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IN ADULTS IN 1957, 1960 and 1962

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RESULTS OF SMALLPOX REVACCINATION
IN ADULTS IN 1957, 1960 AND 1962

Following is the translation of an article by
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The level of specific antibodies formed as a result of anti-smallpox inoculation depends to a considerable extent on the virulence of the vaccines used, the intensity of the skin reaction, and the antibody level in the blood before inoculation (Mastyukova, et al, 1961). Studies of Mineyeva (1959) established that persons who have been successfully revaccinated against smallpox developed antibodies more intensively upon subsequent inoculations than persons with negative skin reaction. Nesmeyanova, et al (1961), noticing the loss of immunity against smallpox in 41.3 % of the population after two years following positive revaccination holds it necessary to reexamine the instructions on smallpox vaccination (1956-1960) as regards the periods of obligatory revaccination in boundary zones and to establish instead of a three-year interval, a two-year. Based on comparative data of repeated inoculations, Shatrov, et al (1962), believes it necessary to continue studying immunities and smallpox in inoculants for the purpose of establishing the duration and intensity of immunity.

We present in this report results of smallpox revaccination of the staff collective of medical workers in the L'vov Oblast Psychiatric Hospital inoculated in 1957, 1960, and 1961. All hospital coworkers in 1957 already had variolar signs and were vaccinated and revaccinated in the corresponding periods under a previously effective instruction (No 743, dated 10 September 1953). However, indications were found (Dzhazadov, 1961) that the number of pock marks remaining following vaccination did not reflect the persistence and duration of the post-vaccinal immunity.

We made an estimate of the results of the revaccination conducted according to the directions on the use of dry smallpox vaccine dated 22 October 1953. The inoculations were given in the form of three linear incisions, arranged in the form of an equilateral triangle. The results of revaccination were confirmed on the 5th and 8th day and the reaction was regarded as weakly positive (+) when a nodule (papule) was present, positive (++) when a blister (vesicle) had developed, and strongly positive (+++) in the presence of a pustule.

Revaccination was carried out in June 1957 with smallpox vaccine of the Odessa Institute of Epidemiology and Microbiology and the two last revaccinations in February, 1962, using the dry vaccine of Kiev Institute of Epidemiology and Microbiology (series No 52 and 33).

The overall results of revaccination showed that positive skin reaction was observed in 1957 in 851 of 1090 persons inoculated (78 %), in 1962 -- in 574 out of 1242 (46 %), and in 1962 -- in 1087 out of 1303 (84 %). These data agreed to a greater or lesser extent with the data of other authors (Dorofeyev and Gubenok -- 66.3 %, Vrochinskiy -- 36 %, Serenko and Baroyan -- 84 %).

The relatively large number of positive reaction (78 %), in 1957, is explained by the fact that the vaccination was carried out initially after an extended interval. Rubinshteyn et al (1961) noted that inoculability was a direct function of the schedule of preceding inoculation. In 1960 out of 1242 inoculated persons positive results were obtained in 574 (46 %), and in 1962 -- in 1087 out of 1303 (84 %), that is, an increase in positive skin reaction results was observed amounting almost to two-fold in two years after the preceding revaccination.

TABLE 1
Results of Revaccination in 1960 and 1962 by Types of Skin Reaction

a) Тип кожной реакции	b) Число прививок по годам			
	1960		1962	
	abs. (г)	%	abs. (д)	%
Отрицательная (d)	668	54	216	16
Папула (f)	334	27	388	29
Везикула (e)	158	12	363	28
Пустула (g)	82	7	336	27
h) Итого	1242	100	1303	100

LEGEND: a) type of skin reaction; b) number of inoculation by years; c) absolute; d) negative; e) papule; f) vesicle; g) pustule; h) total.

Detailed analysis of the inoculation results revealed (Table 1) that in 1960 the largest number (54) were negative skin reactions, and strongly positive reactions were noted in only 7 %, while in 1962 negative reactions were noted in 16 %, and strongly positive -- in 27 %. Such a large difference in the intensity of the vaccinal process evidently can be accounted for by the fact that during 1962 the vaccine of higher virulence was used.

