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BRIEF REPORT – OPEN ACCESS

Human Anthrax in Kazakhstan From 2016 to 2018

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ABSTRACT

Anthrax is primarily a disease of herbivores, and it occasionally infects humans. The majority of human cases occur in an agricultural environment and result from individuals coming into contact with dead or dying animals. Although anthrax occurs worldwide, it is endemic in Kazakhstan. The data were obtained from the reported and recorded cases of anthrax in Kazakhstan between 2016 and 2018. The results were analyzed according to clinical presentation, source of infection, and transmission. In 2016–2018, 21 cases of anthrax were registered in five regions of Kazakhstan. Contamination of people occurred when dying animals were illegally slaughtered. Of these cases, 17 were of cutaneous form and 4 were of generalized form that ended by death due to delayed diagnosis and therapy. A fatal clinic form of anthrax was presented. Clinical forms of human anthrax are life threatening. Early diagnosis and initiating supportive treatment with appropriate antimicrobial therapy can save life. Educating physicians and animal owners, following good veterinary practice, ensuring close surveillance, and regular immunization of animals against anthrax may control infection in endemic and hyperendemic areas.

Keywords: Anthrax, epidemiology, fatal case, Kazakhstan

INTRODUCTION

Anthrax is primarily a disease of herbivores, and it occasionally infects humans. The causative agent of anthrax is *Bacillus anthracis*, which is a gram-positive, aerobic or facultative anaerobic, endospore-forming, rod-shaped bacterium. Although anthrax occurs worldwide, it is endemic or hyperendemic in both animals and humans in some part of areas of the world, particularly in Latin America, Central Asia, China, Middle East, West Africa, and some parts of India (1).

Anthrax infections can be divided on the basis of the manner of infection into two main categories: naturally acquired anthrax (representing by far the commonest type) and bioterrorism-related anthrax (which is rare) (2, 3). *Bacillus anthracis* spores are transmitted by direct contact with or ingestion of contaminated food or inhalation of *B. anthracis* spores. The majority of human cases occur in an agricultural environment and result from individuals coming into contact with dead or dying animals (2, 4–6).

This study aimed to discuss human anthrax in Kazakhstan between 2016 and 2018 and to present a fatal clinic form of anthrax.

MATERIALS and METHODS

This study was retrospectively performed in Kazakhstan. Kazakhstan is located in Central Asia, and it shares its border with Kyrgyzstan, China, Russia, Uzbekistan, and Turkmenistan. The population of Kazakhstan is about 18 million. Of the Kazak people, 42.2% live in rural areas, and their main source of income is animal care. Medical reports of anthrax between 2016 and 2018 were reviewed and evaluated for infection source, lesion localization, severity of infection, complications, treatment, and outcome. In these reports, the diagnosis was based on the history of an exposure to sick animals or animal products, clinical findings compatible with cutaneous anthrax, demonstration of gram-positive bacilli from a lesion, and/or isolation of *B. anthracis* from the lesion (7).

The data for anthrax cases recorded from 2016 to 2018 were also obtained from the Regional Sanitary Epidemiological Service.

RESULTS

Anthrax in Kazakhstan

The Kazak Ministry of Health recorded 21 human anthrax cases in Kazakhstan between 2016 and 2018. These

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cases were registered from five regions of Kazakhstan: 11 cases in Karaganda, 3 in Almaty, 3 in Pavlodar, 3 in East Kazakhstan, and 1 in South Kazakhstan (7). Nineteen cases were registered in 2016, one case in 2017, and one case in 2018 (Table 1). Cumulative regional distribution of 21 cases recorded between 2016 and 2018 is plotted on a map of Kazakhstan (Fig. 1). The last case was registered in East Kazakhstan.

Twenty cases were of cutaneous anthrax. Four cases of generalized anthrax resulted in death. In their history before admission to hospital, 10 patients had used local applications and 1 patient was operated for wound. Eleven cases were admitted to hospital at the fifth day of the disease.

The source of infection in 21 cases was found to be direct contact with contaminated materials (slaughtering and skinning of ill or dead animals, splashing of blood, chopping of meat).

CASE

A 48-year-old patient was admitted to the Infectious Diseases Hospital in Oskemen with the complaints of bullae on the left arm in the area of the hand and forearm, swelling of the left hand and parascapular area, and bursting pain. The lesion had initiated one week ago with itching on left wrist. The patient had no history of visit to physicians. On the fifth day of the disease, the edema expanded from the primary lesion to around and increased. The paramedic, suspecting cutaneous anthrax, transferred the case to the Infectious Department. Clinical diagnosis was confirmed by positive polymerase chain reaction (PCR) for *B. anthracis*. The therapy of an antibiotic combination (ceftriaxone 2 g × two times, and ciprofloxacin 500 mg × two times) together with intravenous fluid infusions for three days was initiated. Even with the treatment, condition of patient became worse, there was an increase in edema of the left arm, extended to parascapular area to develop multiple bullae with serous content on the hand, consists of serous hemorrhagic fluid. Some of bullae were open and developed ulcers. The body temperature did not rise. Epidemiological history showed that the patient lived in the village and had cattle. Four days before admission, a calf fell sick, and the patient slaughtered it.

