10. Intrahepatic Cholestasis, New York (1975).
11. H. Jaeschke, E. Trummer, and H. Krell, Gastroenterology, **93**, 533 (1987).
12. F. Kern, W. Erfling, F. R. Simon, and R. Dahl, Gastroenterology, **75**, 512 (1978).
13. F. G. Long, Brit. Med. J., **280**, 225 (1980).
14. H. Reyes, M. E. Radrigan, M. C. Gonzales, et al., Gastroenterology, **93**, 584 (1987).
15. A. T. Schreiber and F. K. Simon, Hepatology, **3**, 607 (1983).
16. A. Stiehl, Clin. Gastroent., **6**, 45 (1977).
17. M. Vore, Gastroenterology, **93**, 643 (1987).

EFFECT OF NAPHTHENE HYDROCARBONS OF NAPHTHALAN ON CAPILLARY PERMEABILITY

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KEY WORDS: naphthalan, naphthene hydrocarbons, vascular permeability, radioactive phosphorus, rate of resorption.

The study of the effect of certain components of naphthalan (NPH) on physiological functions has shown that they possess high biological activity [1, 5, 8]. To characterize the therapeutic action of factors of NPH, it is essential to study their effect on the state of the capillary and vascular permeability.

Investigations have shown that NPH and some of its components have a definite effect on the permeability of animal tissues and cells [6]. There is evidence that under the influence of cyclopentane–perhydrophenanthrene (CPPP) naphthene hydrocarbons the permeability of erythrocyte membranes and of the blood-brain barrier for various substances is increased [7, 9].

Considering that changes in vascular and capillary permeability may lie at the basis of many physiological and pathological processes, we studied the state of two-way capillary permeability in animals under the influence of a course of injections of CPPP naphthene hydrocarbons, which are among the active principles of NPH [1, 2, 8].

EXPERIMENTAL METHOD

Experiments were carried out on rats. The radioactive isotope of phosphorus was used as indicator. CPPP naphthene hydrocarbons, dissolved in vegetable oil, were injected intramuscularly in a dose of 150 mg/kg daily for 10 days. Control animals received corresponding injections of vegetable oil.

Vascular permeability was investigated in the blood–tissue system by determining the dynamics of outflow of an intravenously injected solution of $Na_2H^{32}PO_4$ (5 μCi) from the bloodstream. Blood samples (0.05 ml each) were taken from the caudal vein after 1, 5, 15, 30, 45, 60, and 120 min. The radioactivity of the dried blood samples was determined on PP-8 and DP-100 instruments with a T-25-BFL end-window counter, with thin mica window in lead housing. The investigations were carried out 1 and 10 days after the end of a course (10-12 days) of injections of the preparation.

Capillary permeability in the direction from tissue to blood (^{32}P clearance) was determined in 24 rats by measuring the rate of 50% resorption of the intravenously injected isotope (0.1 ml). Radioactivity above the site of injection of the isotope was counted every minute for 8-14 min by means of an end-window β-shunt with an MST-17 counter on a B-2 apparatus. The half-elimination time of the isotope from the skin depot ($T_{1/2}$) was determined and the velocity constant of resorption calculated by

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the formula $\lambda = 0.693 \times T_{1/2}$. The investigations were repeated at intervals: after a 10-day course of injections of the preparation and 10 days after the end of the course.

EXPERIMENTAL RESULTS

The study of capillary permeability for ^{32}P in the blood–tissue direction in the control animals showed that after 5 min the radioactivity of the blood was reduced on average to 63.7% (±2%) of the initial value, determined 1 min after injection. The radioactivity of the blood after 15 min fell to 40.3% (±1.6%), and after 1 h to 18.6% (±1.8%) of the initial level, and after 2 h to 15.8%. The half-elimination time from the blood averaged 11 min. The study of the effect of CPPP naphthene hydrocarbons on vascular permeability showed that at the end of the 10-day course of injections the outflow of ^{32}P from the vascular bed into the tissues was increased at all times of the investigation; significant differences were observed 5-30 min after injection of the isotope.

Similar changes, but less pronounced than at the end of the course of injections of the preparations, were observed 10 days after the end of the course. Statistical differences in this case were significant only in the early period (the first 5 min) after injection of the isotope.

In experiments on rats we studied the rate of resorption of intradermally injected indicator under the influence of the test preparation. It was found that in the initial experiments the half-elimination time $T_{1/2}$ of ^{32}P from the skin varied between 6 and 12 min, with a mean value of 8.51 min. The velocity constant of resorption was 0.080.

In experiments in which CPPP naphthene hydrocarbons were injected, it was found at the end of a 10-day course of the preparation that the ^{32}P clearance from the skin was accelerated by comparison with the initial experiments: $T_{1/2}$ was reduced from 9.8 to 7.4 min. The velocity constant of resorption was 0.093. The velocity of resorption of the isotope 10 days after the end of a course of injections of the preparation did not differ significantly from the initial values: $T_{1/2} = 9.37$, $\lambda = 0.0739$.

The results of these experiments thus show that after a course of treatment with CPPP naphthene hydrocarbons the capillary blood flow is accelerated and capillary permeability for ^{32}P increased in the tissue–blood direction. The changes observed are reversible and were not observed 10 days after the end of a course of injections of the preparation. Meanwhile the test preparation has a significant effect on vascular permeability in the blood–tissue direction. After a course of injections of CPPP naphthene hydrocarbons the outflow of ^{32}P from the vascular bed is accelerated, and these changes become much less marked after 10 days.

