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Chapter 4
ZOONOSES

4.1. GENERAL CHARACTERISTICS

Zoonoses are infections common to humans and animals in natural conditions (WHO, 1991). In the Russian medical literature, zoonoses are considered to be a large group of infectious and invasive human diseases (more than 190 nosological forms), in which various types of domestic, synanthropic and wild mammals and birds serve as a reservoir and source of infection. It is they who ensure the existence of the pathogen as a biological species. The human body serves as a non-specific host for the pathogens of zoonoses, its infection occurs episodically and, as a rule, a person becomes a biological dead end for them. A series of infectious diseases of people ends with the death of the pathogen with the arbitrary attenuation of the epidemic process. However, in cases where a person is a source of infection (plague, Ebola and Marburg fever, etc.), there is a need for regime-restrictive measures, including quarantine.

According to the etiology of zoonoses, they are divided into the following infections:

- bacterial (brucellosis, plague, tularemia, campylobacteriosis, leptospirosis, salmonellosis, anthrax, rickettsiosis, chlamydia, borreliosis);
- viral (hemorrhagic fevers, rabies);
- prion (scrapie, spongiform encephalopathy).

For epidemiological purposes it is advisable to subdivide zoonoses for the ability of pathogens to circulate among domestic, as well as synanthropic (brucellosis, foot-and-mouth disease, Q fever, ornithosis, sodoku, trichophytia, etc.) and wild animals (tularemia, tick-borne rickettsiosis, tick-borne borreliosis, arbovirus infections, monkey pox, rabies, Lassa fever, etc.). Diseases, the reservoir of the causative agent of which are wild animals, are called natural focal. Foci of diseases associated with agricultural and domestic animals or synanthropic rodents are called anthropurgical. There is no absolute boundary between natural and anthropurgical reservoirs. Thus, when infecting agricultural and domestic animals with individual arboviruses, temporary anthropurgical foci of natural focal diseases are created. Anthropurgical reservoirs of tularemia occur during the migration of infected rodents from their habitats to settlements where they come into contact with synanthropic rodents.

The causative agent of brucellosis can be transmitted from agricultural animals to wild rodents. At the same time, a temporary natural focus of brucellosis is created. In modern conditions not only new natural foci of zoonotic diseases are discovered, but also the transformation of known foci is noted under changing conditions of the organization of the economy and the way of life of people. According to the mechanism of infection, zoonoses can be classified only when they spread among animals.

In essence, the epidemic process in zoonoses is a mechanism of infection of people who find themselves in the sphere of circulation of the causative agent of these diseases.

Pathogens of zoonoses have a weaker tropicity to individual organs and tissues than pathogens of anthroponoses, which determines their polytropicity and polypathogenicity. This property ensures the continuity of the pathogen circulation in nature. At the same time, the role of various animals as reservoirs of infection is not the same — there are main and secondary hosts. Most often, the pathogen of zoonoses is localized in the blood of animals, so the transfer of the pathogen to humans is carried out with the help of blood-sucking insects. According to this principle, transmissive zoonoses are distinguished: obligate-transmissive (the mechanism of infection is obligate-transmissive, which is realized mainly through blood-sucking vectors) and facultative-transmissive (the mechanism of infection is facultative-transmissive, which is realized in various ways, including possible transmission through blood-sucking insects).

Localization of pathogens in the gastrointestinal tract and on the external coverings (nontransmissive zoonoses) is often noted. Transovarial transmission of the pathogen is also possible (in ticks). Infection of people with pathogens of facultative-transmissive and nontransmissive zoonoses most often occurs with the participation of a variety of infection factors. The fecal-oral (urine-oral) mechanism is associated with the disease of leptospirosis (through water), salmonellosis, trichinellosis, anthrax and botulism (with meat infected during the life of an animal), brucellosis (with milk), etc.

The air (aspiration, inhalation) mechanism of pathogen infection is characteristic only for a limited number of pathogens of zoonotic infections (psittacosis, ornithosis, plague, pneumocystosis, coccidioidomycosis).

The real possibility of infection with a number of pathogens characterized by increased resistance in the external environment, by dust ways (tularemia, anthrax, Q fever) should be borne in mind. The contact (percutaneous) mechanism of infection is characteristic of rabies, sodoku, tetanus, foot-and-mouth disease, sap, leishmaniasis, etc.

