

EFFECT OF PITUITRIN ON THE INTENSITY OF BILE FORMATION AND ON THE MEMBRANE POTENTIAL OF THE LIVER CELLS

M. S. Yaremenko and A. P. Lyapidevskii

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Intravenous injection of pituitrin into rats causes a decrease in the membrane potential of the hepatocytes and in the intensity of bile secretion. Depression of the secretion of neurohypophyseal hormones by loading animals with a water-ethanol mixture is accompanied by an increase in the level of bile secretion and in the membrane potential of the cells. A direct correlation exists between these values.

Investigations [1, 2, 4] have shown that neurohypophyseal extract (pituitrin) has a marked effect on the intensity of bile formation. The mechanism of this action of pituitrin is not yet clear. In particular, the place where the hormone acts has not yet been identified: it is not known whether it affects the bile-secreting function of the parenchymatous cells of the liver, which participate in the formation of primary bile, or whether it acts on the exchange of water and electrolytes taking place in the system of the bile ducts.

The reaction of the liver cells to pituitrin was studied in this investigation by measuring their membrane potential (MP) and the rate of secretion of bile before and after administration of pituitrin to the rats.

EXPERIMENTAL METHOD

Experiments were carried out on 36 female albino rats weighing about 200 g and anesthetized with pentobarbital. The liver was exposed through an abdominal incision along the linea alba, the common bile duct was incised nearer to the duodenum, and a thin polyethylene catheter was fixed into it to collect the bile. The secretion was collected by micropipets every 1, 2, or 5 min. Respiratory movements of the liver were almost completely abolished by fixing the organ with transparent plastic slabs which surrounded the organ on the side of the diaphragm and portal vein. Glass microelectrodes filled with 3.5-M KCl solution, with a resistance of 20-35 M Ω , were used to measure MP. The recording instrument was a vector-electrocardioscope (VÉKS-01M) with cathode follower at the input. When the tip of the microelectrode entered a cell an instantaneous deflection (jump) of the oscilloscope beam from the zero line was observed. The microelectrode was inserted for only 1-2 mm into the liver tissue to prevent the possibility of its entry into the epithelium lining the walls of the bile ducts. MP was recorded from the surface layer of parenchymatous cells. At the beginning of the experiment the rate of bile secretion and the magnitude of MP of several cells were determined, after which the animal was given an intravenous injection of 0.1 ml isotonic sodium chloride solution containing pituitrin-P in a dose of 0.1 unit/100 g body weight. In another series of experiments, 1 h before the experiment the animal received 3 ml, and 30 min later another 3 ml/100 g body weight of 12% ethanol solution, which blocks neurohypophyseal secretion, through a gastric tube.

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TABLE 1. Effect of Pituitrin on Rate of Bile Secretion and on MP of Liver Cells after Administration of a Water-Ethanol Mixture ($M \pm m$)

Index studied	n	Initial level	After injection of pituitrin							
			n	30 min	n	60 min	n	90 min	n	120 min
Rate of secretion (in $\mu\text{l} \cdot \text{g}^{-1} \cdot \text{min}^{-1}$)	11	$1,46 \pm 0,03$	6	$1,13 \pm 0,10$ $<0,01$	12	$1,29 \pm 0,05$ $<0,01$	8	$1,32 \pm 0,03$ $<0,01$	3	$1,51 \pm 0,04$ $>0,5$
MP (in mV)	47	$47,8 \pm 0,8$	40	$35,0 \pm 0,8$ $<0,001$	48	$43,1 \pm 1,1$ $<0,001$	54	$43,9 \pm 0,8$ $<0,001$	28	$45,1 \pm 1,2$ $<0,1$

EXPERIMENTAL RESULTS

The results of the control measurements showed that MP of the superficial parenchymatous cells of the liver in rats anesthetized with pentobarbital has a mean value of 35.8 ± 1.2 mV, in agreement with data in the literature [3].

Injection of pituitrin into the animals caused a decrease in MP of the liver cells and in the rate of bile secretion during the next 5 min. The maximal decrease in these indices took place within the 30 min following the injection of pituitrin. For instance, the rate of bile secretion at this period fell from 1.30 ± 0.07 (initial level) to $0.85 \pm 0.17 \mu\text{l} \cdot \text{g}^{-1} \cdot \text{min}^{-1}$ ($P < 0.05$), while MP fell correspondingly from 35.8 ± 1.2 to 31.9 ± 0.9 mV ($P < 0.02$). These indices were restored to their initial level during the next hour.

Administration of the water-ethanol mixture to the animals increased the cell MP to 47.8 ± 0.8 mV and the rate of bile secretion to $1.46 \pm 0.03 \mu\text{l} \cdot \text{g}^{-1} \cdot \text{min}^{-1}$. Injection of pituitrin into animals after administration of the water-ethanol mixture distinctly lowered both the cell MP and the rate of bile secretion (Table 1).

The results of these investigations show that as the intensity of bile secretion rises and falls, the MP of the hepatocytes undergoes parallel changes. A significantly high degree of correlation was found between these values ($r = 0.78$; $P < 0.001$).

LITERATURE CITED

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