamic and ongoing regulatory balance between pro-apoptosis and suppressor apoptosis genes is bidirectional, wherein Bcl-2 and Bax mutually oppose the function of each other to maintain a healthy balance of cell death, preservation, and growth. In TCM terms, this experiment finds acupuncture effective in harmonizing yin and yang; the balance of mutually interdependent opposites is restored. Acupuncture restores a normal Bcl-2/Bax ratio thereby preventing hippocampal damage due to hypertension. Results were verified by western blot assay, reverse transcription-polymerase chain reaction, and terminal deoxynucleotidyl transferase dUTP nick end labeling assay.

## **Independent Investigations**

The researchers cite independent investigations demonstrating that acupuncture causes neuroprotective effects resulting in reductions of pathological forms of apoptosis in the hippocampus. For example, Zhang et al. demonstrate that acupuncture regulates BDNF and GDNF expression in the hippocampus following hypoxia-ischemia. BDNF (brain-derived neurotrophic factor) assists in the growth and differentiation of new neurons and synapses. BDNF is active in the hippocampus, cortex, and other areas of the brain. BDNF is important in the retention of long-term memories and neurogenesis. GDNF (glial cell-derived neurotrophic factor) is important for nerve function. GDNF improves the overall recovery of neurons and neuroglia by inhibiting cell death caused by injuries.

The researchers selected acupoint LV3 for their investigation based on the results of prior investigations finding LV3 effective for the alleviation of hypertension. Several anti-hypertensive mechanisms were identified across multiple studies. Lu et al. note that acupuncture activates “the hypothalamic arcuate nucleus and periaqueductal gray in the anterior ventral region, as well as inhibition of expression of cardiovascular sympathetic neurons and Apelin (multifunctional peptide that regulates blood pressure and heart function) in the rostral ventrolateral medulla.”

Claunch et al. (Department of Radiology, Massachusetts General Hospital, Charlestown) independently find LV3 active in hippocampal regulation, “Acupuncture at the three classical acupoints of Hegu (LI4), ST36 and Taichong (LV3) produced extensive deactivation of the limbic-paralimbic-neocortical brain network as well as activation of its anti-correlated activation network.” Differentiation between the points was documented, “LI4 was predominant in the pregenual cingulate and hippocampal formation, ST36 response was predominant in the subgenual cingulate, and LV3 in the posterior hippocampus and posterior cingulate.” The results demonstrate that individual acupoints exhibit relative specificity as evidenced by fMRI.

### **Related Research**

In related research, Liu et al. combined LV3 with two additional acupoints and successfully alleviated hypertension in human subjects. Acupuncture was determined to be equally effective for the treatment of hypertension as nifedipine (a calcium channel blocker). In a randomized-controlled clinical trial, both acupuncture and nifedipine successfully reduced blood pressure by 30 – 40 mm Hg for human patients with hypertension.

Acupuncture regulated blood pressure according to the patients’ needs. For extremely high blood pressure, acupuncture significantly reduced systolic and diastolic pressures. For moderate levels of high blood pressure, acupuncture moderately reduced systolic and diastolic pressures. Three acupoints were used for all patients:

- **LV3 (Taichong)**
- **LI4 (Hegu)**
- **SP10 (Xuehai)**

A reducing manual acupuncture technique was applied to the acupuncture points after elicitation of a deqi response. Needle retention time was 20 minutes per acupuncture session. Needles were rotated, lifted, and thrust at 5 – 10 minute intervals.

### **Results**

The results of the aforementioned research indicates that acupuncture

is a safe and effective treatment modality for the alleviation of hypertension, a disorder affecting approximately 25% of the worldwide adult population. Long-term damage caused by hypertension includes morphological destruction of the hippocampus. Researchers demonstrate that acupuncture alleviates hypertension while simultaneously regulating pathways responsible for providing neuroprotective effects to the hippocampus.

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