

Research Article**The Dynamics of the Anthrax Vaccine in Preventing Pets Morbidity in Voronezh Province in the Period from 1909 To 1916**

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ABSTRACT.

Statistical data, given in the presented work in chronological order, on the increase in the number of vaccination points and the number of vaccinated animals confirm irrefutably the increasing role of progressive use of drugs of biological origin in veterinary practice. The increase in the number of vaccination points was due to small farms. Due to the energetic action of the Provincial Council and the veterinary staff of the Provincial Zemstvo the veterinary-epidemiological situation and the state of notarial anthrax established in Voronezh province was considered stable, and the infection is controlled. Protective vaccinations were recognized, both among educated residents and the illiterate layer of the peasant masses. But the use of anthrax vaccinations contributed only to the prevention of morbidity, and simulated virtual well-being did not have a healing effect on the territorial prevalence of the environment from *Bacillus anthracis*. However, the lack of veterinary staff, due to the call of more than half of veterinarians and paramedics to mobilize during 1914-1916, did not increase the incidence rate and did not reduce the ability of the Provincial Zemstvo to carry out actively sanitary and veterinary measures against anthrax.

Keywords: anthrax, antiepidemiological measures, protective, forced and therapeutic vaccinations, post-vaccination period.

INTRODUCTION.

Rampant and contagious diseases of domestic animals in ancient times were interpreted as world executions that undermined human welfare and led him to the brink of death. The threatened nature of epizootics and epidemics for the health and life of animals and humans forced many thinkers and leaders to introduce strict, sometimes tough, measures to prevent them. According to Joh. Wieruss'a Senate of Venice in the XVI century, on the occasion of the developed epizootics of anthrax, the sale of meat was forced to ban on pain of death. A few later A.Kirchner described a disease that occurred among wolves, easily passed on to people, from which about 60 thousand people died in the States of Central Europe (France, Germany, Hungary, Poland).

The main measure of prevention and cessation of anthrax epizootics were forced and protective vaccinations. For the first time such vaccinations began to be carried out in Kherson Zemstvo in 1885, later they began to apply an increasing number of Zemstvos.

Vaccination of animals in some areas against this dangerous disease slightly improved the situation, but in these areas in subsequent years there were outbreaks of epizootics and epidemics of anthrax [1, 3].

A significant reason for the territorial prevalence of anthrax, both in the Russian Empire and in the Voronezh province in the late XIX-early XX centuries, was the lack of understanding of the importance of antiepizootic measures by animal owners. Because of the low cultural literacy and religious prejudices the rural population took with great distrust the recommendations of veterinary specialists, it refused: to carry out the necessary veterinary and sanitary measures and to carry out anti-anthrax protective, forced and therapeutic vaccinations. Therefore, measures to eliminate anthrax lesions were often limited to palliative and veterinary-police methods [2, 5].

The purpose of the study is to clarify the features of the dynamics of growth in the number of anthrax vaccinations and the reasons for their containment in the Voronezh province for the period from 1909 to 1916.

Research problems:

- analysis of literary sources on the use of anthrax vaccination among animals of Voronezh province;
- identification of the reasons contributing to the appearance of anthrax vaccination among animals of the Voronezh province for the period from 1909 to 1916.

Methods and materials included analysis of existing literature, statistical and archival materials.

Archival data confirm that at the end of the XIX century anti-anthrax and anti-erysipelas protective vaccinations received more and more widespread, the popularity and trust of livestock owners. Since November 1895, vaccines produced by the Nizhny Novgorod laboratory were used in the Voronezh province. So if for the whole of 1895 inoculation was made at 70 points of 9 counties (22170 animals), then, for the first 9 months of 1896, coverage increased to 143 points of 12 counties (30879 animals). These figures showed a well-established work in the case of vaccination against anthrax and erysipelas of pigs in the Voronezh province.

Collection of information received by veterinarians from the villages where vaccinations were made, there was no mortality of animals. Although in previous years in these villages there was a significant mortality (up to 506 animals). In the early years vaccination was made only in private estates and wealthy peasants.

