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Mongolian Part of the Trans-Boundary Sailugem Natural Plague Focus in 2017. Communication 2. Modern Epidemiological Risks

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Objective – to study the current epidemiological risks at plague enzootic frontier territory of the Bayan-Ulgy aimag of Mongolia. **Materials and methods.** Epidemiological analysis was performed according to the reporting documentation of the National Centre of Zoonotic Infections in Mongolia, results of anonymous questioning of 179 residents of the Bayan-Ulgy aimag of Mongolia, materials of the Department of Health of the Bayan-Ulgy aimag, the Aimag Centre of Zoonotic Infections and the Administration of the Aimag Governor. **Results and discussion.** Plague was first registered in the Bayan-Ulgy aimag in 1989. The total of 9 patients with plague and 4 lethal outcomes were revealed. In all cases marmots were an infection source, the infection occurred in the process of cutting the carcasses. The majority of the plague patients had bubonic form of plague. All patients were men aged 13 to 34 years. Public inquiry showed that 21.8 % of population considered meat of marmots as a delicacy, 54 % – hunted for the animals, 25.7 % – consumed uncooked organs of marmots as a folk remedy, 19.5 % – participated in cutting of marmot carcasses. Results of the inquiry indicated that a marmot was an object of active hunting for local population. Analysis of epizootic activity of the trans-boundary Sailugem natural plague focus, modern social and economic conditions in the Bayan-Ulgy aimag has showed that in this territory epidemic risks have shaped and act at present. They can be divided into two groups: epidemic risks capable to cause human sporadic plague cases and epidemic risks leading to anthrozoönotic plague dissemination among the population and exportation of *Yersinia pestis* beyond the limits of enzootic territories. Effective interaction of anti-epidemic Institutions of Mongolia and Russia and also the Agencies and Institutions of the executive power of all levels permits to counteract these risks.

Key words: plague, epidemic risk, trans-boundary Sailugem natural focus, Mongolia.

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In most cases, the occurrence of epidemic complications of plague among the population is related to the increased epizootic activity, high virulence of the pathogen circulating in the enzootic territory and to the amount of human contact to the components of the parasitic system of the natural focus [3, 4, 7, 11]. The expansion of plague beyond the endemic territory is possible along the routes of the population migration and main freight traffic at the speed and distance accessible to air traffic of the region. Taking the above mentioned into consideration, the epidemic manifestations of plague on enzootic territories of neighboring countries such as Mongolia, China, Kazakhstan, and Kyrgyzstan, with which close economic, cultural and tourist relations are formed traditionally, should be the matter of particular importance for the entities of the Russian

Federation. It should be noted that the highest danger comes from transboundary natural plague foci, especially in the regions with free economic zones or the advanced development zones with simplified passport and visa requirements for crossing the State border [5, 10, 12]. From this perspective, the Republic of Altai is the region of a special interest, as today it is the region of implementation of large international investment projects and intensive development of eco-tourism. A transboundary Sailugem natural plague focus which epidemic potential has significantly increased over the last years is located on the territories of Kosh-Agach District of the Republic of Altai and Bayan-Ulgy aimags of Mongolia [3, 7, 9, 13]. Therefore, monitoring of the epizootic activity of the transboundary Sailugem natural plague focus and assessing the risk of hu-

man infection in its territory, are the matters of particular interest in order to ensure the epidemiological safety of the population.

The plague in Mongolia has been known for a long time, but its official registration began in 1931. Within 85 years (1931–2016), 627 cases of plague have been registered in 282 epidemiological foci. Plague in Mongolia is characterized with localized outbreaks of familial type, with the number of victims ranging from 2 to 7 people, sporadic cases prevail. Cases of infection among people are registered almost every year, but to date there is a steady reducing trend in the number of cases [1, 2, 6, 8, 10].

Epidemic foci of plague occurred in 15 out of 21 aimags of the country with evident territorial divergency.