The intensity and nature of the connection of people with epizootic foci determine certain elements of social conditions. The activity of the mechanism of pathogen infection among domestic animals and synanthropic rodents is associated with social and natural conditions. For example, tularemia, depending on the household and industrial activities of a person, may turn out to be an infection of both the outer integuments (commercial outbreaks) and the respiratory tract (air-dust mechanism of infection with the threshing of the grain) or transmissible (infection with a human bite by mosquitoes or ticks).

The epidemic process of zoonoses has a dependent character. It is totally conditioned by the epizootic process. A number of zoonoses (mainly with a transmissible mechanism of infection) are characterized by endemicity, that is to say the prevalence in certain geographical areas where specific vectors or guardian animals of infection in nature constantly live. The rise in morbidity coincides with the period of their maximum biological activity.

Territories where zoonotic pathogens circulate among wild, domestic and commercial animals are considered to be potentially dangerous foci for humans. They are divided into natural, anthropurgical (economic) and mixed.

Wild animals form natural foci; agricultural, domestic and commercial animals of cage keeping determine the formation of anthropurgical reservoir.

Natural reservoirs have a landscape nature. The existence of natural foci is ensured by the continuity of the epizootic process in animals. Infection of people in natural foci occurs during agricultural work (mowing wet meadows, harvesting hay, harvesting wheat, rye, and oat fields, when cultivating rice, flax, hemp and other abundantly irrigated crops), hunting, fishing, when drinking water from random shallow reservoirs for drinking, washing and others. Natural foci can serve as a place of infection of agricultural animals. Economic foci do not have a certain landscape timing and can occur everywhere, both in rural areas and in cities. In economic foci zoonoses among people are registered in the form of "bathing" outbreaks, as well as group or individual diseases among workers of livestock farms, fur farms, meat factories, individual livestock owners and other persons at increased risk of infection.

Mixed foci are characterized by typical signs of simultaneously anthropurgical and natural foci of infection. The etiological structure of diseases reflects the structure of agricultural, domestic, and wild animals living in this focus.

In the current socio-economic conditions, the peculiarities of combating diseases common to humans and animals are largely associated with the development of the private sector in animal husbandry, uncontrolled migration of livestock, including from disadvantaged regions. This makes it difficult to record and conduct vaccination of animals, it creates difficulties in the implementation of state veterinary and sanitary-epidemiological surveillance. The increase in the scale and intensity of the development in the territories where active natural foci are located leads to the wide spread of these diseases among the population.

The risk of infection with many zoonoses has pronounced social, household, professional and other specifics. The incidence of the rural population is usually higher than the urban. In recent years under the influence of human economic activity, changed social and economic conditions, the transformation of epidemiological manifestations of a number of zoonotic infections has occurred. Currently quite acceptable conditions have developed in urban conditions for the occurrence, spread and even establishment of certain infections common to humans and animals (rabies, leptospirosis, echinococcosis, toxoplasmosis, ornithosis, tularemia, etc.).

In the Russian Federation, the epidemic and epizootic situation for zoonoses remains tense. Every year up to 30,000 cases of hemorrhagic fever with renal syndrome (HFRS), TBE and borreliosis, tularemia and other natural focal diseases are registered in the country. Even though many natural focal infections are characterized by limited prevalence, their significance is determined by the severity of the clinical course and high mortality (on average from 3 to 35%, and in rabies — 100%), as well as the high costs of treatment and anti-epidemic measures. Expenses for ensuring the functions of state bodies, including territorial ones, for carrying out antiepizootic measures for zoonoses in 2017 were in the amount of 1,360.8 million rubles (126.7% compared to 2016), in 2018 — 1,315.9 million rubles; in 2019 — 1,283.7 million rubles.

The basis for the prevention of zoonoses is the timely detection of the danger of infecting people with a particular infection by conducting sanitary-epizootiological and sanitary-epidemiological intelligence and surveillance. Epizootiological and epidemiological features of infection, the availability of effective means of prevention and the possibility of their use determine the choice of the main measures. These may be in some cases regime-restrictive measures, in others — veterinary-sanitary, deratization, disinsection, vaccination measures and emergency prevention, as well as their

combination. In endemic territories, the measures are carried out according to an approved comprehensive plan, in the implementation of which the following authorities participate:

- carrying out federal state sanitary and epidemiological supervision;
- the executive authorities of the Russian Federation subjects in the field of veterinary medicine and their organizations;
- healthcare institutions, medical prevention centers.

