TREATMENT OF BLOOD TRANSFUSIONAL SHOCK SUPERIMPOSED ON THE ACTION OF NEUROPLEGIC DRUGS

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(Presented by Active Member AMN SSSR A. V. Lebedinskii)
Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 54, No. 11, pp. 42-46, November, 1962
Original article submitted March 25, 1961

According to reports in the literature, shock is accompanied by hemodynamic disorders [4, 5, 10, 13], disturbances of metabolism [2, 11], and changes in the permeability of the vessels [1]. Considerable importance is attached to neuroplegic and ganglion-blocking drugs in the prevention of shock [9, 12]. However, despite the successful use of these drugs in various operations, many cases have been reported [3] in which they were ineffective. In research conducted jointly with A. M. Fedoruchok [14], we observed no protective action of neuroplegic drugs when given to dogs with peptone shock.

According to N. P. Kravkov [8], if the secretion of the suprascapular cutaneous glands of toads is injected into animals it causes constriction of the peripheral vessels, an increase in the strength of the cardiac contractions, a rise of blood pressure, and changes in respiration. V. I. Zakharov and I. P. Krichevskaya [7] showed that toad venom decreases the permeability of the vessels, and also [6] prevents and alleviates peptone shock.

The object of the present research was to study the effect of neuroplegics on the course and outcome of blood transfusional shock, and also to investigate the action of the secretion of the suprascapular cutaneous glands of the toad in conjunction with artificial hibernation, and to compare it with that of adrenalin.

EXPERIMENTAL METHOD

Experiments were conducted on 24 sexually mature dogs weighing from 5 to 8 kg; they consisted of three series, the first two on 5 dogs each, and the third on 14 dogs. Before the acute experiment the dogs were kept for 3 days in identical conditions and on the same diet. To produce shock, fresh, citrated rabbits' blood was given in a dose of 5 ml/kg body weight. The criteria of shock were the level of the blood pressure and the character of the respiration. The blood pressure was recorded in the femoral artery by means of a mercury manometer, and the respiration through a cuff applied to the chest and connected with a pneumographic capsule. After tracings had been made of the initial blood pressure and respiration, fresh citrated rabbits' blood was injected into the femoral vein of the animals of the first and second series, and in the case of the animals of the first series, this was followed by an injection of the secretion of the suprascapular cutaneous glands of the toad. One hour before the experiment, a weighed sample of the dry substance was taken, dissolved in physiological saline to a concentration of 1 : 1000, and injected intravenously in a dose of 0.001 g of dry substance per 1 kg body weight. The animals of the second group received adrenalin intravenously in a dilution of 1 : 1000 and in a dose of 0.2 ml/kg body weight.

After a tracing of the initial blood pressure and respiration had been made, the dogs of the third series received an intravenous injection of neuroplegic drugs over a period of 12-15 min. For this purpose the femoral vein was connected to a system from which a mixture of the following composition was introduced into the blood stream under slight pressure: chlorpromazine 2.5%—2 ml, promethazine hydrochloride 2%—2 ml, promedol 2%—1 ml, vitamin b_1 1%—1 ml, and physiological saline 200 ml. Between 5 and 6 min after the beginning of administration of this mixture the animals fell asleep. Respiration became deep and regular, and the blood pressure fell slightly. When all the mixture had been transferred from the system to the blood stream and the blood pressure had been stabilized at a lower level than originally, fresh citrated rabbits' blood was injected into the femoral vein in a dose of 5 ml/kg body weight, followed by secretion of the cutaneous glands of the toad (1 : 1000 in a dose of 0.001 g/kg body weight of dry substance) and adrenalin (1 : 1000 in a dose of 0.2 ml/kg body weight). The results obtained in this way are given in Table 1.

