CONTROL OF CONDUCTION OF AFFERENT IMPULSES THROUGH THE LATERAL GENICULATE BODY BY THE SUPERIOR COLLICULUS IN CONSCIOUS RABBITS

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Information is known to reach the visual cortex [3, 5, 6, 8] along three main channels of communication: the classical – retinogeniculocortical (RGC) and transcallosal (through the corpus callosum) – and also the retinotectothalamocortical (RTTC) channel (through the superior colliculus; SC). In previous investigations [2] the writers showed that the RGC and RTTC channels have opposite relations with each other at the level of the visual cortex (VC). No significant influences of SC on evoked activity in the ipsilateral region of VC could be found in our investigations conducted on conscious rabbits, and the problem of the level of the visual pathway at which the inhibitory effects of SC are realized, whether at the level of the lateral geniculate body (LGB) or at the VC level, remained unsolved. Most workers [3, 6, 7] are of the opinion that SC has no direct inputs into the VC. On these grounds it is logical to suggest that this mesencephalic visual center may exert an influence on the conduction of impulses in the visual system at the thalamic level, mainly at the LGB level, with which it has direct two-way connections [9]. This hypothesis is confirmed by investigations [12] showing that SC has an inhibitory effect on the formation of evoked activity of the ipsilateral LGB. These investigations, devoted to discovery of the influence of SC on evoked activity of LGB, were conducted on anesthetized or immobilized animals, and this could have a considerable effect on their character, direction, and end result. Structures located ipsilaterally also were tested. The influence of SC on function of the contralateral LGB has not been investigated in conscious animals, although there is morphological evidence [9, 10] that such an influence may take place on account of connections running in the composition of the posterior commissure and crossed connections of SC with structures of the medulla. The latter, however, may also exert an indirect influence on LGB through the nonspecific thalamic nuclei [3, 15].

The aim of this investigation was to determine whether SC exerts influences on function of the contralateral LGB and, if so, to determine their character and direction; may these functional relations between SC and LGB lie at the basis of the inhibitory effect of SC, discovered previously [2], on the formation of evoked potentials (EP) of VC?

EXPERIMENTAL METHOD

Experiments were carried out on 5 normal conscious rabbits under chronic conditions. To record EP of the test structures and also to stimulate SC, nichrome wire electrodes 0.25 mm in diameter, with factory insulation, were implanted chronically in accordance with coordinates from a stereotaxic atlas [14]. EP were recorded by means of a UBP2-03 amplifier and S1-69 cathode-ray oscilloscope. Photic stimulation was applied by means of a "Medicor" photostimulator (Hungary). A single flash with an energy of 1.4J was used. A focus of stationary excitation was created in SC by the anodal polarization method (20 μA, 1 min). The results were subjected to statistical analysis by the Student–Fisher method ($p < 0.05$).

EXPERIMENTAL RESULTS

The experiments showed that anodal polarization of SC leads to a very significant increase (up to 167 ± 15% of the initial level) in the amplitude parameters of its response to flashes (Figs. 1a and 2), evidence of the formation of an active focus of stationary

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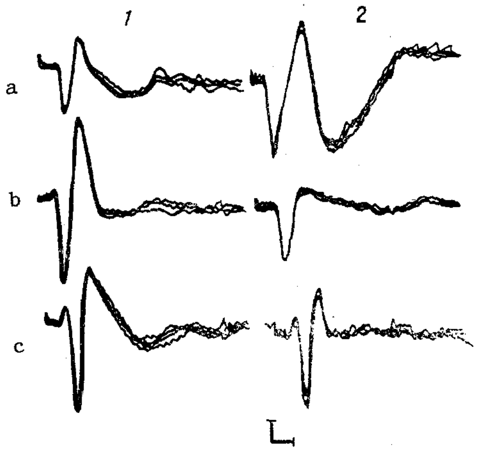

Fig. 1. Effect of anodal polarization of SC on evoked responses of SC itself, and also of the contralateral and ipsilateral LGB, to photic stimuli. 1) Before, 2) during anodal polarization of SC. a) Response of right SC to flash; b) response of contralateral (relative to focus in SC) LGB to flash; c) response of ipsilateral (relative to focus in SC) LGB. Calibration: 50 μV, 20 msec.

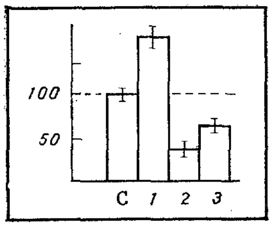

Fig. 2. Histogram of changes in formation of responses of SC (1) and also of LGB contralateral (2) and ipsilateral (3) to it. Ordinate, amplitude of evoked responses (in percent of control); C) control.

excitation in that structure. Against the background of the formation of this focus, marked depression (by 60 ± 7% of the initial level) of the amplitude parameters of the visual response of the contralateral LGB was observed (Fig. 1b, 2; Fig. 2). The amplitude of the negative phase of the visual EP of LGB decreased by a much greater degree under these circumstances than that of the positive phase – by 78 ± 7 and 34 ± 7% of the initial level, respectively.

Meanwhile the amplitude parameters of the response to light in the LGB ipsilateral relative to the focus of excitation in SC also were depressed (Fig. 1c, 2; Fig. 2). However, this depression was much more marked than in the case of the contralateral LGB, and amounted to 87 ± 9 and 80 ± 7% of the initial level, respectively, for the positive and negative components (Fig. 2).