Salmonellosis

Salmonellosis is a group of infectious diseases common to humans and animals, manifested by varying degrees of intoxication, predominant damage to the gastrointestinal tract and the probability of generalization of the infectious process.

Brief historical information. Even at the beginning of the 18th century doctors and veterinarians drew attention to the connection between some diseases of livestock and people who ate the meat of diseased animals. The detailed study of these diseases began in the middle of the 19th century, when the American veterinary pathologist Daniel Elmer Salmon with his assistant J.T. Smith in 1885 discovered the first causative agent of food toxico-infections of animals and humans, currently known as *Salmonella choleraesuis*. Later, in 1888, the German doctor A. Gartner isolated from the diseased cow meat microorganisms identical to the pathogens he found in the spleen of a deceased patient who ate this meat of the diseased cow. This was the first convincing proof of the infectious nature of the disease. The isolated microorganism was named Gartner's bacillus (according to the current classification of *Salmonella enteritidis*). In the course of further research, it turned out that the structure and biological properties of Gartner's bacillus practically did not differ from the bacteria previously discovered by D. Salmon. After that, it was possible to identify and describe a whole group of microorganisms similar to Gartner's bacillus and also causing diseases in humans and similar diseases in animals, which in 1934 was called after its discoverer D. Salmon with the common name "salmonella" by the International Nomenclature Commission.

Etiology. The causative agents of salmonellosis are gram-negative bacteria belonging to the genus Salmonella of the *Enterobacteriaceae* family, currently numbering more than 2,500 serological variants. The current taxonomy divides the genus Salmonella into three species — *Salmonella enterica, Salmonella bongori* and *Salmonella subterranea*. *S. enterica* includes 6 species, the most numerous and including more than half of the known serovars is subspecies 1 (*enterica*). In human pathology about 200 serological variants are important, and no more than 50 are widespread and play a significant epidemiological role. Salmonella of each subspecies are divided into serological variants depending on their antigenic structure, which includes antigenic "complexes". When identifying the salmonella serovar, three main antigens are taken into account: O — somatic; H — flagellar and Vi — one of the components of the O-antigen. It is the principle that underlies the Kaufmann—White antigenic classification, in which salmonella are grouped by somatic O-antigen into serological groups (serogroups) — A, B, C, D, etc. Within the groups salmonella, depending on H-antigens, are divided into serological variants (serovars) — a, b, c, d, etc. The vast majority of salmonella (96–99%) isolated from humans belong to four

serological groups — B, C, D and E. There are accumulated facts indicating the potential pathogenicity of all known salmonella and their ability to cause an infectious process in humans, animals and birds, accompanied by a variety of clinical manifestations. The pathogenicity of pathogens for humans has been proven in relation to salmonella of the subspecies 1 and has not been practically studied for representatives of other subspecies and species of *S. bongori* and *S. subterranea*.

Salmonella has so-called genetic plasticity, that is to say the absence of a stable antigenic structure and the ability to genetic recombination, which results in a huge number of new serological variants of salmonella.

Pathogens remain viable in the external environment for a relatively long time, tolerate drying and low temperatures. Thus, salmonella can survive in the soil for up to 6.5 years; on fabric, paper, frozen meat, eggs and cheese — up to a year; in water, meat, sausage products, butter — up to 4 months; in eggshells — up to 1 month; in milk — up to 10 days. In some products, salmonella can not only persist, but also multiply, without changing the appearance and taste of the product. At the same time, when exposed to high temperatures (over 46 °C), salmonella quickly dies. For example, when cooking eggs, salmonella remain viable for 4 minutes. Salting and smoking practically does not affect the life ability of pathogens. Hospital strains of salmonella, characterized by polyresistance to antibiotics and disinfectants, are particularly resistant in the external environment.

Reservoir and sources of infection. The natural reservoir of salmonella is animals including agricultural ones (birds, pigs, cattle), which have the greatest epidemic significance. In recent decades in the conditions of developed industrial poultry farming, chickens, especially meat of the kind — "broilers", ducks, geese, turkeys, serve as the main reservoir of salmonella of various serovars. In birds transovarial transmission of salmonella is possible (endogenously) and exogenously through the shell of an egg contaminated with bird droppings. When the ovary of birds is affected, the yolk of the egg is infected, and when the oviduct is infected, the protein is infected as well. Exogenous infection is possible within 1–2 hours after egg laying, when salmonella is sucked in with air.