TABLE 1. Changes in the Blood Pressure in Shock after Administration of Secretion of the Cutaneous Glands of the Toad and Adrenalin (mean figures)

Series of experiments	Statistical criterion	No. of animals	Blood pressure (in mm Hg)							
			initial		after injection of rabbit's blood		after injection of secretion of cutaneous glands of toad		after injection of adrenalin	
			maximal	minimal	maximal	minimal	maximal	minimal	maximal	minimal
First	M m± P	5	146 4.0	132 5.4	24 4.4 <0.001	19 3.7 <0.001	94 7.1 <0.001	90 6.6 <0.001		
Mean difference					−122	−113	−52	−42		
Second	M m± P	5	182 2.1	158 4.1	39 4.4 <0.001	37 4.0 <0.001			202 2.0 <0.001	182 8.0 < 0.02
Mean difference					−143	−121			+120	+24

TABLE 2. Changes in the Blood Pressure after Administration of Toad Venom and Adrenalin in Blood Transfusional Shock Superimposed on the Action of Ganglion-Blocking Drugs

No. of animals	Statistical criterion	Blood pressure (in mm Hg)									
		initial		after administration of neuroplegics		after injection of rabbit's blood		after injection of secretion of cutaneous glands of toad		after injection of adrenalin	
		maximal	minimal	maximal	minimal	maximal	minimal	maximal	minimal	maximal	minimal
14	M m± P	163 4.5	125 4.5	133 4.4 <0.001	127 5.3 <0.5	24 4.2 <0.001	22 2.6 <0.001	115 8.5 <0.001	101 9.6 <0.05	187 3.0 <0.02	184 3.2 <0.001
Mean difference				−30	+2.0	−139	−103	−48	−24	+24	+59

It will be clear from Table 2 that the intravenous injection of neuroplegics into the dog in the third series of experiments led to a lowering of the maximal blood pressure on the average by 30 mm Hg, and the minimal pressure rose by 2 mm above the initial level. The pulse pressure fell by 26 mm. These changes developed on the average 229 sec after the beginning of the action of the neuroplegic drugs. The intravenous injection of heterogenous blood against this background was accompanied by a well marked hypotension, developing on the average 88 sec after the beginning of the injection. The maximal blood pressure fell to 24 mm (difference from initial – 139 mm, sevenfold), and the minimal to 22 mm (difference 103 mm, i.e., fivefold). The pulse pressure fell by 36 mm. These changes are shown more clearly in Fig. 2.

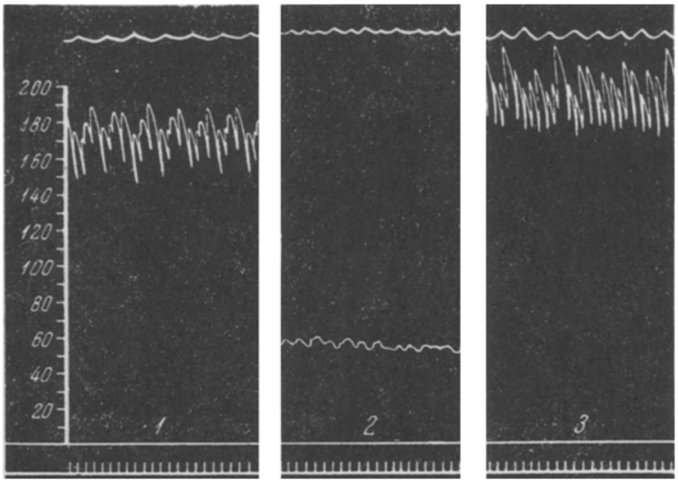

Fig. 1. Changes in reflex activity after administration of toad venom and adrenalin during blood transfusional shock. Significance of the curves (from above, down): Respiration, blood pressure, zero line, time marker (1 sec). 1) Initial blood pressure; 2) after injection of blood; 3) after injection of adrenalin.

