ELECTROENCEPHALOGRAPHIC STUDY OF EFFECT OF SAPONINS FROM Dioscorea villosa ON THE CENTRAL NERVOUS SYSTEM

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The saponins of the Caucasian plant Dioscorea villosa delay development of experimental atherosclerosis in rabbits [7-11] and give good therapeutic results in the treatment of cerebrovascular atherosclerosis in man [1, 3, 4, 12, 14]. One of us (Y. Ya. L. [2]) has shown experimentally that infusions and also the saponins of D. villosa increase permeability between the blood vessels and tissues, especially in the brain.

The object of the present investigation was to study the effect of the saponins of D. villosa on electrical activity of the brain.

EXPERIMENTAL METHOD

Experiments were carried out on 8 rabbits of both sexes weighing 3.0-4.95 kg. The brain potentials were recorded with implanted Nichrome electrodes fixed to the cranial bones with acrylic glue. The subcortical electrodes were located in relation to stereotaxic coordinates of Sawyer, Everett, and Green [15]. Potentials were recorded by the unipolar and bipolar techniques in the frontal, parietal, and occipital regions of the cortex, and also by a unipolar method from the subcortical structures in the region of the mesencephalic reticular formation, the nonspecific nuclei of the thalamus, and the lateral geniculate body. Photic stimulation of subthreshold, threshold, and superthreshold intensities and flashes whose frequency varied smoothly within the range of 1-50 Hz were used. In response to photic stimuli with a frequency of 10-12 Hz and an intensity increasing constantly from 0 to a maximum, stages in the response reaction and thresholds of excitability were noted on the EEG in conventional units from 1 to 8. The duration of each level of photic stimulation was 5-6 sec. Acoustic stimulation took the form of continuous and interrupted stimuli with a frequency of 1000 Hz and duration 8-10 sec (ZG-10 audiofrequency modulator). An activation reaction was noted in these circumstances on the EEG. The degree of the activation reaction was assessed as weak, moderate, strong, and very strong. Duration of the response in seconds after the end of stimulation was taken as the after-effect.

The EEG was recorded initially (after dark adaptation of the animals for 20 min), and also 5, 10, 30, 60, and 90 min after intravenous injection of saponins of D. villosa in a dose of 25 mg/kg.

EXPERIMENTAL RESULTS

Changes in the background activity of the EEG and evoked potentials were observed only 20-30 min after injection of the saponins. At this time the EEG showed a tendency toward conversion of the potentials into a high-frequency, low-amplitude rhythm. The frequency predominance coefficient fell appreciably. The activation response to light of threshold brightness became stronger. The range of rhythm driving by photic stimuli shifted toward the high frequency. The latent period of the activation response to acoustic stimuli was shortened somewhat, while its amplitude and duration were increased compared with the initial response.

After 40-60 min longer segments of a generalized activation response appeared on the EEG of the cortical and subcortical zones. The frequency coefficient of background activity continued to move toward high-frequency waves. Against the background of generalized desynchronization there was a small but perceptible general decrease in the amplitude characteristic of background activity in the cortex (Fig. 1).

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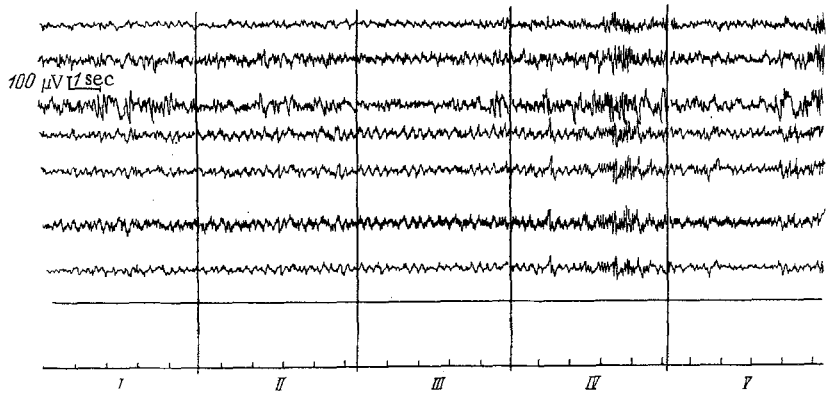