The role of animals kept at home (dogs, cats, amphibians, reptiles, ornamental birds) as sources of salmonellosis pathogens for humans has been proven. Wild animals (foxes, beavers, wolves, arctic foxes, bears, as well as seals and monkeys, etc.) also suffer from salmonellosis.

A wide circulation of salmonella has been established among wild birds (pigeons, sparrows, starlings, gulls), cold-blooded (fish, frogs, turtles, snakes, crayfish, crabs) and many lower animals (oysters, mussels, ticks, cockroaches). Rodents, primarily synanthropic, also represent a massive reservoir of salmonella infection.

Less often, the source of the causative agent of infection is a person. An asymptomatic carrier is particularly dangerous if it is related to the preparation and distribution of food, as well as the sale of food products.

The period of contagion is 3–7 days. In the case of acute bacterial release — up to 3 months, chronic — more than 3 months after clinical recovery.

Mechanism and transmission routes. The main mechanism of transmission of pathogen is considered to be fecal-oral, implemented mainly by food (alimentary) way. The factors of transmission of the pathogen are food products: meat and meat products, eggs and cream products, mayonnaise and dry egg powder. There are known

diseases of salmonellosis associated with the consumption of cheeses, feta, smoked fish, seafood.

Water as a factor of transmission of the causative agent of infection is of secondary importance. The real epidemic danger is the water of open reservoirs contaminated with sewage emissions (sewage emissions, wastewater discharges from meat processing plants and slaughterhouses, as well as poultry and livestock facilities).

The contact path is more often implemented in hospital conditions, where environmental objects, the hands of the service person, linen, cleaning equipment, medicinal solutions, etc. serve as transmission factors.

Transmission of the pathogen is possible with dust by inhalation of air containing an aerosol contaminated with the pathogen.

The **incubation period** ranges from 2–6 hours to 2–3 calendar days. With a contact-household transmission path it can increase to 4–7 calendar days.

Forms of infection. Salmonellosis can occur in the form of various gastrointestinal (gastritic, gastroenteritic, gastro-enterocolitic) and generalized (typhoid-like, septicopiemic) forms of infection, as well as in the form of bacterial carrier (acute up to 3 months, chronic for more than 3 months and transitory — a single detection of the causative agent in the absence of a clinical picture). The lethal outcome in salmonellosis ranges from 0.04 to 0.6% of cases.

Susceptibility and immunity. The natural susceptibility of people to infection is high. The degree of susceptibility depends on the infecting dose of the pathogen, its biological properties, as well as on the individual and age characteristics of the human body (the greatest susceptibility in children and the elderly persons). Postinfectious immunity is short-lived, type- and species-specific, persists for less than a year.

Diagnostics of salmonellosis is traditionally based on clinical, laboratory and epidemiological data. In the case of admission of a patient from an epidemiologically proven focus of salmonellosis, the diagnosis is made on the basis of a clinical and epidemiological history without laboratory confirmation.

Laboratory diagnostics. Methods for confirming the presence of salmonella in biomaterial samples:

- bacteriological (isolation and identification of Salmonella by cultural method using nutrient environments and biochemical tests);
- molecular genetic (detection of Salmonella DNA in biomaterial samples in PCR);
- serological (determination of the level of antibodies to Salmonella antigens in blood serum in PHA);
- others that allow to carry out the indication and identification of Salmonella, including strains, DNA, antigens, antibodies.

The main criteria indicating that the isolated pathogen belongs to the genus salmonella is its antigenic structure, determined according to the Kaufmann–White scheme. The main material for research are stool samples, if necessary — vomit, gastric and intestinal lavage, urine, blood, bile. If salmonellosis is suspected, taking into account clinical and epidemiological data, medical workers take clinical material from the patient on the day of treatment and before the start of etiotropic treatment. Etiological interpretation of cases of salmonellosis should be carried out no later than the 5th calendar day from the moment of sampling.

Differential diagnosis of salmonellosis is carried out in order to exclude diseases of an infectious and non-infectious nature accompanied by diarrheal syndrome (food toxico-infections, shigellosis, escherichiosis, cholera, typhoid fever, rotavirus gastroenteritis and other viral infections, as well as various poisonings). In some cases, there is a need for differential diagnosis of salmonellosis and somatic pathology accompanied by pain syndrome (acute appendicitis, myocardial infarction, cholelithiasis, etc.).

