THE INFLUENCE OF ANESTHESIA OF THE SITE OF INTRODUCTION OF VACCINE ON THE DEVELOPMENT OF VACCINE REACTION

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The question of the influence of anesthesia of the site of introduction of antigen on immunological reactivity has been little studied. The result of such an influence evidently depends on the conditions of the experiment. Thus, the infiltration of 30 ml of 0.5 % novocaine solution into the muscle of a rabbit caused a diminution of antitoxin formation following repeated immunization with tetanus toxoid [3]. In agreement with this, in a communication of E. V. Konovalov [2], when rabbits were injected interarticularly with dysentery bacteria, anesthesia cut antibody production in half.

On the other hand, when the anesthetic acts more weakly (moderate amount of novocaine, vaccine not introduced into a closed space), anesthesia of the area of introduction of antigen increases antibody formation (to tetanus toxoid) 7 – 9 times [1]. Intravenous injection of a moderate amount of novocaine into human beings (0.5 – 1 mg per kg weight) increases the complement titer of the serum [4].

TABLE 1

Influence of Novocaine on Development of General Inoculation Reaction Following Vaccination with Polyvalent Vaccine

Group	Method of immunization	No. persons vaccinated		Number of reactions						Av. time of development of reaction (hrs)
				strong		moderate		weak		
		actual	%	actual	%	actual	%	actual	%	
First	Control	200	100	6	3	22	11	49	24.5	6
Second	with novocaine	1500	100	16	1.06	73	4.86	165	11	9

TABLE 2

Influence of Novocaine on Development of Local Inoculation Reaction Following Vaccination with Polyvalent Vaccine

Group	Method of immunization	No. persons vaccinated		Number of reactions						Av. time of development of reaction (in hrs)
				strong		moderate		weak		
		actual	%	actual	%	actual	%	actual	%	
First	Control	200	100	3	1.5	6	3	74	37	24
Second	with novocaine	1500	100	9	0.6	26	1.73	285	19	36

TABLE 3

Agglutination Reactions of Rabbits Against Typhoid Antigen

No. of rabbit	Group	Weight (grams)	Sex	Time of test bleeding																													
				Before immunization					After immunization																									
									14 days					21 days					28 days					40 days					60 days				
									titer of serum																									
				1 : 40	1 : 80	1 : 160	1 : 320	control	1 : 40	1 : 80	1 : 160	1 : 320	control	1 : 40	1 : 80	1 : 160	1 : 320	control	1 : 40	1 : 80	1 : 160	1 : 320	control	1 : 40	1 : 80	1 : 160	1 : 320	control	1 : 40	1 : 80	1 : 160	1 : 320	control
1	4%	1960	Male	—	—	—	—	—	++	++	+	—	—	++	++	—	—	—	++	++	—	—	—	++	—	—	—	—	—	—	—	—	—	—
2	novo-	1840	female	—	—	—	—	—	++++	++++	++	++	—	+++	+++	++	—	—	+++	+++	++	+	—	+++	++	+	—	—	++	++	++	+	—
3	caine	2000	male	—	—	—	—	—	++	+	—	—	—	+++	++	++	—	—	+++	++	+	—	—	++	++	—	—	—	+++	+++	+	±	—
4		2056	male	—	—	—	—	—	++++	+++	++	—	—	++	++	+	—	—	+++	++	+	—	—	+++	++	+	—	—	+	—	—	—	—
5		1570	male	—	—	—	—	—	++++	++++	+++	+++	—	++	++	++	—	—	+++	++	+	—	—	+++	++	—	—	—	+	±	—	—	—
6	1% novo-	1950	male	—	—	—	—	—	+++	++	++	—	—	++++	++++	+++	+	—	++	++	—	—	—	++	++	—	—	—	+	±	—	—	—
7	caine	1800	male	—	—	—	—	—	++	++	—	—	—	++	±	—	—	—	+++	+++	+	—	—	++	++	+	—	—	++	++	±	—	—
8		2010	female	—	—	—	—	—	++	+	—	—	—	++++	++	+	—	—	+++	++	±	—	—	++	++	+	—	—	++	+	—	—	—
9		1980	male	—	—	—	—	—	+	+	—	—	—	±	±	±	±	—	++	++	±	—	—	++	+	—	—	—	++	+	—	—	—
10	con-	2000	female	—	—	—	—	—	++	++	—	—	—	++	++	±	—	—	+	±	—	—	—	++	++	±	—	—	—	++	++	—	—
11	trol	1600	female	—	—	—	—	—	+	+	—	—	—	+	+	—	—	—	++	++	—	—	—	++	++	±	—	—	++	+	—	—	—
12		2030	male	—	—	—	—	—	++	++	+	±	—	++	++	±	—	—	++	++	—	—	—	++	++	—	—	—	++	++	—	—	—
13		1860	male	—	—	—	—	—	+	+	—	—	—	++	++	—	—	—	+++	++	÷	—	—	++	++	±	—	—	+++	++	÷	—	—

