Efficacy of Hemoperfusion in Myasthenia Patients Monitored by Serum Laser Correlation Spectroscopy

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Among the methods of pathogenetic treatment of myasthenia, since the 1960s various methods of extracorporeal detoxication of the blood have been extensively used, such as hemodialysis, lymphosorption, plasmapheresis, hemoperfusion, and immunosorption [1-8]. Nevertheless, experience of the use of sorption methods of treatment of patients with myasthenia, obtained in practice worldwide requires critical examination.

At present no satisfactory description exists in the literature of changes taking place in the human body associated with a positive clinical effect, or the causes of its absence. The result of this is either an unjustified widening of the indications or failure to utilize these techniques. Most frequently the main criterion for the use of methods of efferent therapy in myasthenia patients is a combination of the clinical picture of the disease and the physician's personal experience.

The aim of this investigation was to determine some of the precise mechanisms of the therapeutic action of hemoperfusion in myasthenia patients on the basis of the use of new biophysical methods of investigation of serum homeostasis and, in particular, of laser correlation spectroscopy.

Experimental Method

Hemoperfusion was a component of the combined treatment of 30 patients with myasthenia aged from 18 to 48 years, the average duration of the illness being 3.5 years. The diagnosis of myasthenia was based on the clinical symptoms, a positive pharmacological test, and the results of electrophysiological investigation. Thymectomy had been performed previously on 25 patients (83.3%). All the patients were taking anticholinesterase drugs (neostigmine, kalimin), and 22 of them were taking prednisolone (73.3%).

Hemoperfusion was conducted on the AT-196 apparatus. The absorbent was grade SKN-NS activated charcoal, from Kiev Research Institute of General and Inorganic Chemistry, and the capacity of the column was 400 ml. The type of perfusion was venovenous. The volume velocity of perfusion was 80-120 ml/min. In the course of hemoperfusion 20,000 U of heparin was injected, and neutralization with protamine sulfate was not used. In the course of one session from 5000 to 7500 ml of blood, i.e., 1-1.5 CBV, was perfused. Hemoperfusion was carried out twice in the course of 3 days. The only complications observed during hemoperfusion were transient shivering, in two persons (6.6%); no withdrawal syndrome connected with adsorption of therapeutic agents was observed.

During investigation of the blood serum by laser correlation spectroscopy (LCS) information (graphic and numerical) about the subfractional composition of molecular, supramolecular, and complex biological constituents, whose main contribution was due to various protein subfractions, immune complexes, and also (in the case of virus diseases and cancer) viruses, and RNP-
Fig. 1. Averaged character of LCS spectrum: a) in group of myasthenia patients before hemoperfusion; b) in group of myasthenia patients after two sessions of hemoperfusion. Abscissa, diameter of particles from 1 to $10^4$ (in nm); ordinate height of columns of histogram is proportional to relative contribution of particles of the given diameter to the total spectrum of scattered light.

and DNP particles, was recorded in the final form. The basic physical principles, the apparatus used, and the method of mathematical analysis of the spectra were described in a recently published monograph [9]. Blood serum for LCS investigation was prepared as follows: 5 ml of venous blood, after retraction of the clot for 20-30 min, was centrifuged at 1500-2000 rpm for 10 min at 18-20°C. Next, 50-100 μl of serum was withdrawn into a glass test tube of Eppendorf type, in a volume of 1.5 ml, and frozen at $-20^\circ$C. The samples could be kept up to 2 or 3 weeks in that form. Before measurement the sample was frozen and diluted 1:50 with sterile physiological saline, centrifuged at 5000 rpm for 15 min, after which 0.5 ml of the diluted and centrifuged sample was placed in the measuring cuvette of the spectrometer. The process of measuring the spectrum of scattered laser light took not more than 5 min. The cuvette of the spectrometer was then washed and filled as follows. By means of a specially drawn up program of regularization the integral spectrum of fluctuation of the intensities of scattered light was converted into a histogram, consisting of the distribution of particles of different sizes by their contribution to the total effects of the intensity of light scattering. Comparative evaluation of individual spectrograms was carried out by means of a specially devised classification program for computer analysis. The serum was investigated twice, before and after the end of the course of hemoperfusion.

To make an objective evaluation of the effect of hemoperfusion on the state of homeostasis of the blood serum in myasthenia patients in whom the duration of the disease differed, and in some cases with a history of thymectomy, we carried out additional tests on patients without thymectomy at different times from the beginning of the disease, and also a group of patients before the operation and at different times after thymectomy.

**EXPERIMENTAL RESULTS**

When the blood serum from myasthenia patients not subjected to thymectomy was tested at different times after the beginning of the disease, and when times from the beginning of the disease were taken as the basis of the systematizing criterion, no general principles were found in the distribution of the results after multiparametric evaluation of individual LCS spectrograms, by means of the classifying computer. Thus changes in homeostasis of components of the blood serum, discovered previously in a study of 91 patients with myasthenia and 30 healthy blood donors, were virtually independent of the duration of the disease. This result correlates in principle with the clinical data characterizing the course of myasthenia as intermittent.

Analysis of the results obtained after multiparametric assessment of individual LCS spectrograms with the aid of the classifying computer, when the systematizing criterion was based on absence or presence of thymectomy, performed at various times before this present investigation, with respect to the parameters studied these groups of patients also were found to be indistinguishable.