Fig. 1. Dynamics of changes in EEG of the cortex and certain subcortical structures of rabbits after injection of saponine from D. villosa in a dose of 25 mg/kg. I) Initial EEG; II-V) EEG 10, 30, 60, and 90 min after injection of saponins. EEG recorded in (from top to bottom): frontal, occipital, parietal, cortex, reticular formation (right), reticular formation (left), lateral geniculate body, and nonspecific nuclei of thalamus.

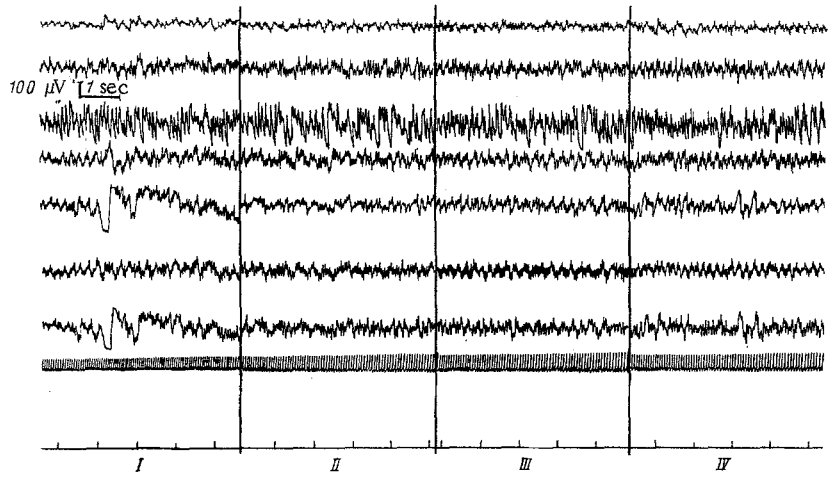

Fig. 2. Dynamics of changes in rhythm driving on EEG of a rabbit during photic stimulation with a frequency of 20 Hz. I) Initial EEG; II-IV) EEG 10, 30, and 60 min after injection of saponins. EEG recorded from same zones as in Fig. 1.

Intensification of the EEG response to photic stimulation of threshold intensity was observed although the excitability varied only very slightly from its initial level.

In response to photic stimulation at frequencies of 4, 10, and 20 Hz, a marked change in the rhythm driving toward a high frequency of stimulation was observed after 30-60 min on the EEG. In particular, rhythm driving was appreciably improved within the frequency range of 10 and 20 Hz, especially in tracings from the subcortical zones (Fig. 2).

Strengthening of the EEG activation reaction in response to acoustic stimuli and an increase in its duration were observed 15-20 min after injection of saponins. The latent period of the activation reaction in response to acoustic stimulation diminished slightly after 30-60 min; the response itself was considerably intensified and its duration and its after-effect were increased.

The effect of saponins on spontaneous electrical activity of the brain and evoked potentials was similar in type in all animals investigated.

These findings suggest that saponins from D. villosa have some degree of stimulant effect on subcortical structures, manifested by activation of the ascending activating system of the mesencephalic reticular formation.

A distinctive pattern of stabilization of the level of excitability of the neurons, despite obvious ascending activation of the cerebral cortex, is observed in the action of the saponins from D. villosa. This fact indicates that the action of these saponins differs somewhat in its character from the effect of saponins with desynchronizing action studied previously—those from Aralia mandschurica and the hawthorn [5, 6].

Consequently, the saponins of D. villosa, so far as their ability to evoke a generalized EEG activation reaction is concerned, may be classed as stimulants with desynchronizing action.

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