The Provincial Council, looking for ways to reduce the cost of vaccines and overcome the inconveniences associated with the production of vaccines and the cost of their transfer from Nizhny Novgorod, sent the senior veterinarian I. Kolesnikov in the summer of 1897 to the provinces, where the veterinary and bacteriological laboratories engaged in the production of vaccines were already functioning.

Returning from a business trip, I. Kolesnikov presented a report on the results of the inspection of veterinary and bacteriological

laboratories and his views on the device of a similar laboratory in Voronezh at the Veterinary Department of the Provincial Council.

Results and discussions.

In 1909, the Voronezh veterinary and bacteriological laboratory prepared and sent

67008 g of the first and 33504 g of the second anthrax vaccines to the local veterinarians, and 70740 g of the anti-anthrax serum obtained from four horses was sent.

The presented table 1 contains data on anthrax vaccinations for the period from 1909 to 1916 inclusively.

Table 1 - Digital indicators of the growing need for anthrax vaccination and the consequences of their use among animals of the Voronezh province

№	Year	Number of vaccination points	Vaccinated			% dead		
			horses	cattle	sheep and other animals	horses	cattle	sheep
1.	1909	966	11627 ^v	23676 ^v	42511 ^v	0,18	0,06	0,16
			4529 ^{v+s}	1909 ^{v+s}	5119+11 ^{v+s}	0,22	0,18	0,30
			68 ^s	2 ^s	126 ^s	16,18	-	-
			16224	25587	47767	0,20	0,12	0,23
2.	1910	1113	12157 ^v	29971 ^v	97620 ^v	0,15	0,03	0,11
			5945 ^{v+s}	572 ^{v+s}	6614 ^{v+s}	0,16	0,26	0,9
			45 ^s	119 ^s	39 ^c	6,67	-	15,39
			18147	30662	104273	0,20	0,13	0,24
3.	1911	1091	14401 ^v	32524 ^v	111890 ^v	0,29	0,15	0,12
			4563 ^{v+s}	547 ^{v+s}	6029 ^{v+s}	0,31	1,83	0,45
			35 ^s	1 ^s	-	8,57	-	-
			208 ^{ssv}	146 ^{ssv}	240 ^{ssv}	-	-	-
			19207	33218	118159	0,20	0,12	0,13
4.	1912	915	7536 ^v	20225 ^v	68887 ^v	0,21	0,09	0,23
			4587 ^{v+s}	1451 ^{v+s}	6787 ^{v+s} 13 ^c	0,31	0,69	0,44
			30 ^s	4 ^s	644 ^{ssv}	13,3	-	-
			2486 ^{ssv}	3574 ^{ssv}	76331	0,08	0,03	-
			14639	25254		0,20	0,08	0,20
5.	1913	943	17205	25383	81096	0,18	0,04	0,13
6.	1914	1001	15759 ^v	29080 ^v	81383 ^v	0,15	0,05	0,24
			2948 ^{v+s}	604 ^{v+s}	1630 ^{v+s} 11 ^s	0,17	-	0,55
			24 ^s	5 ^s	2750 ^{ssv}	12,5	-	-
			4035 ^{ssv}	4512 ^{ssv}	85774	0,07	0,04	0,03
			22766	34201		0,12	0,04	0,23
7.	1915	787	9259 ^v	19183 ^v	51121 ^v	0,05	0,02	0,08
			-	-	-	-	-	-
			49 ^s	1 ^s	608 ^s	4,08	-	-
			4818 ^{ssv}	6436 ^{ssv}	4661 ^{ssv}	0,05	0,02	0,08
14126	25620	56390	0,08	-	0,04			
8.	1916	694	16580	32291	69398	0,02	0,01	0,001
					176			

Note: ^v – number of vaccinated animals; ^{v+s} – number of vaccinated animals with vaccine + serum; ^s – number of animals vaccinated with serum; ^{ssv} – simultaneous sulfur vaccination.

