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STUDY OF EFFECTIVENESS OF ANTITULAREMIA VACCINATION IN ZONE OF CONSTRUCTION OF STALINGRAD HYDROELECTRIC STATION

(Izuchenie effektivnosti protivotuliaremiinoi vaktsinatsii v zone stroitel'stva Stalingradskogo gidrouzla)

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Voprosy Edidemiologii i Profilaktiki Tuliaremii [Problems of Epidemiology and Prophylaxis of Tularemia], book edited by Professor N. G. Olsuf'ev et al., Medgiz, Moscow, 1958, pages 152-155 (10 refs)

From the Stalingradsdaya Oblast Tularemia Station

N. A. Gayskiy was the first to use live tularemia vaccine in epidemic foci. He showed distinctly that it is possible to eliminate tularemia morbidity by mass vaccination of a population. Subsequently, these data were confirmed by other authors (B. Ya. El'bert and others, 1947; V. S. Sil'chenko, 1948, 1953; N. G. Olsuf'yev, 1953; Yu. A. Myasnikov, 1953; M. I. Tsareva, 1953; V. A. Yudenich, 1953, and others).

We had the opportunity of studying the efficacy of vaccination when used during an outbreak of tularemia, and during the subsequent period of planned vaccination.

In the summer of 1946, cases of arthropod-borne (and, partially of industrial origin) tularemia occurred in the territory of the Volga-Akhtubinsk River Valley, among the inhabitants of various populated places (chiefly within the limits of the Leninskiy and Sredne-Akhtubinskiy Rayons). (See V. P. Borodin's article in this collection, page 10-17). That was the first time in our oblast that tularemia vaccination was used for the purpose of eliminating the disease after a well developed outbreak.

In view of the fact that the principal results of this work have already been published (V. P. Borodin, 1951) we shall dwell on them only in brief. We are therefore, presenting data only for the Leninskiy Rayon, where we were in charge of the innocculations, and had the opportunity of following their results, rather than for the whole river valley territory.

The inoculations were begun in May 1946, increased in June, reached a maximum in July, decreased in August, and were completed in September. If the total number of inoculations given is taken as 100 percent, then six percent were given in May, 29 percent in June, 58 percent in July, six percent in August, and one percent in September. In all, 44.8 percent of the population of this rayon territory was included in the inoculations, but in individual populated places the number of inoculated persons ranged from 11 to 68 percent. The inoculations were given epicutaneously with fluid egg-yolk vaccine.

Among those inoculated during the entire summer season of 1946, 0.17 percent became sick with tularemia, whereas among the persons who were not inoculated the incidence was 3.4 percent. Therefore, the morbidity rate in the group of those inoculated was 20 times less than the morbidity rate in the group which was not inoculated.

The majority of vaccinated persons succumbing to the disease were inoculated several days before (from two to ten days) becoming ill. These persons were, apparently, either inoculated during the incubation period, or were exposed to the infection during the period just prior to production of immunity. As is known, immunity against tularemia, of adequate strength, develops only on the 12th-15th day after the vaccination. The course of

the disease in those inoculated was mild or, which was encountered less often, of moderate severity. Three inoculated individuals fell ill with tularemia a month after the vaccination. They had mild cases.

The above presentation permits the conclusion that vaccination, by protecting the population against infection, only reduced the tularemia morbidity rate, but did not eliminate it completely, because of the late and incomplete coverage with this preventive measure. For the purpose of achieving a complete antiepidemic effect a rapid coverage of 100 percent of the threatened groups is required.

In subsequent years, the vaccination of the population on the territory of the Volga-Akhtubinsk River Valley, and in the adjacent areas, was carried out as a planned measure, as a result of which the number of those vaccinated increased every year. In view of the fact that the duration of the immunity from the vaccine was not definitely known at this time, the same groups were, in a number of cases, given second inoculations. In 1951, when the construction of the Stalingrad Hydroelectric Station was begun, the inoculations were extended to laborers and office workers coming in for construction.

During the period from 1946 through 1954 a total of 81,739 persons was inoculated in the Leninskiy, Sredne-Akhtubinskiy and Krasnoslobodskiy Rayons. From 1946 through 1954, the number of inoculations given increased by seven times, the greatest number of them were administered in 1951 and 1952, which was associated with the construction of the hydroelectric station. The entire population, beginning at age seven, except for those with contraindications, was

vaccinated.

We judged the results of the vaccinations by the appearance of the characteristic skin reaction. In view of the fact that in many persons the local reaction developed later than on the fifth to seventh day, and in certain persons later than on the 10th day, we recommended that medical workers check the results of the vaccination on the 12th-15th day.

In various inhabited places successful results, judged by the appearance of the skin reaction, ranged within limits of 70-95 percent. The fact that in a number of cases the vaccine did not "take" is explained basically by a violation of the conditions under which the vaccine should have been kept and transported, as well as by various technical errors (use of disinfectants other than alcohol for cleansing the skin, etc.).

On the basis of our data we believe that, on the average, the vaccine "takes" in no less than 80 percent of cases.

If we compare the number of inoculations with the tularemia morbidity which occurred during these years in the territory of the Volga-Akhtubinsk River Valley, it may be noted that with the increase in the number of persons inoculated the morbidity rate decreased, and by 1951 the disease was completely eliminated (Table 1).