Manifestations of the epidemic process. The epidemic process in salmonellosis is characterized by an outbreak and sporadic morbidity. Salmonellosis is widespread everywhere, but the maximum levels of morbidity are registered in countries with developed economies, which makes it possible to attribute this group of infections to "diseases of civilization". The intensity of the salmonellosis incidence in people in different territories depends on many social and environmental factors. Among them, first of all, there are changes in the production and consumption of food products by the population (centralization and intensification of their production, expansion of the production of various semi-finished products and ready meals sold through the retail network, development of the catering network, etc.), expansion of exports and imports of raw materials, food and feed substances, intensive pollution of the environment and others.

The long-term dynamics of the incidence of salmonellosis in the Russian Federation is characterized by cyclicity, the general trend towards a decrease in the incidence rate. In 2020, compared to 2019, the indicator decreased by 1.6 times and amounted to 14.71 per 100,000 population (2019 — 29.1). The highest rate of morbidity was registered in Tomsk (41.36 per 100,000 population), Irkutsk region (34.91 per 100,000 population), Sakha Republic (34.45 per 100,000 population), Arkhangelsk region (32.02 per 100,000 population). The etiological structure is dominated by salmonellosis caused by salmonella group D (77.4%).

At the same time, salmonellosis remains relevant in the formation of outbreak morbidity and occupies the 3rd place in the structure of foci of group morbidity with a fecal-oral mechanism of infection transmission. In 2020, 20 foci (70 in 2019) of group infection with salmonellosis were registered with a total of 422 people affected (1829 in 2018). The largest foci of group morbidity, with the number of victims more than 40 people, were registered in the Irkutsk, Volgograd regions, the Republic of Dagestan.

According to the data of the reference center for salmonellosis monitoring, in 2020 27 serotypes of salmonella were isolated from victims in the foci of group morbidity, 17 from food raw materials, 16 from environmental objects. As in previous years the release of salmonella was most often observed from poultry products. The main pathogens isolated are *S. enteritidis* and *S. infantis*. When studying food products, the highest proportion of samples containing salmonella was detected in the Irkutsk and Krasnoyarsk regions.

In 2020, 58.7% of *S. enteritidis* isolates were characterized by resistance to colistin, 75% — to ciprofloxacin. Multiple resistance (resistance to more than two classes of antibiotics) was found in 4.1% of the isolates. Resistance to polymycins, monobactams, penicillins, and cephalosporins of the II–IV generation has been established for two S. enteritidis isolates.

Isolates of *S. infantis* in 85% of cases showed resistance to more than three classes of antibiotics. At the same time, all the studied isolates were sensitive to glycocyclines,

polymyxins, carbopenems, cephalosporins of the first generation and aminoglycosides of the third generation.

Half of *S. typhimurium* isolates were sensitive to the action of all antibiotics, while in 30.0% of isolates resistance was observed to two classes (penicillins, tetracyclines).

Preventive measures. For preventive purposes, clinical and laboratory examinations and restrictive measures are carried out among certain groups of the population.

A single laboratory examination is subjected to persons applying for work:

- to enterprises (food, catering) and trade objects that sell food products, dairy kitchens, farms and factories, as well as directly engaged in processing, storage, transportation of food and delivery of ready-made food, repair of inventory and equipment;
- to the medical institutions and children's organizations engaged in direct maintenance and nutrition of children;
- to organizations operating water supply systems, delivery and storage of drinking water.

Laboratory examination of persons before admission to hospitals and health resorts is carried out according to clinical and epidemiological indications.

In health-improving organizations for children, before the start of the health-improving season, laboratory examination is subject to employees who come to work at food units whose activities are related to the production, storage, transportation, sale of food and drinking water, as well as operating water supply facilities. In the case of isolation of bacteria of the genus *Salmonella*, the subject from the above-mentioned categories is not allowed to work and is referred to a doctor's consultation to the medical institution.