Reduction of the amplitude parameters of the visual EP of LGB against the background of excitation of the contralateral SC is evidence of an inhibitory influence of SC on the relay function of the contralateral LGB. The problem of the ways in which this influence is realized is not yet quite clear. We now know [9] that SC forms close connections with the ipsilateral LGB, and that the latter communicates with LGB of the opposite half of the brain through connections running in the posterior commissure [10]. It can be tentatively suggested that the influence of SC on function of the contralateral LGB is effected via this channel of communication. However, electrophysiological investigations of relations between the left and right LGB showed that these thalamic structures in the two halves of the brain have reciprocal relations [11]. Meanwhile our own data and data in the literature [12] are evidence of the unidirectional (although differing in strength) inhibitory

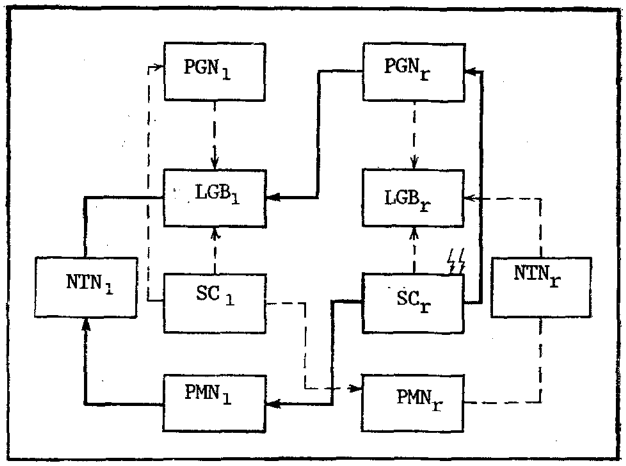

Fig. 3. Diagram showing possible functional connections of SC with contralateral LGB, realizing inhibitory effect of their stimulation on LGB function. PGN) Perigeniculate nucleus; NTS) nonspecific thalamic nuclei; PMN) paramedian nucleus; r) right, l) left. Continuous lines indicate connections of SC with contralateral LGB, broken lines – with ipsilateral LGB. Arrows indicate presence of a focus of excitation in SC.

influence of SC on both the ipsilateral and the contralateral LGB. Consequently, the channels of communication SC–ipsilateral LGB–contralateral LGB cannot be used to transmit the inhibitory influence of SC on function of the contralateral LGB.

Morphological investigations [9] have shown that SC sends direct fibers to contralateral structures of the medulla, including the paramedian nucleus which, through its connections with LGB through the nonspecific thalamic nuclei, may have a definite influence on its functional state [3, 15]. Consequently, one channel of communication of SC with the contralateral LGB may be a channel mediated through the structures described above (Fig. 3). The second possible channel of communication of SC with the contralateral LGB (Fig. 3) may be a connection through the perigeniculate nucleus, which received direct inputs of the ipsilateral SC and has an inhibitory influence on both ipsilateral and contralateral LGB [4, 7, 16]. The possibility cannot be ruled out that inhibitory influences of SC on the contralateral LGB may be effected simultaneously along two channels of communication. In the last case, the stronger influence of SC on function of the contralateral than of the ipsilateral LGB can evidently be explained by this circumstance.

The inhibitory influence of SC on conduction of afferent impulsation in the system of the RGC channel of communication of the visual analyzer is thus exerted at the thalamic level, or specifically at the level of LGB. The functional significance of this phenomenon may probably be that it lies at the basis of the known [1, 13] effect of saccadic inhibition of EP of the central visual structures, which, it has been suggested [1, 13], is connected with the process of identification of visual patterns at higher levels of the brain.

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CONSUMPTION OF WATER AND SODIUM CHLORIDE SOLUTION BY RATS AFTER CENTRAL INJECTION OF LITORIN AND AFTER IMMUNIZATION WITH LITORIN–BOVINE SERUM ALBUMIN CONJUGATE

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Central and peripheral administration of the regulatory peptides (RP) bombesin and litorin inhibit the feeding and drinking behavior of animals [4-7]. However, the effects observed after administration of exogenous bioregulators are not always identical with their physiological functions. It is important to assess not only the consequences of an increase in their concentration in the body, but also the manifestation of their deficiency. A promising method in this respect is active immunization of animals with peptides conjugated with high-molecular-weight carrier antigens [1, 2].

The aim of this investigation was to study the pattern of consumption of water and sodium chloride solution by rats after a single intracerebral injection of litorin and after long-term immunization of animals with a conjugate of litorin and bovine serum albumin (BSA), in order to elucidate the role of the bombesin-like factor in the "salt appetite" phenomenon in rats.

EXPERIMENTAL METHOD

Before the experiments the physiological activity of litorin was tested on a separate group of rats for the characteristic hypothermic effect of this RP. The animals were kept in a Kogan chamber and were given an intraperitoneal injection of physiological saline or of litorin in a dose of 10 μg/kg body weight. The rectal temperature was measured by means of a TPM-1 electric thermometer. The air temperature was 18°C. The rectal temperature of animals receiving an injection of litorin was significantly reduced: on average by 1°C. Behavioral tests were carried out on 46 noninbred male rats weighing 250-300 g. Those animals which subsequently received an intracerebral injection of litorin or physiological

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