In the past four years (1951-1954) not a single case of tularemia has been noted among the population of the Volga-Akhtubinsk River Valley, and there have been no cases among the construction workers of the hydroelectric station either. (In subsequent years, 1955, 1956 and 1957, there have been no cases of tularemia in the territory of the Volga-Akhtubinsk River Valley either).

Table 1

Tularemia Morbidity Rate and Inoculations for the Period 1946-1954, according to Rayons of the Volga-Akhtubinsk River Valley

Year	Number of cases of tularemia	Number of persons inoculated during the year	Accumulative number of persons inoculated
1946	593	11,622	11,622
1947	1	4,377	15,999
1948	1	4,054	20,053
1949	6	6,465	26,518
1950	5	5,181	31,699
1951	-	20,508	52,207
1952	-	14,395	66,602
1953	-	4,785	71,387
1954	-	10,352	81,739

We made a special study of the problem of the immunologic efficacy of inoculations given extensively over the territory in which we were interested.

Through this study it was possible to suggest the periods, depending on the loss of immunity, when revaccination became necessary. This problem cannot be considered conclusively solved yet.

During the period 1951-1952 we conducted immunologic testing of persons inoculated in previous years beginning with 1946. The testing was carried out by the intracutaneous tularin method, because establishment of the allergic state is at present the most accurate method of determining the existence of immunity to tularemia in people (B. Ya.

El'bert, V. S. Sil'chenko, N. G. Olsuf'yev, I. N. Mayskiy and others).

A. P. Koroleva and A. P. Samsonova participated in this work. In all, we examined 3,747 persons who had been inoculated with the fluid egg-yolk vaccine during the period from 1946 through 1951.

Among those tested were 1533 men (40.9 percent) and 2214 women (59.1 percent). According to age these persons were distributed in the following way: from 7 to 14 -- 441 persons (11.7 percent); from 15 to 19 -- 534 (14.3 percent); from 20 to 29 years -- 662 (17.5 percent); from 30 to 39 years -- 915 (24.4 percent); from 40 to 49 years -- 1012 (27.1 percent); from 50 to 59 years -- 128 (13.6 percent); from 60 years up -- 55 persons (1.4 percent).

From these data it is seen that chiefly persons of working age were checked. Results of the intracutaneous test with tularin in those inoculated were read after 48-72 hours, because it has been established through observation that the occurrence of an allergic reaction in those immunized, as compared with those who have had the disease, is frequently delayed.

The intensity of the reaction was designated on a three-point scale.

Reactions were noted as one plus (+) when hyperemia and tissue edema at the site of the tularin injection were less than one centimeter in diameter; as two plus (++), when the hyperemia and tissue edema were equal to of from one to two centimeters in diameter; as three plus (+++), when the hyperemia and tissue edema reached more than two centimeters in diameter.

The immunized population of 15 inhabited places were included in the examination; the results are presented in Table 1.

Table 1

Result of the testing, according to severity of local reaction, in those who had been immunized with fluid egg-yolk tularemia vaccine

Vaccine

Year of immunization	Time intervals between testing and immunization	Number of immunized persons tested	Number of those reacting to the intracutaneous test	Number of those immunized who had a reaction of:		
				+	++	+++
1946	After 6 years	538	463 (86%)	125	199	139
1947	" 5 "	435	328 (75.4%)	91	128	109
1948	" 4 "	402	267 (66.5%)	79	108	80
1949	" 3 "	863	651 (75.5%)	72	271	308
1950	" 2 "	923	768 (83.3%)	88	352	328
1951	" 1 "	325	272 (85.6%)	23	105	144
	Total.....	3,486	2,749 (78.8%)	478	1,163	1,108

The greatest number of positive reactions (86 percent) occurred in persons who had been inoculated six years previously (1946). Almost the same number of positive reactions (83 percent) occurred among persons who had been inoculated one or two years previously (1950-1951). The smaller percentage of positive reactions among those immunized in 1947-1949, as compared with those inoculated in 1946, may be explained by the fact that in 1946 the vaccinations were done by specialists of the tularemia station, with technical errors reduced to a minimum, whereas in subsequent years the

inoculations were given by personnel of the general medical system. We believe that technical errors may have occurred then, which had an influence on the subsequent results of this measure.

In reading the tularin intracutaneous tests induration of over one centimeter in diameter (++ and +++) predominated, which attests to a good degree of intensity of the allergic reactions in all the observations on the inoculated persons.

According to our records, beginning with 1947, there has not been a single case of tularemia among those vaccinated.

Conclusions

1. Study of the epidemiologic efficacy of the tularemia Gayskiy-El'bert vaccine, during a period of an already developed outbreak of arthropod-borne tularemia, showed that the morbidity rate among those vaccinated may be reduced 20 times as compared with an unvaccinated group. ( )

2. Among vaccinated persons cases occurred up to 10 days after the inoculation; however, three persons fell ill a month after the inoculation. The cases were usually mild.

3. For the purpose of complete epidemiologic protection vaccination against tularemia must be carried out in 100 percent of the susceptible population.

4. Subsequent, planned, and more extensive coverage of the population reduced the tularemia morbidity to solitary cases; and no cases of tularemia have been seen in the regions of the Volga-Akhtubinsk River Valley in 1951-1957 period.

5. Checking the immunologic efficacy of tularemia vaccine, by means of the intracutaneous tularin test, has shown that in a considerable number of vaccinated persons quite a strong immunity is maintained for six years after vaccination (observation period).

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