Capabilities of non-medicamentous sympathocorrection of the tone of cerebral veins in people with accelerated ageing

M E Yakimova¹, M N Gavrilova², O V Polozova², I S Zimina³ and S A Mukhina²
¹ Head of the Department of Functional Diagnostics, Republican Clinical Hospital for War Veterans, Yoshkar-Ola, Russia
² Associate Professor, Mari State University, Yoshkar-Ola, Russia
³ mbdibg@yandex.ru

Abstract. The article studies the effectiveness of the electroimpulse sympathocorrector influence on the area of the cervical sympathetic ganglia in patients with early signs of ageing. Using the ultrasound angiography method, we found that the course of sympathocorrection normalizes the diameter of internal jugular veins and contributes to improvement of cerebral venous outflow. In its turn, this implies that the development of angiodystonic changes, arterial hypertension and atherosclerosis in the organism are decelerated. The method of percutaneous electroimpulse actions in the area of the cervical sympathetic ganglia can be recommended as a way to prevent premature and accelerated ageing in the blood circulatory system and as an additional method in complex therapy.

1. Introduction

It is known that extreme stresses in the form of ionizing radiation or psychoemotional stresses accelerate the development of systemic atherosclerosis [1, 2]. Naturally, this manifests itself as pathological changes in the walls of the whole brachiocephalic system, in aorta and as remodeling signs according to the echocardiography data [3].

Therefore, there is a problem of search for the measures to prevent the development of atherosclerosis.

Today, the development of atherosclerosis and its typical complications still remains a hard-to-solve problem, although many pathogenetic mechanisms have already been revealed. They include the following: genetic predisposition [4], immune [5] and autoimmune disorders, hypercholesterolaemia [6], arterial hypertension [7], type 2 diabetes mellitus [8].

The purpose of our paper is to study the possibility of delaying the development of early appearance of vascular disorders that contribute to accelerated ageing of people, who experienced extreme stresses, using the electroimpulse corrector of the sympathetic nervous system activity— Sympathocor-1 to treat vegetovascular dystonia, the consequences of craniocerebral injury, arterial hypertension, etc. [7].

We proceeded from the fact that the executive link of neurogenic mechanism in the regulation of cerebral blood flow and the tone of large arterial and venous trunks are efferent vegetative nerves coming from the superior cervical and stellate ganglia [9]. They provide predominantly sympathetic constricting effects on blood vessels. This mechanism controls dynamic interaction of regulatory contours of both arterial and venous blood flows. Such interaction aims to provide appropriate microcirculation in...
capillaries of brain, heart and other organs and tissues of head, neck and thoracic cavity, i.e. tissue homeostasis [9, 10].

2. Research method
To correct progeric changes in great vessels, we used percutaneous electroimpulse action in the stellate ganglia localization area alternately on the right and left sides of the neck. Each procedure did not last for more than 10 minutes, treatment was provided in the courses of everyday sessions for 5-7 days on an outpatient basis.

The study involved the patients who had, according to the data of clinical and laboratory-instrumental examination, the signs of accelerated ageing, which was confirmed by the appearance of early atherosclerotic changes in great vessels: induration of aorta and intima of carotid arteries with subsequent wall thickening, dilation of internal jugular veins. At the time of study the patients did not receive vasoactive drug therapy.

In each case we performed compulsory triplex angiography of IJV, which allowed us to determine the diameter of the lower bulbs of IJV before sympathocorrection and just after it. A decrease in the internal diameter of IJV was seen as a sign of IJV hypertension and improvement of venous outflow.

The study involved 89 male patients aged 20 to 60 with typical clinical manifestations of angiodystonia syndrome that developed because of the past effects of ionizing radiation in average and small doses, psychoemotional overloads and craniocerebral injury.

The results of studies were registered in a specially developed patient card where the following was recorded: diagnosis, complaints, results of objective examinations – arterial blood pressure on both arms before and after therapy sessions, clinical and biochemical blood analysis, echocardiography and extracranial angiography analyses before treatment and extracranial angiography data after the therapy course.

