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ACTION OF NALOXONE IN TRAUMATIC SHOCK

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According to recent reports naloxone, a specific antagonist of opiates and opioids, is effective in animals against various types of shock: hemorrhagic, endotoxic, spinal, and painful electric shock [2, 6-8]. It has accordingly been postulated that endogenous opioid peptides (enkephalins, endorphins, etc.) play a part in the genesis of these shock processes. However, the most typical form of shock and that most frequently found in life is traumatic shock [1]. No data have yet been published on the action of naloxone in traumatic shock.

It was accordingly decided to study the effect of naloxone on the course of traumatic shock under experimental conditions.

TABLE 1. Effect of Naloxone on BP, HR, RR, and TV in Torpid Phase of Traumatic Shock (M ± m)

Experimental conditions	BP, mm Hg	HR, beats/min	RR, cycles/min	TV, % in 1 min
Control	133±3 / 111±1	267,1±8,5	66,2±4,7	100
Immediately after trauma	73±1* / 58±2	283,8±15,4	88,3±5,1*	92±12
Before injection of naloxone	73±2 / 58±2	262,1±8,2	84,3±5,3	94±12
Naloxone	77±4 / 61±4	258,7±7,4	100,1±7,7	204±33*

Legend. TV before trauma taken as 100. Number of experiments 10.
*$P < 0.01$ compared with control.

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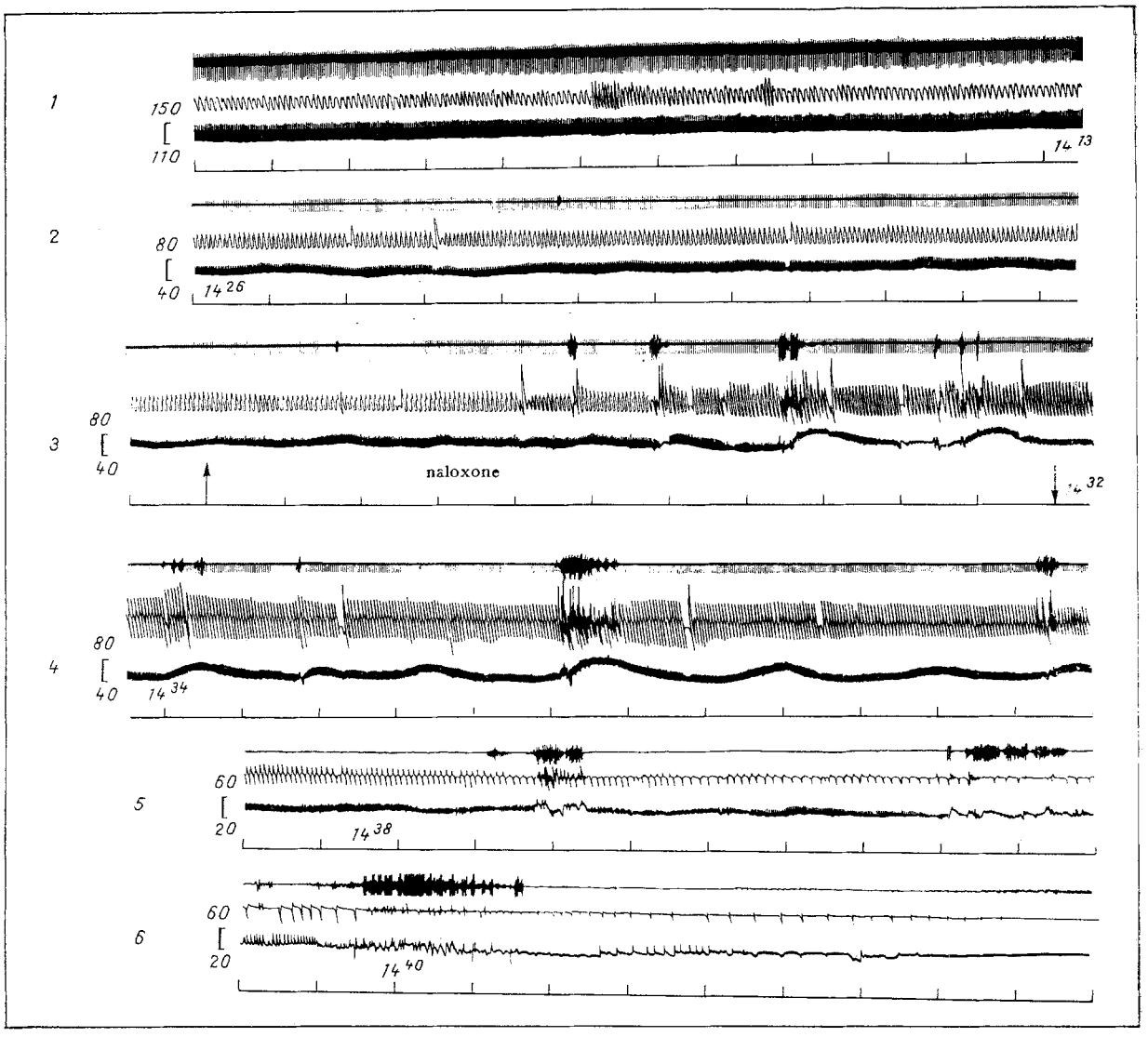

