The Mechanism of Action and Clinical Research Progress of Gastrodin in the Treatment of Vertigo

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DOI: 10.32629/jcmr.v5i1.1787

Abstract: Gastrodin is a phenolic glycoside with the chemical name of 4-hydroxybenzyl alcohol-β-D-glucopyranoside, which is the main bioactive component of Gastrodia in China. Gastrodin has low toxicity, good sedative and sleeping effects, can effectively dilate the body's blood vessels, increase myocardial blood flow, have a protective effect on the body's nerve cells, and play a role in regulating the excitation and inhibition of the cerebral cortex in the central nervous system, improving vestibular function, anti-inflammatory, antioxidant and other effects, thereby improving the clinical dizziness and other symptoms of patients. Gastrodin injection has good clinical effect in the treatment of vertigo, and no obvious adverse reactions have been observed. Compared with gastrodin alone in the treatment of vertigo, the combination with promethazine, diphenhydramine, betahistine and other drugs can effectively improve the treatment rate and reduce the incidence of related side effects.
***Keywords*:** gastrodin, vertigo, combination therapy

1. Clinical effect of gastrodin on vertigo

The chemical name of gastrodin is 4-hydroxybenzyl alcohol-β-D-glucopyranoside, which is the main bioactive component of Chinese herbal medicine Gastrodia, which has good sedative, sleeping and analgesic effects, and can also improve vestibular function, protect brain cells and damaged endothelial cells, reduce peripheral resistance and improve memory. Based on the above characteristics, studies have shown that gastrodin can be used for the clinical treatment of neuropsychiatric diseases, such as headache, vertigo, depression, neurasthenia and epilepsy. [1] Vertigo is a common clinical disease, in which patients feel themselves or their surroundings spin and sway, accompanied by nausea, vomiting, tinnitus, balance disorders, nystagmus and other symptoms. Causes of vertigo include persistent postural perceptual dizziness, central vertigo, benign paroxysmal positional vertigo, vestibular migraine, Meniere's disease, and vestibular paroxysmals. Modern pharmacological studies have found that gastrodin can effectively dilate blood vessels, increase myocardial blood flow, improve myocardial microcirculation, and at the same time have a protective effect on the body's nerve cells, improve the ability of brain cells to resist hypoxia, thereby improving the clinical dizziness and other symptoms of patients.[2] The main therapeutic effect of gastrodin is to exert sedative, neuroprotective, anti-inflammatory, antioxidant and other effects in the central nervous system, and it can quickly pass through the blood-brain barrier and be distributed in the brain after entering the systemic circulation. After 15 minutes of intravenous injection, gastrodin can penetrate the blood-brain barrier and be detected in the frontal lobe, hippocampus, thalamus and cerebellum of rats, among which the cerebellum concentration is the highest and discharged through the hepatobiliary tract, which has a good effect on improving neurodegenerative diseases. In addition, compared with Western medicine, gastrodin has the advantages of fewer side effects, more sites of action, and safe efficacy. Gastrodin can not only treat vertigo alone, but also can be combined with other drugs to better exert its therapeutic effect.

2. Mechanism of gastrodin in the treatment of vertigo

2.1 Anti-inflammatory effect

Ménière's disease (MD), namely paroxysmal spontaneous vertigo and central vertigo (CV), are two common vertigo disorders caused by different causes, MD is an autoimmune disease, and the common acute causes of CV are cerebrovascular disease and inflammation. Therefore, the anti-inflammatory effect of gastrodin has a good effect on the treatment of vertigo. Chen et al. demonstrated that gastrodin was able to inhibit the increase of interleukin-1beta (IL-1β) and tumor necrosis factor-alpha (TNF-α) levels, both of which were pro-inflammatory cytokines, as well as reverse the decrease of interleukin-10 (IL-10) level, an anti-inflammatory cytokine in the brain of PTZ-induced mice.[3] Guan Jinqi et al. used rat cerebral artery occlusion method to establish an ischemic stroke model, and intraperitoneal injection of gastrodin injection, and found that the positive expression of NLRP3 inflammasome decreased, and the expression of Toll-like receptor 4, myeloid differentiation

factor 88, apoptosis-related spot-like protein, cysteine protease 1, interleukin 1β protein and mRNA decreased in the high-dose gastrodin group. The results showed that gastrodin intervention could alleviate the inflammatory damage in ischemic stroke rats, and its mechanism of action may be related to the inhibition of the expression of inflammatory response-related factors. [4]

2.2 Anti-oxidative stress

Persistent postural perceptual dizziness (PPPD) is a chronic vestibular dysfunction that belongs to secondary chronic vestibular syndrome, benign paroxysmal positional vertigo (BBBP) is an induced episodic vestibular syndrome, vestibular migraine (VM) and vestibular neuritis (VN) can also cause spontaneous vertigo, and the occurrence and progression of auditory vestibular dysfunction is the result of age-related inflammation and oxidative stress. Therefore, the antioxidant effect is also involved in the anti-vertigo and neuroprotective effects of gastrodin. Zhong et al. reported that gastrodin pretreatment could inhibit the decrease of catalase (CAT), glutathione (GSH), superoxide dismutase (SOD), glutathione reductase (GR) and total antioxidant (T-AOC), and alleviate the increase of malondialdehyde (MDA) levels. [5] Gastrodin can also promote the expression of miR-124 in activated microglia and inhibit the expression of miR-155, thereby exerting its neuroprotective effects.