The number of vaccinated animals against anthrax in 1909 among the peasant and landlord cattle, respectively, was 47380 and 40527 heads, and the population of other estates only 1671 animals. Peasant cattle mainly were vaccinated in the following counties: Bogucharskiy,

Nizhnedevitskiy, Ostrogozhskiy, Korotoyanskiy and Pavlovskiy. From 40 available sites the main number of country animals was vaccinated in 19. The remaining 7 counties: Biryuchenskiy, Bobrovskiy, Valuyskiy, Voronezh, Zadonskiy, Zemlyanskiy and Novokhoperskiy vaccinated

predominantly owners' cattle. Also in each county there were volosts where anthrax vaccinations were not made at all.

Vaccination was not widespread in the Valuisky and Pavlovskiy counties, in which most of the volosts (53% and 79%, respectively) did not vaccinate animals.

Only in the province, 77814 heads were vaccinated, including: 11627 horses, 23676 cattle, 42511 sheep, 40 heads of other species of animals. 11568 animals were immunized with sulfur vaccination (4529 horses, 1909 cattle, 5119 sheep, 11 other animal species). Anti-anthrax serum was injected to 196 head of cattle. The vaccine used in the 798 points, sulfur vaccination in 304, and serum for therapeutic purposes only in 20 points, including 15 – by the peasants and 5 – by owners.

The percentage of animal deaths after sero-vaccination was insignificant, but seemed to be disproportionately high, compared to the death after vaccination. This apparent difference was due to the fact that the laboratory could not meet all the requirements for anthrax serum. As a result, district doctors used sulfur vaccination only in the most risky cases: in the presence of epizootics, in exhausted by hard work animals that without sulfur vaccination could give a significant deaths. Secondly, because of deficiency of serum in the County a doctor with a vial of the serum, tried to divide it into more number of doses, and very often the animal is instead of 5.0 ml serum received only 0.5-1 ml. Meanwhile, the lab having a 2-year experience in the application of sulfur vaccination, was not yet able to set accurately the dose of the serum. The dose of 5.0 ml of serum at which the laboratory initially stopped was insufficient. In the same year, in the Voronezh district it was found experimentally that the dose of serum for horses should be at least 10.0 ml.

In parallel with the issue of death of animals after vaccination, there was still a problem of complications after re-vaccination. From 614 animals on that local practitioners filed and properly completed registration cards, complications were observed in 14% of cases of the total number. Complications were observed

in 16 sectors: Alekseyevsky, Kantemirovsky, Zemlyansky, Buturlinovskiy, Annensky, Nikolsky, Bogucharskiy, Urazovsky, Zadonsky, Ivanovsky, Korotoyasky, Semidesyatsky, Ostrogzhsky, Rovensky, Podgorensky and Pavlovsky. The greatest number of complications was accounted for Novo-Chigolsy and Rossoshansky areas [10].

In the reporting year of 1910, the Voronezh veterinary and bacteriological laboratory prepared and sent 123218 g of anthrax vaccine and 110550 g of anthrax serum (more than last year at 30750 g) to the local veterinarians.

During 1910, the following vaccinations were used against anthrax: only vaccine (first and second); vaccine in combination with serum (first vaccine + serum or first vaccine and second – + serum), both methods were used as preventive and forced; serum for therapeutic purposes. Compared with the previous year, 63,504 more animals were vaccinated. Residents of Bogucharskiy, Pavlovsky and Ostrogzhsky districts were mostly peasants, who in previous years did not try vaccinating their livestock against anthrax, but in 1910 by the number of vaccinated animals, they came in first place.

The average number of vaccinated animals in the province, made up 12757 heads in one county. In three counties: Bobrovsky, Ostrogzhsky and Bogucharsky this figure was higher, and in the rest – below average.