Fig. 1. Typical example of effect of naloxone on course of torpid phase of traumatic shock in rabbits. 1) Background before trauma; 2) immediately after trauma; 3) before injection of naloxone; 4) effect of naloxone (0.1 mg/kg intravenously); 5, 6) terminal stage, ending with complete respiratory arrest and death of animal. From top to bottom: ECG, respiration, BP (in mm Hg), time marker (10 sec). Arrows indicate beginning and end of injection of naloxone (0.1 mg/kg).

EXPERIMENTAL METHOD

Experiments were carried out on 25 tracheotomized male Chinchilla rabbits weighing 2.7 ± 0.1 kg. The animals' blood pressure (BP) was recorded in the left common carotid artery, and the ECG, respiration rate (RR), and tidal volume (TV) also were recorded. Traumatic shock was induced by Cannon's method. Naloxone hydrochloride (Endo Laboratories, USA) was injected intravenously, slowly over a period of 1-2 min.

EXPERIMENTAL RESULTS

In the torpid phase of traumatic shock (after trauma) the animals' BP fell to 60-80 mm Hg, third-order waves appeared on the BP curve, with periodic breathing and inhibition of the corneal reflex. This picture agrees fully with data in the literature [1, 3-5].

Naloxone in doses of 0.1-1 mg/kg, injected 2-15 min (on average 6 ± 1 min) after trauma, caused an increase in the frequency and depth of respiration, which led to a statistically significant increase in TV (Table 1, Fig. 1). Under these circumstances there was virtually no change in BP and the heart rate (HR) (Table 1). Naloxone, in a dose of 0.1 mg/kg, was found to have a stronger action on respiration than in a dose of 1 mg/kg. If the drug was

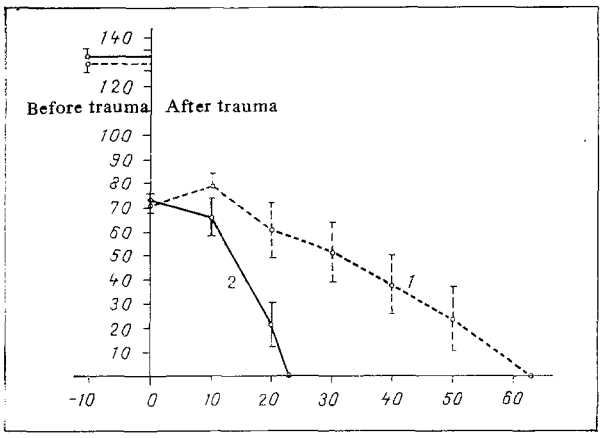

Fig. 2. Dynamics of changes in BP in experimental and control animals. 1) Control; 2) naloxone 0.1-1 mg/kg. Abscissa, time (in min); ordinate, BP (in mm Hg). Arrows indicate time of injection of naloxone. Number of experiments 10.

injected 15-45 min after trauma, it had virtually no activating effect on respiration (BP and HR likewise were unchanged).

Comparison of the survival of animals receiving naloxone after trauma with that of the control animals showed it to be shorter in the former (Fig. 2). Rabbits receiving naloxone, for instance, survived on averaged for 23 ± 4 min, compared with 63 ± 16 min in the controls ($P < 0.05$).

In the torpid phase of traumatic shock naloxone thus activates respiration and shortens the animals' period of survival. The action of the drug described above can be tentatively explained as follows. Endogenous opioid peptides in the torpid phase of traumatic shock play an adaptive, protective role, leading to survival of the animal or, at least, lengthening its life. Naloxone, which is their antagonist, induces purposeless (in this case) activation of respiration, which is accompanied by considerable expenditure of energy, and this leads to rapid death of the animals.

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