In the middle of the last century, cases of plague infection were registered in the Arkhangai, Bayankhongor, Zavkhan, Govi-Altai and Uverkhangai aimags, which accounted for about 66.5 % of the epidemic foci. However, by the end of the century, cases of plague were first detected in Khovd (1983) and Bayan-Ulgy (1989) aimags. Within the period from 2001 to 2017 disease cases were registered in Bayan-Ulgy, Khovd, Bayankhongor, Arkhangai, Zavkhan, Khuvsugul, Uverkhangai and as well in Khentii and Govisumber aimags [2, 10]. It should be emphasized that in Arkhangai, Khuvsugul, Uverkhangai, Gov-Sumber aimags plague cases among people in those somons where epizootic manifestations were not detected.

Objective – to study the current epidemiological risks at plague enzootic frontier territory of the Bayan-Ulgy aimag of Mongolia.

Materials and methods

The study applied the data of reporting documentation of the National Zoonotic Infections Center of the Ministry of Health of Mongolia, the results of an anonymous survey of 179 residents of the border somons of the Bayan-Ulgy aimag of Mongolia, obtained during an epizootiological investigations of the territory of the transboundary Sailugem natural plague focus by the joint Russian-Mongolian epidemiological troop in summer 2017. The troop members were specialists of the National Center for Studies of Zoonotic Infections of the Ministry of Health of Mongolia, the Center for Studies of Zoonotic Infections of the Bayan-Ulgy aimag, the Altai Anti-Plague Station and the Irkutsk

Research Anti-Plague Institute.

The investigation used the materials of the Department of Health and Social Policy of the Bayan-Ulgy aimag, the aimag Center for Zoonotic Infections and the Governor's Executive Office of the Bayan-Ulgy aimak about migration activity of the population at the Ulaanbaishint vehicle Border Inspection Post.

Results and discussion

For the first time, the plague among the population of the Bayan-Ulgy aimag was found in 1989 in the territory of the Tolbo Somon, in the central part of the aimag bordering the endemic Khovd aimag.

Further cases of the disease of people were registered in Tolbo (1990, 1993), Deluun (1991), Buyant (1998), Ulaankhus (1999), Bugat (2002), Sagsai (2009) and Tsengel (2010) somons of the Bayan-Ulgy aimag.

The total of nine plague patients, four of which had lethal outcome, were revealed within the period from 1989 to 2017 in 7 out of 14 somons of the aimag.

In all the cases of the disease the infection source was a marmot, infection occurred during cutting of the carcasses of marmots.

Seven patients had the bubonic form of plague, among which in one case the course of the disease was complicated by the development of secondary septicemic form, in two cases, it was complicated with secondary pneumonic form. Two registered cases were primary septicemic and cutaneous forms of plague. All the patients were men aged from 13 to 34 years.

Over recent years in the neighboring Khovd aimag plague patients have been registered in Altai (2013), Bulgan (2015) and Jargalant (2017) somons.

Let us consider the case of the plague that is indicative in many respects. On August 24, 2017, a man "M" applied for medical assistance to the Khovd aimag Hospital. As it became known based on his words, on the eve, he injured his right thumb near the joint while cutting a marmot's carcass, and he licked the appeared blood instinctively. He boiled marmot meat and consumed a few pieces. «M» threw away the skin, head, remaining cooked meat and offal into the trash container near his house. The patient personally hunted the two marmots on July 26, at Ulaagchin pass in Deluun somon of Bayan-

Ulgay aimag and kept them frozen for a month in an in-house refrigerator. Previously the patient has multiple times consumed marmots, but in this time he was alarmed by the taste, the meat texture, the plethoric internal organs and liver swelling of the animal, therefore he immediately applied for medical help.

At the moment of applying to the hospital, the patient had no registered clinical evidences. Considering the epidemiological history, he was hospitalized in the department of infectious disease, where he was started on combined antibiotic therapy, combining first-generation cephalosporins (cefazolin) with broad-spectrum aminoglycosides (gentamicin, streptomycin).

During examination of the epidemic focus by the specialists of the aimag Center of the study of zoonotic infections, the remains of the first marmot in the garbage can were not found. A whole carcass of the second marmot was removed from the refrigerator in the apartment of the patient and sent for laboratory testing. Microscopic investigation detected Gram negative bipolars in smears of the marmot's brain and spinal cord. It was not possible to isolate the culture of the plague microbe from the parenchymal organs, lungs, heart and bone marrow of the animal by the bacteriological technique. During a serological examination on August 24, a capsular antigen (FI) of the plague microbe was detected in three samples of the clinical material of the patient «M» (2 – swabs of the lymphoid ring, 1 – secretion of the wound).