In the past 1909 the average number of vaccinated animals in the province per one area was 2235 heads. In 1910, in one area, from the 43 one available in the province, more by 1325 heads were inoculated. The share of peasant cattle accounted for 49.2% of vaccinated animals, the share of landowners – 48.6%, other persons – 2.2%. The spread of anthrax vaccinations among animals, the owners of which were different classes, was significantly different in methods of vaccination. As private farms in the past few years vaccinated cattle mostly regularly, outbreaks of anthrax due to the lack of the pathogen in the herds were not observed. Therefore, landowners, mainly in 50.9% of cases (against 47.2% in farms) immunized their animals only with vaccine.

Peasant cattle, often affected by the epi- and enzooty of anthrax, required more careful immunization with sulfur vaccination, which gained a higher percentage of vaccinated animals (70,5%) than landowners (24,6 %). The same category of more or less infected farms included animals under the heading "other persons", because they gave a significant percentage of animals vaccinated with sulfur vaccine, namely 4.9% against 1.9% of animals vaccinated with one vaccine.

The main object of sulfur vaccination were horses (32,7 %), as animals carrying the most heavily vaccination with vaccine that was forced to use the vaccine in combination with the serum. The total death of animals after protective and forced vaccinations was expressed in the figure of 316 heads of different species of animals, which to the total number of vaccinated animals was only 0.20 %, and the death rate for certain types of animals also did not exceed the established indicators [11].

Vaccination against anthrax in 1911 in Voronezh province was produced: safe and indispensably in households where the herd or the village caused the epizootic, and for therapeutic purposes – only with anthrax serum. In the first two cases, vaccination was carried out with a vaccine (first and second) or a vaccine with serum (2-fold sulphur vaccination). In the same year, the first experiments of single (simultaneous) vaccination (second vaccine with serum) were conducted. The main reasons for the introduction of vaccination of this nature were the following motives: reduce by half the time spent on double vaccination; more rapid formation of immunity in vaccinated animals, which was especially important with the emergence of the epidemic antraxa caused the death of cattle.

The total number of animals vaccinated against anthrax made 170584 head; it exceeded the indicator of last 1910 by 17502 heads. At the same time, the following number of animals was vaccinated with vaccine, sulphur vaccine, serum and simultaneous sulphur vaccination: 158815, 11139, 36, 594. The first places in the number of vaccinated animals occupied the same counties

as in 1910 (Bobrovsky, Ostrogozhsky and Bogucharsky). Only three of the districts, Pavlovsky Nizhnedevitsky and Zemlyansky, reduced levels of the anthrax vaccine in animals: Pavlovskiy by 4331, Petropavlovsk – 2259, and Zemlyansky by 232 heads. For therapeutic purposes, anthrax serum was used in five counties. In total, 35 horses and one cow were vaccinated. Under this three horses died because of injection of serum on late-stage disease.

On the estate of the owners animals were vaccinated as follows: in the peasants 84286 heads were vaccinated, the owners – 83652, other people – 2646. The total mortality from protective and forced vaccinations against anthrax amounted to 277 heads of different cattle. Among them: 56 horses, 58 cattle and 163 sheep. As a percentage of the total number of animals vaccinated mortality was equal to 0.16 %. Compared with the past 1910, the mortality decreased by 0.04 %.

As for the first experiments of the use of the simultaneous method of anthrax vaccination, in 1911 208 horses, 146 heads of cattle and 240 sheep were vaccinated in various counties and areas. This inoculation was performed in 11 locations, including three in relief, and 8 forced. Animal mortality after a simultaneous vaccination was not observed [4].