3. Results and discussion

3.1 Influence of sympathocorrection on the tone of cerebral veins in patients who experienced radiation stress
It was found that in 100% of cases, before sympathocorrection sessions, the patients subjectively experienced headache, dizziness, and memory impairment. In 80% of cases arterial hypertension was diagnosed, moreover, some patients were in a state of hypertensive crisis. However, after the sympathocorrection course in 97% of cases subjective improvement of physical well-being was observed—the above-mentioned complaints disappeared, and arterial blood pressure tended to normalize itself. The obtained hypotensive effect maintained for 3-6 months. Hypertensive crisis was also effectively treated.

It was found that all patients, by the moment of visiting a doctor, had bilateral or unilateral ectasia of internal jugular veins (IJV) with intensity from 12 to 18 mm in diameter (on the average 13±1 mm on the left, 17±1 mm on the right), with a standard of up to 10 mm. After the sympathocorrection course the therapy effect was evaluated based on the IJV diameter as follows:

1) complete normalization of the IJV diameter;
2) partial (incomplete or unilateral) normalization of the IJV diameter on the right or on the left;
3) the absence of effect.

Among the people who experienced the effects of ionizing radiation in average and small doses in the past, 53 people aged 33 to 60 with these signs were examined. It was found that in 31% of cases the electroimpulse correction course normalized the IJV diameter on both sides (the 1st variant of the result), a decrease in intensity of ectasia on the right or on the left was observed in 49% of cases, however, it was not fully cured (the 2nd variant of the result), and only in 20% of cases the absence of effect was reported (the 3rd variant). Thus, most patients reacted to electroimpulse actions by a decrease in cerebral venous stasis, i.e. hypertension of veins.
When analyzing this phenomenon, we took interest in the issue of the age factor influence on the reactivity of the venous contour of cerebral blood flow regulation. For this purpose, we traced the effectiveness of electroimpulse therapy, having divided the data into two age groups (first group: 33÷45 years old and second group: 46÷60 years old).

In the first age group (19 people) the following was observed: complete normalization of the IJV diameter in 47% of cases, partial normalization: with complete normalization of the left IJV and a decrease in ectasia of the right one in 20%, with complete normalization of the right IJV and a decrease in ectasia of the left IJV in 11% of cases, partial normalization of both ectatic IJV in 6% and the total absence of effect only in 16 %. At the same time, subjective improvement of physical well-being was observed in 97% of cases (Figure 1).

![Figure 1](image1.png)

**Figure 1.** Effectiveness of electroimpulse therapy in 33÷45 age group, where 1 is complete normalization of the IJV diameter; 2 is with complete normalization of the left IJV and a decrease in ectasia of the right one; 3 is with complete normalization of the right IJV and a decrease in ectasia of the left IJV; 4 is partial normalization of both ectatic IJV; 5 is the total absence of effect.

In the second age group (34 people) normalization of the IJV diameter was only observed in 15 % of cases, partial normalization: with complete normalization of the diameter of the left IJV and a decrease in ectasia of the right IJV in 21% of cases, with complete normalization of the diameter of the right IJV, a decrease in ectasia of both IJV in 31% of cases. The absence of effect was observed in 23 % of cases (Figure 2).

However, subjective improvement of physical well-being was observed in 97% of cases as in the first group. Therefore, it can be believed that with age the effectiveness of the sympathocorrector influence on the tone of cerebral veins is gradually decreasing, and improvement of physical well-being can be attributed to simultaneous positive influence of electroimpulse sympathocorrection on other contours of cerebral blood flow regulation in the arterial system, that was found earlier [9, 11,12].

3.2. **Influence of sympathocorrection on the tonus of cerebral veins in patients suffering from post-traumatic stress disorders (PTSD)**

It was found that at the age of 32÷60 (25 people) all patients in this group enjoyed a positive effect of electroimpulse sympathocorrection: there was complete normalization of IJV in 48% of cases and partial elimination of ectasia in 52% of cases. There were no cases of effect absence.

The therapy effectiveness was analyzed in two age groups: 32÷45 years old (21 people) and 46÷60 (4 people).
In the first group normalization of the IJV diameter was observed in 53% of cases, partial normalization: with complete normalization diameter of the left IJV and a decrease in ectasia of IJV in 16% of cases, and a partial decrease in ectasia of both IJV in 31% of cases.