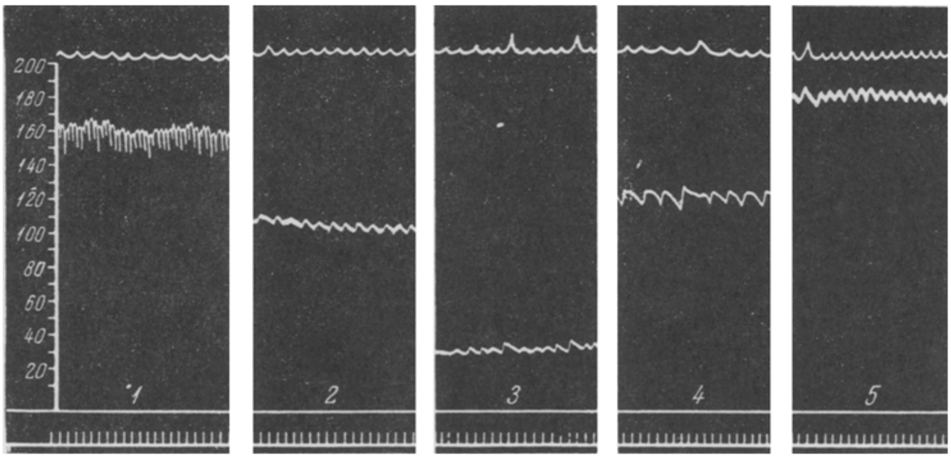

Fig. 2. Changes in reflex activity after administration of toad venom and adrenalin during blood transfusional shock superimposed on the action of ganglion-blocking drugs. Significance of the curves (from above, down): respiration, blood pressure, zero line, time marker (1 sec). 1) Initial blood pressure; 2) after injection of ganglion-blocking drugs, 3) after injection of blood, 4) after injection of toad venom, 5) after injection of adrenalin.

Hence, the preliminary injection of neuroplegics did not prevent the development of shock as a reaction to heterogenous blood, usually associated with hemodynamic disturbances. According to V. V. Bakanskaya, the hypotension should be regarded as severe if the fall in blood pressure amounts to two-thirds of its initial value. In our experiments the decrease was greater than this.

When a state of shock had developed 2-3 min after administration of the blood, the toad venom was injected. Thereupon the maximal blood pressure rose to an average level of 115 mm (difference from initial 48 mm) and the minimal to 101 mm (24 mm). Respiration became slower and its amplitude was increased periodically.

Laboratory experiments on isolated organs [8] have shown that toad venom causes spasm of the vessels. This suggests that in its mode of action, toad venom resembles adrenalin.

Bearing in mind that both adrenalin and toad venom increase the blood pressure in blood transfusional shock, and also their identical action on the blood vessels, we subsequently attempted to discover whether adrenalin was still effective after administration of toad venom, and thereby to elucidate the mechanism of action of the latter substance on the blood vessels. For this purpose, having raised the blood pressure by giving an intravenous injection of toad venom, we injected adrenalin intravenously in a dilution of 1 : 1000 and a dose of 0.2 ml/kg body weight.

The maximal blood pressure 116 sec after the injection of adrenalin (see Table 2) rose to an average level of 187 mm, i.e., 72 mm higher than its level due to the action of toad venom. The minimal blood pressure rose to 184 mm, i.e., 35 mm above that due to the action of toad venom. The respiration rate rose slightly.

Hence, toad venom is a highly active substance, capable of overcoming the hypotension accompanying shock, yet inferior in its action in this respect to adrenalin.

SUMMARY

Experiments were made on 24 dogs. Fresh citrate rabbit blood given in a dose of 5 ml/kg of body weight was used as a shock-producing factor. Blood pressure level and the character of respiration served as shock indices. The initial maximal blood pressure averaged 146 mm Hg, the minimal one 132 mm Hg. Intravenous administration of rabbit blood against the background of preliminary action of ganglioblockers led to development of hemotransfusional shock with a marked drop of the maximal and minimal blood pressure. The animals recovered from shock hypotension following the intravenous injection of toad toxin and adrenalin. As established, ganglioblocking preparations, given in the combination and dosage prescribed, did not protect the organism from hemotransfusional shock. Administration of the toad-skin gland secretion against the background of the ganglioblocking preparations action led to recovery from the hemotransfusional shock by increasing the blood pressure. The efficacy of adrenalin action on the blood pressure is greater than that of the toad toxin.

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