Veterinary-bacteriological laboratory in 1912 produced 196200 g of anthrax serum, and veterinarians demanded 208300 g of serum. The laboratory could not meet the growing demand of anthrax serum every year in full amount. As the serum was also used to treat anthrax patients, the laboratory released 5090 g of serum to the Sanitary Department according to the requirement. Consequently, for veterinary purposes laboratory gave only 175990 g serum. Vaccination against anthrax in the Voronezh province during 1912 was made: safe, preventing and with the purpose of treatment with anthrax serum. In the first two cases the vaccination was carried out: only with vaccine (first and second) 96648 heads, vaccine with serum 2-fold (the first vaccine, the second vaccine + serum) 12819 heads, vaccine with serum only once (simultaneously with a second vaccine + serum)

6704 heads. With therapeutic serum only 47 cattle were vaccinated. The total number of grafted sheep included other animal species (152 pigs, 36 goats and 1 donkey). After the therapeutic vaccination against anthrax by the serum 13.3% of horses died. The minimal mortality of animals after simultaneous vaccinations, despite the fact that 33 % of vaccinations were forced, pointed to the exceptional suitability of this method.

On the estates of the owners of the animals vaccinations were as follows: peasants – 58396, landowners – 53729, others – 4093 heads.

In comparison with the previous 1911 the number of vaccinated animals in 1912 decreased by 54366 heads. The decrease in anthrax vaccinations was due to the unfavorable spring weather, which delayed the spring agricultural work, and conducted the military horse census during the vaccination period from 1 to 30 June, which distracted all veterinarians for a month from the main work. The following counties took the first place on the number of vaccinated animals: Bobrovsky, Bogucharsky, Ostrogozhskiy and Novokhopersky.

On average, for one of the 50 areas in the province 2,324 heads of grafted cattle accounted. In 1911, this figure decreased by 1305 animals. Above the average on the number of heads, the vaccination against anthrax was carried out in 12 sites: Annensky, Bogucharsky, Rossoshansky, Schuchensky, Makarovsky, Korotoyasky, Vorontsovsky, Volokonovsky, Yarkovskiy, Nikolaevsky, Verkhne-Khavsky and Berezovsky [6].

In 1914, the veterinary and bacteriological laboratory produced 96653 g of the first anthrax vaccine and 50690 g of the second, a total of 147343 g of vaccines. This amount of vaccine was produced according to the applications of local veterinarians and provided to these veterinary areas.

Anthrax serum in 1914 was received from 8 horses. The method of serum production remained the same (defibrination of blood taken from animals with subsequent settling, suction of the settled serum, and preservation by carbolic acid and heating at a temperature of 56-

580 C). 272400 g of hyperimmune serum was received. Veterinary doctors demanded 293350 g of serum, but the laboratory was able to allocate 237880 g due to the fact that at the request of the Sanitary Department the anthrax serum, in the amount of 12700 g, was released for the treatment of people with anthrax. The remaining amount of serum was reserved by the laboratory for unforeseen cases of the disease.

In the Voronezh province, vaccination against anthrax was carried out according to the same scheme as in previous years (safety, forced and for therapeutic purposes). The total number of vaccinated animals was 142681 heads. In comparison with the previous 1913 in the reporting year the number of vaccinated animals increased by 18997 heads. Anthrax serum was injected to 24 horses, 5 heads of cattle, 9 sheep and 2 pigs for therapeutic purposes.

During the period from 1896 to 1908, the average percentage of deaths from the use of anthrax vaccinations was: for horses – 0.50 %, cattle – 0.17 %, sheep – 0.30%.

Due to the fact that the use of anthrax serum together with the vaccine began, from 1909 to 1914, the percentage of animal mortality significantly decreased. Horses by 5 times, despite the fact that horses were the most susceptible to anthrax. The mortality of cattle decreased almost by four times. The least waste was lower in sheep (1/3) because with the vaccination of sheep sulphur vaccination was used in minimal quantities.

On estates of owners of animals in 1914 vaccinations were distributed as follows: at peasants, landowners and other persons respectively – 62902, 74212, 5567 heads.

The average number of animals vaccinated against anthrax for the areas (58) in the province was 2472 heads, compared to 1913, by 182 heads more. The above average performance was in the 18 areas: Annensky, Bogucharskiy, Peskovsky, Davyidovsky, Olkhovatsky, Verkhne-Khavsky, Schuchensky, Makarovsky, Podgorenskiy, Nikolaevsky, Volokonovsky, Bobrovsky, Voronezh, Borisovsky, Ivovsky, Zadonsky, Kastorensky, and Novo-Chigolsky [7].