In the oldest age group complete normalization of IJV was only observed in 25% of cases, partial normalization: with normalization of the diameter of the left IJV and a decrease in the diameter of the right IJV in 25% of cases and a partial decrease in the diameter of both IJVs in 50% of cases. The subjective improvement of physical well-being in all patients was also observed in 97% of cases.

![Figure 2](image.png)

**Figure 2.** Effectiveness of electroimpulse therapy in 46-60 age group, where 1 is complete normalization of the IJV diameter; 2 is with complete normalization of the left IJV and a decrease in ectasia of the right one; 3 is with complete normalization of the right IJV and a decrease in ectasia of the both IJV; 4 is the total absence of effect.

Therefore, it can be believed that the effectiveness of sympathocorrection in people who experienced a stress was slightly higher than in people exposed to radiation.

Of special interest is the group of young people aged 20 to 28 (11 people), suffering from post-traumatic stress disorders. This group experienced, under the influence of sympathocorrection, complete normalization of the IJV diameter in 55% of cases, partial normalization: with complete normalization of the diameter of the left IJV and a decrease in ectasia of the right IJV in 9% of cases, partial normalization of the diameter of both IJV in 27% of cases. However, the absence of effect was also observed in 9% of cases. And yet, the highest percentage of a positive effect of electroimpulse sympathocorrection on the diameter of internal jugular veins is observed in the group of young people suffering from post-traumatic stress disorders.

**4. Conclusion**

The courses of electroimpulse sympathocorrection in the stellate ganglion area, given using the Sympathocor-1 device, contribute to normalization of the diameter of internal jugular veins and improvement of venous outflow in patients with the signs of accelerated ageing in 31-55% of cases.

The age factor has a natural influence on the effectiveness of the sympathocorrection method: this method had the strongest effect in the youngest age group in people who experienced stresses and suffer from PTSD, and the weakest effect in the oldest age group in people exposed to radiation.

The method of percutaneous electroimpulse actions in the area of the cervical sympathetic ganglia can be recommended as a way to prevent premature and accelerated ageing in the blood circulatory
system in people suffering from stresses, and as an additional method in complex therapy that helps reduce the medicamentous body burden in patients with marked disorders in the cerebrovascular system.

References
[1] Azin A. L. et al 2014 *Natural Sciences* **4**(49) 21–27 URL: http://nature.asu.edu.ru/?articleId=406&lang=en
[2] Carter J. R. and Ch. A. Ray 2009 *Am J Physiol Heart Circ Physiol* **296**(3) 847–53 doi: 10.1152/ajpheart.01234.2008
[3] Bobkova A. O. et al 2013 *Biomedical Radioelectronics* **4** 19–26 URL: http://www.radiotec.ru/article/12653#english
[4] Kozhanova T. V. et al 2018 *Archive of Internal Medicine* **8**(6) 407-417 doi: 10.20514/2226-6704-2018-8-6-407-417 (in Russian)
[5] Hemingway H. et al 2008 *Circulation* **117** 1526–36 doi: 10.1161/CIRCULATIONAHA.107.720953
[6] Alberts M. J. et al 2009 *Eur Heart J* **30**(19) 2318-26
[7] Kubplanov V. S. et al 2018 *Biomedical Engineering* **52**(1) 9–13 doi: 10.1007/s10527-018-9771-6
[8] Sokolova L.K. et al 2017 *Endokrynologia* **22**(2) 127–138
[9] Patil M. K. J and Patil S. M. 2017 *Natl J Physiol Pharm Pharmacol* **7**(6) 637–641 doi: 10.5455/njppp.2017.7.0205128022017
[10] Grassi G. 2009 *Hypertension* **54** 690–697 doi: 10.1161/HYPERTENSIONAHA.108.119883
[11] Raina A. et al 2017 *Clin Epigenetics* **14** 9–21 doi: 10.1186/s13148-016-0302-6
[12] Wardlaw J. M. et al 2013 *Lancet Neurol* **12**(8) 822–838 doi: 10.1016/S1474-4422(13)70124-8