In order to prevent nosocomial salmonella infection of patients and staff in the medical institution, the following measures should be carried out[1]:

- allocation of diagnostic wards (isolation rooms) in non-infectious profile departments for hospitalization of patients with signs of diarrheal disease;
- single laboratory examination of children under 2 years of age, mothers and other persons hospitalized for patient care;
- persons admitted to hospitals of a psychoneurological profile and specialized social service institutions for citizens of residential age, disabled people and children under the age of 2 years upon admission to children's homes.

Measures in the epidemic focus. Anti-epidemic measures in the foci of salmonellosis and with an epidemic rise in the incidence of salmonellosis should be aimed at:

- source of infection (isolation, hospitalization);
- ways and factors of transmission of infection (a specific food product or water suspected of infection) are excluded from use until the completion of the entire complex of anti-epidemic measures in the focus;
- increasing the body's defense forces of people at risk of infection (emergency prevention is possible with the prescription of bacteriophages, immunomodulators in accordance with the instructions for the use of medicines).

Hospitalization of identified patients with salmonellosis (suspected of it) and bacterial carriers is carried out according to clinical and epidemiological indications

[1] СанПиН 3.3686-21 «Санитарно-эпидемиологические требования по профилактике инфекционных болезней» пп. 1996–2009.

[if it is impossible to comply with the anti-epidemic regime at the place of residence (identification of the patient), patients with salmonellosis from among the decreed population group].

Monitoring of persons at risk of infection in epidemic foci of salmonellosis is carried out by employees of territorial medical institutions. The duration of medical observation is 7 calendar days.

Contact persons belonging to the decreed contingent, children attending preschool organizations and summer health organizations, are medically monitored at the place of residence or actual stay.

The concurrent disinfection in the apartment foci is carried out by family members after a briefing by medical workers. The terminal disinfection is performed by specialists of organizations that have the right to engage in disinfection activities.

The rules for discharge and follow-up of convalescents after salmonellosis are as follows.

- Persons from among the decreed population group after clinical recovery (absence of fever, normalization of stool, cessation of vomiting) and a single laboratory examination with a negative result, conducted 1–2 days after the end of treatment in a hospital or at home, are discharged from the hospital.
- Persons who have had salmonellosis and do not belong to the decreed population group are discharged after clinical recovery. The necessity of their laboratory examination before discharge is determined by the attending physician, taking into account the peculiarities of the clinical course of the disease and the recovery process.
- When identifying carriers of salmonellosis pathogens that may be sources of infection (from the decreed population group), they are temporarily suspended from work and sent to the medical institutions for treatment (rehabilitation). Admission to work is given on the basis of the conclusion (certificate) of the attending physician on clinical recovery, taking into account the data of a control laboratory study.
- In case of a positive result of laboratory examinations conducted before discharge, the course of treatment is repeated with adjustments of therapy prescribed in accordance with the characteristics of the sensitivity of the pathogen to antibiotics. With positive results of a control laboratory examination conducted after a repeated course of treatment the persons from decreed contingent are monitored by a dispensary with a temporary transfer, with their consent, to another job that is not associated with epidemic risk. If it is impossible to transfer on the basis of the decision of the Chief State Sanitary Doctor or his deputies, they are temporarily suspended from work.
- Persons who have been ill with acute forms of salmonellosis of the decreed category are allowed to work after discharge from the hospital or treatment at home on the basis of a certificate of recovery issued by the medical institution, and if there is a negative result of a laboratory examination.
- Children studying in organizations engaged in educational activities, people who are in organizations for children's recreation and their health improvement, for orphans and who were left without parental care, are not allowed to be on duty in the food hall for 2 months after suffered salmonellosis.

- Persons from the decreed contingent who have been ill with salmonellosis and are carriers of the pathogen are subject to dispensary observation for 1 month with a clinical and laboratory examination conducted at the end of the observation.
- Children and adolescents who have been ill with salmonellosis, who attend preschool, who are in organizations for children's recreation and their recovery, for orphans and those who were left without parental care and in other types of closed institutions with round-the-clock stay, are subject to dispensary supervision for 1 month after recovery with daily medical examination. Laboratory examination is prescribed according to the indications (the presence of intestinal dysfunctions during the period of dispensary observation, weight loss, unsatisfactory general condition).
- The remaining categories of people who have had salmonellosis, dispensary supervision is prescribed on the recommendation of a doctor from medical institution.
- Removal from dispensary observation is carried out in the presence of a negative result of a laboratory examination.