Meaning of Symbols: ++++ Complete agglutination, clear liquid with large precipitate; precipitate; + Liquid not clear, very slight precipitate; ± Doubtful reaction; — Negative.

The lack of agreement of the data given above can probably be explained by the fact that prolonged and strong action of a local anesthetic, putting receptors out of action, removes one of the mechanisms of action of antigen on the organism being immunized, as a result of which its immunological reactivity is weakened. But if the action of the local anesthetic is weak, possibly after a temporary inactivation of receptors there is a compensatory strengthening of their function which is the cause of a stronger influence of the antigen on the organism.

The reaction of the body to the introduction of vaccine is not limited to immunological disturbances which have a specific character. In the vaccinated organism phenomena also develop which proceed uniformly and do not depend on the character of the injected antigen. These phenomena, manifesting themselves as temporary distrubances of temperature and inflammatory reactions at the site of injection of the antigen, acquired the designation of general and local vaccine reactions.

The influence of novocaine on the course of the vaccine reaction has been studied even less than its influence on immunogenesis. In the present communication we attempt to fill this gap, and present the results of our observations on the course of vaccine reactions in human beings immunized with polyvalent vaccine containing 1% novocaine. Two ml of the novacine vaccine was injected subcutaneously (Table 1 and 2).

From Table 1 it is evident that a sharp general reaction (temperature rise to 38.6° C or higher) was noted in the control group in 3% of those vaccinated, but in only 1.06% of those vaccinated with novocaine. Reactions of moderate degree (temperature 37.6 – 38.5°) were observed in the second group in 4.86%, but in 11% of the control group. The number of weak general reactions (temperature 37.1 – 37.5°) decreased to 11% as compared to 24.5% in the controls. Novocaine postponed the time of development of general reactions 3 hours on the average.

As is clear from Table 2, local reactions were observed in persons vaccinated with novocaine more rarely than in the controls, and appeared on the average about 12 hours later.

Our observations confirm that anesthesia of the site of injection of vaccine may change the course of the response of the organism, including the vaccine reaction.

After it had been thus established that with the aid of novocaine general and local vaccine reactions are diminished in persons immunized with polyvalent vaccine, we were confronted with the question: what influence does the addition of novocaine to polyvalent vaccine have on the development of immunity in the vaccinated organism. To answer this question we carried out an experiment on animals.

METHODS

For the experiment 13 rabbits were taken. Five animals were immunized with polyvalent vaccine containing 4% novocaine (four times as much as in the vaccine used for immunization of human beings). A fourth rabbit was vaccinated with vaccine containing 1% novocaine. We gave the control group, consisting of 4 rabbits, polyvalent vaccine without novocaine.

The anti-typhoid agglutinins developed in the serum were studied in all the experimental animals. Determinations of these antibodies were carried out before immunization, then about 14, 21, 28, 40 and 60 days after immunization.

Serum titers, for the cases in which anti-typhoid agglutinins were found in the experimental animals, are presented in Table 3, where the degree of agglutination is shown by plus signs (+).

As in evident from Table 3, anti-typhoid agglutinins appeared in the serum of all experimental animals after immunization. The agglutinin titers of the animals vaccinated with novocaine are no lower than those of the controls. It may be concluded that the application in our method of novocaine diminishes the vaccine reactions following immunization with polyvalent vaccine and does not hinder the development of antibodies to any significant extent.

SUMMARY

The influence of anesthesia of the site of introduction of vaccine on the development of vaccine reactions was studied. For this purpose one group of patients was immunized with polyvalent vaccine which contained 1% novocaine. It was established that under the influence of the novocaine local and febrile reactions were greatly reduced. The addition of novocaine had no effect on the immunogenic effect of the vaccine.

LITERATURE CITED

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