Plague microbe was detected by the PCR method in the suspension of organs of the marmot and in the patient's secretion from the wound. On August 25 with the background of antibiotic therapy, the patient complained of chest pain on the right while inhaling. On examination: the tonsils were hyperemic, slightly swollen and the cervical lymph nodes were painful on palpation. In general, the patient's condition was satisfactory, fever was absent, as well as other clinical evidences. The outcome of this case was the recovery of the patient. Based on the combination of the epidemiological history, clinical evidences and the results of laboratory investigations, the final diagnosis was “plague, anginous form.” Epidemiological investigation detected six people who had contact with the patient. They were hospitalized in the infectious diseases department of the aimag hospital, where they received combined prophylactic antibiotic therapy with doxycycline and

ciprofloxacin. As can be seen from the above, the epidemic plague focus was localized and eliminated in the shortest term, resulting from the early applying of the patient for medical assistance, timely diagnosis, and prompt implementation of a complex of preventive and anti-epidemic measures.

It should be noted that one of the new epidemiological risks has manifested itself with a human infection with plague in the Khovd aimag. Such risk is determined by the wide penetration of modern household appliances, in particular, refrigerators and freezers into the life of the nomadic population. Usage of such appliances creates conditions for the long-term preservation of products in frozen form, including marmot carcasses contaminated by the plague pathogen. It can lead to epidemic complications both in the non-characteristic for this disease year season and far beyond the endemic territory. Furthermore, it is a potential risk of plague infection for people who are normally not in any way in contact with the ecosystem of the natural focus due to their professional activities or living conditions [3].

The materials obtained in the period from 1953 to 1990, when the epizootic situation in the transboundary Sailugem natural focus was monitored on an ongoing basis, demonstrate that the plague pathogen that was circulating on the territory of this focus was related to Altai and less often to the Ulegy subspecies. A characteristic feature of the plague microbe of these subspecies is selective virulence, which determines their low epidemic danger. Since 1991, epizootiological investigation in the Mongolian part of the Sailugem transboundary natural focus is being carried out occasionally and on a limited scale, which does not allow assessing the actual situation in this territory.

According to the results of the epizootiological investigation performed by the Russian-Mongolian epidemiological troop (summer 2017), it was established that in the border areas of the Bayan-Ulgay aimag in the territory of Ulaanhus, Tsagaanuur and Nogoonnuur somons there are active epizootic manifestations occurring on a vaster area. The epizootic process takes place mainly in the settlements of the gray marmot and is caused by the circulation of the plague microbe of the main subspecies. Penetration of the microbe into the Sailugem natural focus led to a significant increase of the risk of epidemic complications of plague among the population of the northern somons of the Bayan-Ulgay

aimag, It resulted as well in significant increase of the probability of the disease exportation outside the enzootic territory to adjacent regions of Russia and Mongolia. In the summer period of the year about 18 thousand people inhabit the territory of active epizootic manifestations and the main occupation of the adult population is transhumance.

The risk of plague infection of the local population is illustrated by the results of an anonymous questioning of 179 residents of frontier somons (Nogoonuur, Tsagaannuur, Ulaanhus). It showed that 21.8 % of respondents consider marmot meat a delicacy, 54 % hunt for it, 25.7 % consume raw marmot organs as a folk remedy, 19.5 % participate in cutting carcasses. The results of the survey demonstrate that, despite the inhibition on marmot hunting in Mongolia, it is subject to active hunt.

Despite the high risk of plague infection in the population, as evidenced by the detection of sporadic cases of the disease in the aimag, only 3,000 doses of live anti-plague vaccine have been ordered in 2017, wherein, population of the aimag is over 100 thousand people. The vaccination coverage of the population living in the plague enzootic border area of the Bayan-Ulgy aimag in 2017 ranged from 23 % in the free economic zone of Tsagaannuur, to 1.5 and 2.3 % in the majority of the Nogoonuur somons and Ulaanhus, respectively. It should be highlighted that the majority of the local population are rural people, and their main occupation is transhumance; the richest rangelands are located on the enzootic in plague territory.