The results are evidence that CPPP naphthene hydrocarbons have a marked influence on two-way vascular permeability, and this may be to some extent responsible for their biological action, observed under clinical conditions.

On the basis of data in the literature [4, 5, 10, 11] and also of our own data [3] it can be postulated that an essential role in the mechanism of the increased permeability of the vascular membranes under the influence of CPPP naphthene hydrocarbons is played by changes in the state of metabolic processes during the course of treatment.

It can be tentatively suggested that this preparation, under appropriate conditions, by inducing biosynthesis of steroid hormones, specifically progesterone [1], increases the Ca^{2+} concentration in the cells [3], and stimulates *c*AMP synthesis, thus facilitating changes in permeability of vascular membranes. Membrane effects of steroid hormones (interaction with adenylate cyclase system and regulation of the active transport of ions) have been reported in the literature [12].

Our own data can provide an objective basis for the use of NPH and its preparations to stimulate the nonspecific defensive reactions of the body, and this is evidently an important aspect of the therapeutic action of this natural healing factor.

LITERATURE CITED

1. T. D. Gaibov, Uch. Zap. MV SSO Azerb. SSR, Ser. Biol., No. 4, 79 (1968).
2. T. D. Gaibov, Uch. Zap. MV SSO Azerb. SSR, Ser. Biol., No. 2, 68 (1972).
3. T. D. Gaibov, G. A. Guseinov, and I. A. Omarov, Uch. Zap. MV SSO Azerb. SSR, Ser. Biol., No. 2, 71 (1972).
4. R. N. Glebov and G. N. Kryzhanovskii, Vest. Akad. Med. Nauk SSSR, No. 3, 63 (1983).
5. S. A. Gulieva, S. I. Samedov, T. G. Guseinov, et al., Current Problems in Pathology and Physiology [in Russian], Erevan (1985), pp. 77-78.
6. S. M. Gusman, S. A. Gulieva, and V. A. Zhukov, Proceedings of a Scientific Conference on the Problem of Naphthalan [in Russian], Baku (1968), p. 82.
7. M. Ya. Maizelis, R. I. Kruglikov, T. D. Gaibov, et al., Vopr. Kurortol., No. 2, 61 (1980).

8. A. N. Muradov, "Investigations of the chemical composition of therapeutic naphthalan naphtha," Author's Abstract of Dissertation for the Degree of Candidate of Chemical Sciences, Baku (1979).
9. I. A. Omarov, Uch. Zap. MV SSO Azerb. SSR, Ser. Biol., No. 1, 55 (1977).
10. S. I. Samedov, Naphthalan Treatment of Some Diseases of the Joints, Skin, and Peripheral Nervous System [in Russian], Baku (1987), pp. 53-63.
11. S. E. Severin, B. O. Glotov, S. M. Dudkin, et al., Mol. Biol., No. 1, 248 (1985).
12. P. V. Sergeev, R. D. Seifulla, and A. I. Maiskii, Steroids and Biological Membranes [in Russian], Moscow (1973), pp. 94-117.

EFFECT OF ARTERIAL BLOOD LOSS ON MYOELECTRICAL ACTIVITY OF THE PYLORIC SPHINCTER AND DUODENUM

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KEY WORDS: blood loss; pyloric sphincter; duodenum.

Blood loss is a stress factor which may lead to gastric and duodenal ulcer formation [3, 9, 13-15]. Arterial blood loss leads to considerable release of catecholamines [8, 9, 15], which predominantly inhibit the motor function of the gastrointestinal tract [1, 2, 5, 7, 12] and take part in ulcer formation [4, 6, 13]. Meanwhile the effect of this stress factor on motor function of the pyloroduodenal zone (which is most vulnerable to ulcer formation) has not been fully explained. The aim of this investigation was to study changes in electrical activity of smooth muscles of the pyloric sphincter and duodenum under the influence of arterial blood loss.

EXPERIMENTAL METHOD

Chronic experiments were carried out on six male rabbits weighing 2.6-3.2 kg. Two weeks before the experiment silver loop electrodes were implanted into the smooth muscles under the serous membrane of the pyloric sphincter and duodenum, by a method described previously [10, 11]. Electrical activity of the smooth muscles of the pyloroduodenal zone was recorded on an encephalograph at a speed of 7.5 mm/sec, with time constant of 0.3 sec. The rabbits received the normal diet (vegetables, oats, hay) and were used in the experiments without any preliminary limitation of food intake. One week before the experiments the right common carotid artery was exteriorized in the neck into a skin bridge 2-3 cm long. Blood loss was produced by puncture of this vessel in animals immobilized in the supine position by the method in [3]. The blood loss amounted to about 5, 10, and 25% of the total blood volume, and it lasted not more than 2 min. Electrical potentials of the smooth muscles of the sphincter and duodenum were recorded for 1 h before blood loss, during blood loss, and for 1 h thereafter. The frequency of bursts of action potentials of smooth muscles of the pyloric sphincter and duodenum was analyzed before and after blood loss, and the pulse rate (as an indicator of activation of the adrenergic system) was recorded on the electrocardiogram. The statistical significance of differences of the means was estimated by Student's test with a level of significance of 95%.

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