Dzhavadov (1960) suggested that the decrease and disappearance of postvaccinal immunity to smallpox is possible in persons undergoing influenza. We can also assume that as the result of the epidemic influenza outbreak during January 1962, a sharp decrease in the intensity of anti-smallpox immunity set in, therefore a high index (84 %) of persons reacting to the inoculation was observed upon the revaccination during February. However, the previous antismallpox revaccination during February 1960 also preceded the influenza epidemic (during January-February 1959) and positive skin reactions were observed one-half as often as during subsequent revaccination.

Further, Dzhavadov (1961) based on his observations of children, asserted that illnesses experienced before revaccination did not represent the only factor affecting persistence and duration of post vaccinal immunity. Thus, even in our observations, the higher percentage of positive results in the skin reaction in 1962 can depend not so much on the reduction of anti-smallpox immunity resulting from influenza, as much as on other reasons, for example, the quality of the vaccine used. In 1960, evidently, the vaccine was at a lower virulence, and therefore immunogenicity, which accounts for the insufficient intensity of post-vaccinal immunity.

When we compared the intensity of the postvaccinal process in inoculated persons of different age groups (Table 2) we were unable to note higher inoculability in persons older than 40 years, as was observed by Belikova-Aldakova et al (1960). This can be explained by the fact that most persons had already been inoculated in 1957 and 1960.

Of particular interest were the comparative indices of revaccination against smallpox in the same persons. Of 665 persons inoculated in 1960, the reaction upon 1962 revaccination proved to be positive in the 584 (85 %). All these were distributed in groups based on the results of revaccination the previous time (Table 3).

The first (largest) group included 318 persons, for whom the reaction was negative after preceding revaccination. Of these, the repeated revaccination in 1962 led to only 36 persons (11 %) being found resistant to smallpox vaccine. Only papulae were observed in 114 inoculated persons (36 %) after the repeated revaccination, in 91 (29 %) the skin reaction was limited to vesicles, and in 77 (24 %) variola was formed after the stages of papulae, vesicles, and pustules, ending in scabs and scars.

TABLE 2
Intensity of Vaccinal Process in Different Age Groups of
Inoculants During 1962

(a) Возраст (в годах)	(b) Число обследо- ванных	(c) Результаты реакции у привитых					
		резко положи- тельные (d)		слабо положи- тельные (f)		отрицательные (g)	
		абс. (i)	%	абс. (e)	%	абс. (e)	%
20-29	254	63	29	140	52	48	19
30-39	453	115	27	282	59	76	14
40-49	368	90	25	213	57	65	18
50 и старше (h)	228	65	28	136	60	27	12
(i) Итого...	1303	336	27	751	57	216	16

LEGEND: a) age (in years); b) number of persons examined; c) results of reaction in inoculants; d) strongly positive; e) absolute; f) weakly positive; g) negative; h) 50 and older; i) total.

The second (and smaller) group comprised 195, for whom a weakly positive reaction was revealed for the first time. By the second time, negative results following revaccination were observed in 22 (11 %) of those inoculated, a weakly positive reaction in 77 (40 %) a positive -- in 51 (26 %), and a strongly positive -- in 45 (23 %).

In the third and fourth groups of persons inoculated as a function of increasing intensity of vaccinal process in 1960, the number of negative and strongly positive reaction also varied, correspondingly. For instance, in the fourth group consisting of 50 persons, in which a strongly positive skin reaction was found in 1960 (postules with the formation of scab, and then scar), in 1962 the negative reaction was found in 4 (8%), weakly positive -- in 23 (46%), positive -- in 17 (34%), and strongly positive -- in only 6 (12%).

This data indicates that inoculability of the vaccine in adults depended also on the results of preceding revaccination, which confirmed literature report on this question (Mastyukova et al, 1961, and others).