2.3 Vasodilation

Xie et al. used the rat ex vivo thoracic aortic annular perfusion model as the research object, and found that gastrodin has a concentration-dependent, endothelium-dependent vasodilatory effect, which can significantly resist the vasoconstriction effect induced by norepinephrine. [6] Modern medical research has shown that gastrodin can not only dilate blood vessels, but also reduce peripheral vascular resistance, improve the ability of brain cells and myocardium to resist hypoxia, increase cerebral blood flow and coronary artery blood flow, improve blood supply to the inner ear and labyrinth artery, improve hemodynamic indicators of patients, and further alleviate symptoms such as dizziness, tinnitus and balance disorders caused by insufficient blood supply. It can also inhibit platelet aggregation and have a significant depolymerization effect on aggregated platelets, so as to reduce the weight and length of thrombus, thereby avoiding the formation of thrombus. Gastrodin can restore lysosomal function and autophagic activity, thereby reducing lipid accumulation and preventing foam cell formation. In addition to reducing the accumulation of foam cells, it can also inhibit the proliferation of vascular smooth muscle cells, regulate the action of vascular smooth muscle, and promote angiogenesis.

3. Dastrodin in combination with other drugs for vertigo

3.1 In combination with promethazine

Promethazine hydrochloride is a commonly used antihistamine drug, with high safety and low price, mainly for dizziness, vomiting and other symptoms to play a pharmacological role, but can not fundamentally change the pathological pathogenesis, and because vestibular inhibitor inhibition may slow down vestibular compensation, long-term use is not recommended. As a natural ingredient extracted from Gastrodia gastrodia tubers, gastrodin can maintain the balance of excitation and inhibition in the cerebral cortex, improve vestibular function, and relax blood vessels, so as to achieve the purpose of treating vertigo. Yang Huan et al. showed that the common adverse reactions after the use of gastrodin alone included nausea, vomiting, palpitations, dry mouth and nose, rash, itching, phlebitis, etc., while only nausea, rash and drowsiness occurred after the combination of drugs, and the total incidence of adverse reactions was 8%. Compared with promethazine alone, the combination of gastrodin did not significantly increase the adverse reactions caused by the drug, and the addition of gastrodin could significantly improve the short-term efficacy of promethazine hydrochloride and effectively reduce recurrence within 12 months. [7]

3.2 In combination with Betastine

Gastrodin injection is a monosystem agent, which is the active ingredient of gastrodia, which is decomposed into gastroside after entering the human body, which quickly penetrates the blood-brain barrier and combines with CI receptors and benzodiazepines to produce significant effects and give full play to the therapeutic effect. The chemical structure and pharmacological properties of betahistine mesylate are similar to histamine, and it is a weak agonist of histamine H1 receptor and a strong antagonist of H3 receptor, and oral administration is the most effective, with a good effect of dilating brain capillaries and increasing blood flow in the posterior circulation of the brain. Guo Ling and Chen Yuxia observed 70 patients with posterior circulation ischemic vertigo and found that gastrodin injection combined with betahistine mesylate tablets increased the effective rate of posterior circulation ischemic vertigo by 11.43%, the recurrence rate decreased by 11.5%, and the incidence of adverse reactions was lower. [8] Zhang Shupei and Xu Yanxia also pointed out that compared with the use

of betastine alone, the effective rate of treatment after adding gastrodin injection increased by 5.96%, and the incidence of adverse reactions decreased by 8.73%. [9]

3.3 Combined with diphenhydramine

Diphenhydramine is a commonly used clinical drug for the treatment of vertigo, which is an antihistamine drug, which can antagonize histamine H1 receptors after entering the human body, fully inhibit the effect of this receptor in the central nervous system, and can improve the patient's vestibular excitability, produce a better effect of calming nausea and relieving vertigo. However, diphenhydramine has poor drug safety, and there are large differences in the treatment effect on patients, with relatively many adverse reactions and a short half-life. Gastrodin can not only act on cranial nerve tissue, but also fully improve the energy metabolism of patients' cardiomyocytes, help patients reduce the lack of cerebral blood supply caused by the decrease in the heart's pumping ability, and alleviate the symptoms of vertigo. Li Xiuhua's research pointed out that the addition of gastrodin on the basis of diphenhydramine treatment can improve the symptoms of vertigo in patients, reduce the adverse reactions caused by vertigo, promote the improvement of sleep quality, help patients effectively repair nerve function, cut off the mechanism of vertigo while curbing vertigo, improve the treatment effect, shorten the treatment time, and reduce the economic and life pressure of patients. [10]

4. Concluding Remarks

Gastrodin can relieve vertigo by inhibiting cerebral cortex excitation, vasodilation, anti-inflammatory effects, antioxidant stress effects, and improving vestibular function. There are many types of vertigo and complex pathogenic factors, so when using gastrodin and its combination drugs, different choices should be made according to the specific types of vertigo. Gastrodin alone has a certain effect in the treatment of vertigo, but produces more adverse reactions, and the synergistic treatment with other drugs can improve the treatment efficiency of vertigo, reduce the recurrence rate, and reduce the occurrence of related adverse reactions, which has a high safety profile and is worth promoting. Improving the way gastrodia is administered, such as making granules for administration, can improve the utilization rate of the drug. It can also be combined with nanomaterials to make targeted drugs, which can improve the drug delivery rate while reducing the impact on possible side effects at other sites. However, up to now, there are few studies on the treatment of gastrodin in vertigo, and the number of patients in the study is mostly 50 to 300, and the sample size is small. So in order to draw accurate and objective conclusions, the clinical sample size should be expanded in the future, and the application of gastrodin lacks sufficient evidence-based evidence, and more clinical studies are needed.

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