In 1915 the laboratory produced anthrax vaccine in the amount of 43703 g of the first vaccine and 25244 g of the second.

Anthrax serum was obtained from 7 horses in the amount of 243600 g. Veterinarians were requested 186540 g, laboratory this requirement was met in full amount. Anthrax serum in the amount of 11200 g was allocated at the request of the Sanitary Department for the treatment of people with anthrax.

Vaccinations against anthrax in the Voronezh province produced safe and forced: vaccine (first and second), vaccine with the serum once (simultaneously with a second vaccine+serum).

In comparison with 1914 the number of vaccinated animals decreased by 46,545 animals and amounted to 96,136 animals. The decrease in the number of vaccinations was due to the fact that most doctors were called up to the army.

Counties in which the number of vaccinated animals was higher than the average (8011 heads): Novokhopersky (28563 heads), Bobrovsky (13112 heads), Valuysky (11527 heads), Korotoyaksky (9834 heads). The remaining 8 counties had indicators below average: from 7426 to 620 heads.

The average number of vaccinated animals in 60 veterinary and medical areas in the province was 1602 heads. In comparison with 1914, this figure decreased by 870 heads.

Among the various estates of livestock owners the number of animals vaccinated against anthrax in 1915 was: the peasants 28004 heads, landowners 64301 heads and other persons 3831 heads.

In 1915, in comparison with 1914, the death rate of animals in the post-vaccination period decreased: among horses by 1.71 times, cattle – by 2 times, among sheep and other animals – by 2.5 times [8].

Despite the insufficient number of veterinary personnel, 1916 was characterized by the active implementation of sanitary and veterinary measures against anthrax, especially through vaccinations, for which to help the remaining specialists who were not called up for military service, students were invited and sent to

veterinary outpatient clinics of the province, students of senior class of veterinary and paramedic school. Due to these measures, the number of vaccinated animals in 1916 increased to 118445 heads against 91136 – in 1915. At the same time, the death of animals after preventive anthrax vaccination in the province was minimal (8 heads) and did not exceed the existing at this time acceptable indicators [9].

However, because of the mobilization of personnel of the veterinary and bacteriological laboratory of the Provincial Zemstvo, where the head of the laboratory and one drug remained, its work could not be carried out in full amount. New tasks and increase in the production of biological products were postponed until a favorable time.

CONCLUSIONS.

1. With the opening of the Voronezh bacteriological laboratory in March 1897, it became possible to use locally produced vaccines and anthrax serum in the province.
2. Observing the spread of vaccinations during the 8-year period, it should be noted that the veterinary-bacteriological laboratory, despite the short period of its existence, merged firmly with the veterinary organization of the province, and it would be difficult to imagine not only its closure, but even a slight weakening of activity.
3. Protective vaccinations, which became a need for the population in the rational fight against epizootics, were recognized, both among educated residents and among the illiterate layer of the peasant masses.
4. The statistical data given in the presented work in chronological order, confirm irrefutably the increase in the number of vaccination points and the number of vaccinated animals.
5. Basically, the increase in the number of vaccination points was due to small farms that resorted to immunization, as a sure means of protection against the death of their few cattle.
6. The presented data allow concluding that the control of anthrax in the Voronezh province

was based on the use of protective, forced and therapeutic vaccinations of animals.

7. Thanks to the energetic action of the Provincial Council and the veterinary staff of the Provincial Zemstvo the veterinary-epidemiological situation and the state of notarial anthrax established in Voronezh province was considered stable, and the infection is controlled. However, the lack of veterinary staff, due to the call of more than half of veterinarians and paramedics to mobilize during 1914-1916, did not increase the incidence rate and did not reduce the ability of the Provincial Zemstvo to carry out actively sanitary and veterinary measures against anthrax.

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