

EFFECT OF NORADRENALIN ON DURATION OF LOCAL ANESTHESIA

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Thorough comparative investigation of noradrenalin and adrenalin has disclosed essential differences in their pharmacological activity [1-4, 11]. The most striking is the difference in their effects on the cardiovascular system. According to the literature data, noradrenalin does not produce the depressor phase which characteristically follows the pressor effect induced by adrenalin; noradrenalin induces milder, more economical stimulation of the cardiac function than adrenalin does, and fewer complications are observed with its clinical use.

These features of noradrenalin have led many researchers [4,6,8, 9, 10, et al.], to recommend that it be used freely in combination with local anesthetics to prolong the effect of the latter. However, the literature data concerning the effect of noradrenalin on the course of local anesthesia are inadequate and often contradictory. For example, Holler [6] compared experimental data on the vasoconstrictor effects of noradrenalin and adrenalin with clinical data on the use of these substances to prolong anesthesia and concluded that noradrenalin's effect is weaker and less durable than that of adrenalin. Lecannelier and colleagues [8], in experiments on guinea pigs, found adrenalin and noradrenalin to prolong Novocain anesthesia equally effectively. In experiments on rats injected subcutaneously with Novocain combined with vasoconstrictor substances, Luzi [10] found that noradrenalin was more effective in prolonging Novocain's effect. Adrenalin was not as efficient in this respect.

The purpose of this investigation was to study noradrenalin's effect on anesthesia induced by certain preparations (Novocain and Bencaïne in infiltration anesthesia, cocaine and Dicaine in terminal anesthesia).

EXPERIMENTAL METHODS

Experiments were performed on rabbits and guinea pigs. Renier's method was used to investigate terminal anesthesia, the Bülbbring-Wajda method to investigate infiltration anesthesia [5]. In the latter case, experiments were performed on guinea pigs of the same age and with approximately equal sensitivity to painful stimulation. After the pain reaction of the animals to needle pricks was tested, they were intracutaneously injected with the experimental solution of the anesthetic in a dose of 0.25 ml. Then mild (6 each time), rhythmic (at 1-sec intervals) pricks with a needle were given every 5 min in the region of the injection. We recorded the number of pricks which provoked no pain reaction and the time that anesthesia disappeared. Adrenalin and noradrenalin were added to the anesthetic solutions in equimolecular amounts (adrenalin : noradrenalin = 1 : 1.45).

EXPERIMENTAL RESULTS

In experiments investigating infiltration anesthesia on 28 guinea pigs, we studied the anesthetic effects of 0.125% and 0.25% Novocain and 0.125% Bencaïne, and of these solutions combined with noradrenalin and adrenalin. The following concentrations were tested: adrenalin, 1 : 100,000, 1 : 25,000; noradrenalin — 1.45 : 100,000, 1.45 : 25,000. The average duration of anesthesia in min was determined for each concentration. The results of this series of experiments are given in the table.

As the table shows, noradrenalin did not prolong Novocain or Bencaïne anesthesia as much as did adrenalin. Anesthesia induced by 0.125% Novocain was more than doubled in duration by noradrenalin (1.45 : 100,000), but more than tripled by adrenalin in the same concentration.

Holtz and colleagues [7] have indicated that noradrenalin increases the depth as well as the duration of Novocain local anesthesia. We conducted another series of experiments on guinea pigs to determine whether noradrenalin could increase the depth of anesthesia.

Effect of Noradrenalin and Adrenalin on Duration of Novocain
and Bencaïne Infiltration Anesthesia

Experimental conditions	Duration of anesthesia (min)		
	Novocain		Bencaïne (0.125%)
	0.125%	0.25%	
Control	17.3 ± 1.8	23.2 ± 3.5	17.2 ± 1.2
Noradrenalin (1.45 : 100,000)	39.5 ± 2.9	50 ± 2.1	30.7 ± 3.1
Noradrenalin (1.45 : 25,000)	45 ± 4	—	37.5 ± 2.3
Adrenalin (1 : 100,000)	54.5 ± 1.3	91.8 ± 1.9	44.6 ± 2
Adrenalin (1 : 25,000)	57.1 ± 3.4	—	39 ± 1.8

We first determined the subliminal concentrations of Novocain, i.e., the concentrations with no anesthetic effect when administered intra- and subcutaneously; 0.05% Novocain was found ineffective when administered intracutaneously with and without noradrenalin (1 : 100,000). When the intracutaneously effective concentration of Novocain (0.125%) was administered to guinea pigs subcutaneously, the skin over the infiltration sector was not anesthetized, i.e., this concentration became subliminal. The addition of noradrenalin in a concentration of 1 : 100,000 to this solution did not produce anesthesia. However, if 0.125% Novocain were injected intracutaneously, and noradrenalin injected in a concentration of 1 : 100,000 subcutaneously under the focus of anesthesia, the same prolongation of anesthesia would occur as was observed with the combined intracutaneous injection of these solutions.

Therefore, these data indicate that noradrenalin increases the duration of Novocain's effect, but does not potentiate it in force and depth.

The cornea of a rabbit's eye was used to study the effect of noradrenalin on terminal anesthesia induced by cocaine and Dicaine. The local anesthetic effect of 0.05% and 0.5% Dicaine and 2% cocaine, used in combination with noradrenalin or adrenalin, was studied in 123 experiments. We found that noradrenalin does not materially affect the anesthetic effect of Dicaine or cocaine under conditions of terminal anesthesia in a rabbit's cornea. Adrenalin proved more active in these experiments than noradrenalin.

SUMMARY

Experiments were staged on guinea pigs and rabbits. A study was made of the peculiarities of the effect of noradrenaline on the anesthetizing action of Novocain, bencaïne, dicaine, and cocaine. Prolongation of the local anesthetizing effect of Novocain and bencaïne with noradrenaline in infiltration anesthesia is slightly less than that of adrenaline. During terminal anesthesia, investigated on the rabbit cornea, noradrenaline, in distinction to adrenaline, had no significant effect on the duration of the anesthetizing action of dicaine and cocaine.

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. Some or all of this periodical literature may well be available in English translation. A complete list of the cover-to-cover English translations appears at the back of this issue.