In addition, in the natural foci of the plague, no measures are taken on a regular basis for the non-specific preventive treatment of plague in closed and open stations. Under such conditions, the risk of infection of people increases significantly. Therewith there are more than 5,000 Mongolian Bactrian camels on free grazing on the territory of the aimag; in the absence of systematic veterinary surveillance and anti-plague vaccination, this condition strongly increases the epidemiological significance of these animals as possible sources of infection for the local population.

Over the last years, ecological and ethnographic tourism has been actively growing in Mongolia. This growth is related to the low population density, the preservation of the traditional way of life, respect for historical and natural monuments, and the ecosystem of the country. About 60 thousand tourists from Russia, Kazakhstan, Europe and North

America visit the Bayan-Ulgy aimag annually.

Generally, the objects of visit are ethnographic, geological and natural monuments, sport fishing on lakes and rivers is popular. Tourists visit aimags as members of organized groups, as well as independently, using motor transport and even bicycles.

In 2017 the number of people crossing the Russian-Mongolian border at the Ulaanbaishint vehicle Border Inspection Post in both directions was 94585 people (2015 – 102953; 2016 – 115773).

In comparison to 2014 (55,125 people), the passenger traffic over the past three years has increased 1.5–2.0 times. The following bus routes operate on a regular basis: Ulgy – Tsagaannuur – Ulaanbaishint – Kosh-Agach – Barnaul – Novosibirsk and Ulgy – Tsagaannuur – Ulaanbaishint – Kosh-Agach – Almaty – Astana.

The international airport of Ulgy has regular flights to Ulaanbaatar and major cities of Kazakhstan.

The peak point of migration activity of the population occurs in the period of June – August, which overlaps with the seasonal intensification of epizootic manifestations in the natural plague foci of the marmot type of northwestern Mongolia.

An analysis of the epizootic activity of the transboundary Sailugem plague focus and social and economic factors of the Bayan-Ulgy aimag showed that at the present day there are epidemiological risks that can be divided into two groups in this territory.

The first group is epidemiological risks that can lead to the occurrence of sporadic cases of human plague infection:

- further spread of highly pathogenic epidemically significant agent of plague of the main subspecies in the ecosystem of the transboundary Sailugem natural focus;
- large population of gray marmot and intense epizootics in its settlements, caused by the circulation of the plague microbe of the main subspecies;
- popularity of hunting for the gray marmot among the local population;
- a high level of contact of the local population with the components of the parasitic system of the natural plague focus, due to the nature of the main occupation of the able-bodied population and the way of life;
- low vaccination coverage of the local population;
- the lack of non-specific plague prevention

measures organized on regular basis;

- the lack of constant veterinary supervision of camels grazing on the enzootic plague territory, and their vaccination against the plague.

The second group is epidemiological risks that can lead to the anthroponotic spreading of plague among the population and the exportation of the plague agent beyond the enzootic territory:

- isolation of the areas of livestock grazing at summer period from health care facilities, which complicates timely applying for medical help;

- availability of conditions for long-term preservation in the frozen state of the marmot carcasses contaminated by plague causative agent;

- high intensity of migration activity in the aimag, caused by the development of cross-border trade and international tourism.

The realization of these risks can lead to occurrence of both sporadic cases of the disease and significant epidemic complications of plague among the population of the Bayan-Ulgy aimag, including in the areas bordering Russia. These events against the background of high migration activity of the population and developed tourist destinations in the aimag territory significantly increase the probability of transporting the disease both to neighboring aimags and far beyond the borders of Mongolia. The only way to counteract the existing epidemic risks is to ensure the efficient cooperation of the anti-epidemic institutions of Mongolia and Russia, as well as the bodies and institutions of the executive branch at all levels. The development and implementation of a targeted interstate program is the best solution for minimizing the risks of epidemic complications of plague in the border areas of the transboundary Sailugem focus.

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