Still more clear-cut results were obtained on analysis of only positive results of skin reaction in 1962 (584 persons) and their dependence on the intensity of the vaccinal process in 1960 (Table 4). The largest number of positive results in 1962 was found in the 282 persons (48 %) who in 1960 had reacted negatively to inoculation, and the lowest -- in the 46 (8 %) persons with strongly pronounced positive reactions during 1960.

Based on comparative indices of skin reactions of different intensity upon reimmunization during 1960 and 1962, it was established that the lower percentage of strongly positive reactions in 1962 was

obtained for persons for whom strongly positive reaction had been observed two years ago. On this basis, it can be concluded that the most intense immunity is formed upon the development of typical variolae. Therefore, the differing results of vaccinal process upon the last revaccination depends on the intensity of skin reactions of the previous revaccination.

TABLE 3

Results of Revaccination Against Smallpox in 665 Persons
Inoculated During 1960 and 1962

(a) Группа	(b) Год	(c) Число привитых	(d) Результат			
			(e) отрицательный	(f) положительный ре- ной интенсивности		
				+	++	+++
Первая (g)	1960	318	318	—	—	—
	1962	318	36	114	91	77
Вторая (h)	1960	195	—	195	—	—
	1962	195	22	77	51	45
Третья (i)	1960	102	—	—	102	—
	1962	102	19	35	23	25
Четвертая (j)	1960	50	—	—	—	50
	1962	50	4	23	17	6

Symbols: — negative reaction, + weakly positive (papule), ++ positive (vesicle), and +++ strongly positive (pustule).
 LEGEND: a) group; b) year; c) number of persons inoculated; d) results; e) negative; f) positive of differing intensity; g) first; h) second; i) third; j) fourth.

TABLE 4
Indices of Positive Results of Skin Reaction in 1962 as a
Function of Intensity of the Vaccinal Process in 1960

(a) Группа привитых	(b) Результат кожной реакции в 1960 г.	(c) Положительный результат кож- ной реакции в 1962 г.	(d) Число приви- тых	
			(e) абс.	%
Первая (4) . . .	-	+ + + + +	282	48
Вторая (9) . . .	+	+ + + + +	173	30
Третья (14) . . .	++	+ + + + +	83	14
Четвертая (.) . . .	+++	+ + + + +	46	8
Итого . . .			584	100

Symbols: - negative reaction, + weakly positive, ++ positive reaction, +++ strongly positive reaction.

In addition to the local reaction accompanied by intensive inflammation, especially in persons with strongly positive results, high temperature and painful lymphadenitis was observed for several days in the submusculature region. In 1962, the vaccinal process occurred severely for certain persons with strongly pronounced local symptoms (unbroken pustule), very painful infiltratis in the region of the should and general symptoms (headache, chilling, insomnia, debility, lassitude, loss of appetite, and in one instance brief loss of consciousness), with temperature in the limits 39-40°; these effects became aggravated for two and even four weeks, but ended favorably. The vaccination induced some exacerbation of the skin disorders (eczema). Other more serious complications were not recorded.

Conclusions

1. Positive results from revaccinating adult persons using smallpox detritus in 1957, 1960, and 1962 were obtained from, respectively, 78, 46, and 84 % of those inoculated.
2. The influenza epidemic evidently cannot be the reason explaining the high inoculability upon the last revaccination, since in the same epidemiological situation inoculability was half as high before the preceding revaccination.
3. The high inoculability upon revaccination in 1962 can be explained by the higher virulence of the vaccine.
4. The inoculability of the vaccine depended also on the results of the preceding revaccination: the smallest number of positive skin reactions (8 %) on repeated reimmunization was observed for inoculated persons who had evidenced strongly positive postvaccinal reaction the last time.

5. Significant fluctuations in the fairly high inoculability of smallpox detritus on repeated revaccinations at an interval of 2-3 years, pointing to the decrease and loss of immunity, evidence the need to conduct repeated inoculations every two years.

6. Upon each massive smallpox vaccination further study of the results of the vaccinal process and the factors affecting the different comparative indices of the skin reactions at the last re-immunization is worthwhile, in particular the effect influenza has on the state of anti-smallpox immunity.

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