Anti-epidemic measures in the foci of nosocomial salmonellosis when identifying a patient suspected of salmonellosis include:

- immediate dispatch of an emergency notification to the territorial authority authorized to carry out state sanitary and epidemiological supervision;
- immediate isolation, transfer of the patient to the infectious diseases department or diagnostic isolation rooms (semi-isolation rooms) in the specialized department in accordance with the legislation of the Russian Federation;
- prohibition of admission of new patients to the ward (isolation rooms, semi- isolation rooms) with the identified patient within 7 calendar days;
- medical supervision of persons at risk of infection within 7 calendar days from the moment of detection of the patient (to identify carriers or asymptomatic course of the disease among them — a single laboratory examination);
- removal from work of personnel with identified salmonella carrier, treatment and dispensary observation on general grounds;
- transfer of medical institution personnel with salmonella to work not related to nutrition, as well as servicing of children and patients requiring continuous care;
- specific prevention of salmonellosis among patients and hospital staff by bacteriophages;
- carrying out the terminal disinfection.

In case of a group incidence of salmonellosis in one or more departments of the medical institution or when salmonella is detected in the air and on other objects of the external environment the following measures are carried out:

- isolation of patients and bacterial carriers to the infectious department in accordance with the legislation of the Russian Federation;
- admission cessation of patients to the department (departments) where group morbidity is registered, and medical monitoring of contact persons is carried out within 7 days from the moment of isolation of the last patient;
- terminal disinfection in the department(s), cleaning and disinfection of ventilation systems;

- bacterio- and serological examination of contact persons, personnel to identify the source of infection;
- carrying out specific prevention by bacteriophages;
- prohibiting the movement of patients from ward to ward, as well as reducing the number of patients due to early discharge, taking into account the general condition of patients;
- closure of the department(s) by order of the organization carrying out state sanitary and epidemiological supervision.

The opening of the department(s) is carried out after a set of anti-epidemic measures[1] and the completion of medical supervision of contact persons.

Leptospirosis

Leptospirosis is an acute zoonotic natural focal infection caused by pathogenic representatives of the genus *Leptospira*. They are characterized by multiple organ lesions (mainly of the kidneys, liver and nervous system), accompanied by the development of intoxication, hemorrhagic syndrome and often jaundice.

Brief historical information. For the first time leptospirosis as an independent nosological form was described by A. Weil (1886) and N.P. Vasiliev (1888), and for a long time it was called Weil–Vasiliev disease. The discovery of the causative agent of this severe disease — *Leptospira icterohaemorrhagiae* — in 1914 by Japanese researchers R. Inada and U. Ido was of crucial importance for the nosological insulation of the disease. In subsequent years other leptospirosis became known, which causative agents were identified as independent serological types of *Leptospira*.

Etiology. Leptospirosis is caused by a number of morphologically similar pathogens from the genus *Leptospira*. This genus includes two species: parasitic — *interrogans* and saprophytic — *biflexa*. Differentiation of pathogenic and synthetic forms of *Leptospira* is carried out on the basis of cultural, biochemical, serological properties of microorganisms. On the basis of antigenic properties in *Leptospira interrogans* there are isolated serological variants (serovars), which are grouped by serological connections. By the present moment more than 250 serovariants of pathogenic *Leptospira*, assigned to 25 serological groups, have been identified.

The etiological structure of human leptospirosis is dominated by the pathogens of the serogroups grippotyphosa, icterohaemorrhagiae, canicola, pomona and seiroe. *Leptospira* are thin, mobile spiral-shaped microorganisms. They are grown on nutrient environment, containing blood serum. The growth optimum is 27–30 °C.

Leptospira is relatively stable in the external environment, especially in conditions of high humidity and pH in the range of 7.2–7.4. For example, in open water reservoirs they remain viable for up to 30 days, in moist soil — up to 279 days, on food products — from several hours to several days, in the alkaline urine of herbivores up to 3–4 days. *Leptospira* are sensitive to high temperatures: boiling kills them instantly, heating to 56–60 °C — within 20 minutes. They die quickly under the influence of direct sunlight. Bile, gastric juice and acidic human urine have a disastrous effect on them.

Reservoir and sources of infection. More than 130 mammalian species have been found to carry *Leptospira*. The main hosts (reservoirs) and sources of the causative

[1] СанПиН 3.3686-21 «Санитарно-эпидемиологические требования по профилактике инфекционных болезней» пп. 1974–1992.