GENERAL PATHOLOGY AND PATHOLOGICAL PHYSIOLOGY

Effect of Thyrotropin-Releasing Hormone on the Development of Cardiac Arrhythmias during Stimulation of Sensorimotor Cortex in Cats

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Preliminary intravenous injection of thyrotropin-releasing hormone in a dose of 20 μg/kg to cats with developing myocardial ischemia during stimulation of the cerebrocortical sensorimotor zone had a pronounced antiarrhythmic effect.

Key Words: *thyrotropin releasing hormone; sensorimotor cortex; acute myocardial ischemia; cardiac arrhythmias*

We previously showed that during the development of acute myocardial ischemia thyrotropin-releasing hormone (TRH) stabilized blood pressure (BP) and reduced the incidence of severe cardiac arrhythmias, including ventricular fibrillation [9]. Cardiac arrhythmias often result from stress and changes in the functional state of CNS [3,5,7]. Moreover, it was shown that electric stimulation of some brain structures, for instance the sensorimotor cortex (SMC) also led to the development of cardiac arrhythmia [1,11,14].

We investigated the effect of TRH on the development of cardiac rhythm disturbances in acute myocardial ischemia during stimulation of the hemispheric SMC.

MATERIALS AND METHODS

Thirty-three experiments were carried out on adult male and female cats (2-4 kg). The animals were narcotized with Nembutal (40 mg/kg intraperitoneally) and artificially ventilated with a Vita-1 device. ECG was recorded in standard lead II and BP in the femoral artery was recorded directly using an EMT-34 electromanometer (Elema). The data were recorded on a Biokomb-8 polyphysiographer (Medikor).

The thorax was opened, the heart was exposed, and the coronary artery was prepared. Myocardial ischemia was modeled by ligation of the circumflex branch of the left coronary artery with a regulated loop for ~15 min, after which the bloodflow was resumed. For electric stimulation of the cerebral cortex, craniotomy was carried out, the dura mater was opened, and the sigmoid groove was exposed. Monopolar silver electrodes (0.8 mm tip) were used. The indifferent electrode was fixed to the frontal sinus bone. SMC was stimulated for 20 sec (10 sec before and 10 sec after coronary occlusion) with rectangular 1-msec pulses at 30 Hz frequency. The intensity of stimulation was 2.5-6.5 mA. The stimulating current was estimated by voltage drop on a known resistance connected to the electric circuit by means of a C1-48B oscillograph.

Experimental cats (n=13) were injected with TRH (Bokiron Firm) in a dose of 20 μg/kg intravenously 15 min before coronary occlusion.

The results were statistically processed using Student's t test.

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TABLE 1. BP (mm Hg) during Coronary Artery Occlusion against the Background of SMC Stimulation in Cats (*M*±*m*)

Time	Control (*n*=22)		TRH (*n*=13)	
	systolic	diastolic	systolic	diastolic
Initial	139.0±4.7	90.6±4.2	137.2±10.8	108.9±9.9
Start of SMC stimulation	—	—	147.2±9.1	118.3±6.6
30th sec of occlusion	123.1±4.8*	75.3±3.6*	132.2±10.9	106.1±8.9
15th min of occlusion	—	—	122.2±18.6	96.1±16.7

Note. *p<0.05 compared to the initial level.

RESULTS

Direct stimulation of SMC did not induce cardiac arrhythmia. In the control a 20% decrease of BP was observed after 30-sec occlusion of the coronary artery in almost all (90%) cases (Table 1). Myocardial ischemia against the background of SMC stimulation was complicated by cardiac rhythm disorders in 100% cases (Fig. 1). Ventricular fibrillation developed in 60% cases, in more than 50% cases it appeared during myocardial ischemia (1-15 min after coronary artery occlusion).

Hence, during SMC stimulation the course of acute myocardial ischemia is paralleled by severe arrhythmia, including ventricular fibrillation.

After injection of TRH changes in BP were negligible (Table 1). Occlusion of the coronary artery against the background of SMC stimulation led to the development of severe cardiac rhythm disorders in only 61.54% experiments (Fig. 1); ventricular fibrillation developed in only 15.4% experiments (p<0.05 compared to the control) and only after resumption of bloodflow.

Thus, TRH stabilized BP and reduced the incidence of severe cardiac arrhythmias in acute myocardial ischemia, including ventricular fibrillation, paralleled by stimulation of SMC. We know that TRH stimulates the CNS structures, including the respiratory center of the medulla oblongata, by increasing the depth of respiration [2,4,6, 10,12,13]. On the other hand, myocardial ischemia not complicated by ventricular fibrillation is characterized by increased respiration depth, which plays the compensatory role under these conditions [8]. Presumably, TRH in acute myocardial ischemia triggers the compensatory mechanisms of the circulatory system (stabilization of BP) and respiratory system (increased depth of respiration), which essentially decreases the incidence of cardiac arrhythmias even under conditions of SMC stimulation.

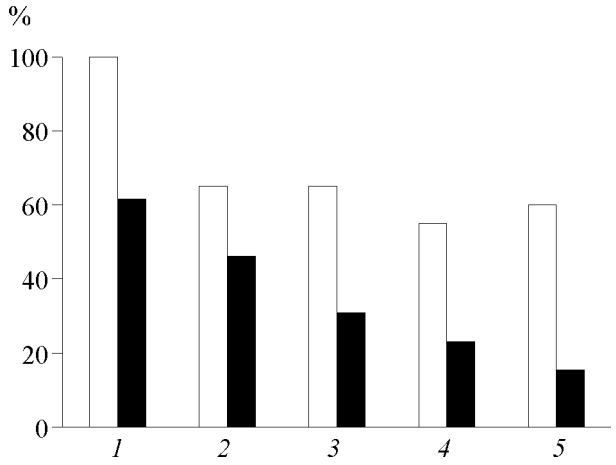

Fig. 1. Effect of thyrotropin-releasing hormone on the development of cardiac arrhythmia during stimulation of the sensorimotor cortex in animals with experimental myocardial ischemia. *1*) all cardiac rhythm disorders; *2*) single extrasystoles; *3*) group extrasystoles; *4*) ventricular tachycardia; *5*) ventricular fibrillation. Light bars: control; dark bars: injection of thyrotropin releasing hormone. All p<0.05 compared to the control.

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