The initial examination showed that body temperature was 36.6°C. The general condition was severe toxic together with local inflammation. Consciousness was clear and sluggish. There was no meningeal syndrome. In the left axillary region, a painful, dense, moderate mobile lymph node up to 3.0 cm in size was palpated. Pulse was 94 per minute, and blood pressure was 110/80 mm Hg. Swelling was observed in the left arm, anterior chest wall, left parascapular area. A hemorrhage bulla formation was also observed on the left hand and arm (Fig. 2). A painless ulcer was covered by a black cortex. In left axillary area, a painful lymph node 3 cm in size was palpated. Laboratory examinations revealed leukocytosis, hematuria, impaired liver and kidney functions tests, high C reactive protein (CRP) level, decrease of fibrinogen, and activated partial thromboplastin time (Table 2). In the samples taken from the lesions, PCR for *B. anthracis* was positive. Upon the diagnosis of complicated and severe form of cutaneous anthrax with toxemia, the antibiotic treatment was changed to intravenous penicillin G (1000000 IU × six times) and ciprofloxacin (400 mg × two times) together with intravenous fluid infusions.

On the eighth day of the disease, the patient's condition deteri-

Table 1. Annual number of human anthrax cases from 2016 to 2018 and anthrax incidence in Kazakhstan

Year	Mid-year population	Number of cases	Incidence rate (per 100.000)
2016	17.918.200	19×	0.1
2017	18.157.100	1	0.0055
2018	18.324.237	1	0.0054

× - 1 case was diagnosed as digestive system anthrax who was died

Figure 1. Regional distribution of human anthrax cases recorded between 2016 and 2018 in Kazakhstan

Figure 2. An extended edema, severe inflammation, and bullae in the left arm of the patient

Table 2. A summary of the laboratory test results of the case according to hospital days

Laboratory test	Hospital days		
	Day 1	Day 2	Day 3
WBC (x10^9/l)	26.9	26.0	22.8
Haemoglobin (g/l)	165	163	56
RBC (10^{12}/l)	5.15	5.0	1.74
Trombocytes (x10^9/l)	147	195	110
ESR (mm/h)	3	7	12
ALT (Ed/l)	125	101	49
AST (Ed/l)	164	139	103
T bil (mcmol/l)	68.22	65.42	17.53
D bil (mcmol/l)	10.27	8.6	15.8
Creatinine (mcmol/l)	122.12	82.8	96.5
Glucose (mcmol/l)	4.81	5.5	9.8
Amylase (Ed/l)	34	33	27
CRP		+	
INR	1.4	1.45	
APTT (sec)	22.8	22.8	
Fibrinogen (g/l)	2.20	1.18	

WBC: White blood cells; RBC: Red blood cells; ESR: Erythrocyte sedimentation rate; ALT: Alanine aminotransferase test; AST: Aspartataminotransferase test; T bil: Total bilirubin; D bil: Direct bilirubin; CRP: C reactive protein; INR: International normalized relation; APTT: Activated partial thromboplastin time

orated and gastrointestinal bleeding developed, objectively manifested by bloody vomiting and diarrhea. The clinical picture was disseminated intravascular coagulation (DIC) due to severe cutaneous anthrax complicated with toxemic shock. Despite intensive therapy, the case resulted in death.

DISCUSSION

In many countries in the world, anthrax is a serious health problem. According to the World Health Organization data, the frequency of anthrax distribution in the world ranges from 2000 to 20,000 cases in 82 countries (8). Instability of the current epidemiological situation of anthrax is associated with intermittent epizootic outbreaks, which cause human morbidity, as people are infected mainly because of contact with sick animals, their corpses, or livestock products. New mechanisms of infection spread in aerosol due to the intentional use of spores for bioterrorism and because of the use of African drums contaminated with spores of the Anthrax microbe, parenteral use of contaminated heroin, which led to the release of a new clinical form of anthrax that is named injectional anthrax (9).

More than 95% of naturally occurring anthrax presents a clinical form of cutaneous infection (2, 5, 10). More than 90% of the lesions occur on exposed areas such as the face, neck, arms, or hands (2, 10). Pulmonary and digestive system anthrax are rare. Majority of cases registered in Kazakhstan were of cutaneous anthrax. No pulmonary system anthrax was registered, but only one digestive system anthrax was recorded in 2016–2018.

In Kazakhstan, there are 1778 unfavorable by anthrax settlements and 2433 epizootic and epidemic foci. Sporadic cases of anthrax occur every year in Kazakhstan. Relative morbidity rate varies from 0.01 to 0.24 per 100,000 population. Uncontrolled and illegal slaughtering is main reason for the developing anthrax infection in Kazakhstan. Illiteracy and poverty are main forces contributing to uncontrolled and illegal slaughtering in rural areas.

Almaty region is located in the territory with a high risk of anthrax. A total of 183 unfavorable by anthrax settlements, and 271 epizootic and epidemic foci are situated in the region. From 1935 to 2016, 198 human anthrax cases and 1845 animal anthrax cases were recorded. In 2016, three cases were recorded.

East Kazakhstan region is situated in the territory with a high risk of infection. The region has 195 unfavorable by anthrax settlements and 281 epizootic and epidemic foci. From 1938 to 2016, 132 human anthrax cases and 4223 animal anthrax cases were registered. In 2016, two cases of cutaneous form were registered in the region. Both cases recovered by therapy.

Pavlodar region is located in the territory with a low risk of anthrax. A total of 115 unfavorable by anthrax settlements and 116 epizootic and epidemic foci are situated in region. From 1951 to 2016, 77 human anthrax cases and 618 animal anthrax cases were registered. Three cases of anthrax occurred in 2016; one case had fatal outcome (7). Three patients in age from 30 to 50 years from one epidemiological focus were applied to Pavlodar Infectious Hospital. Two patients had cutaneous form, and one had generalized form. Patient with generalized form was hospitalized on the sixth day of the disease. In clinical picture intoxication, painless ulcers with black cortex on forearm and finger of the right arm, lymphadenitis in left axillary area, weakness, abdominal pain developed. Diagnosis was anthrax sepsis. The case was complicated with toxemic shock, toxic nephritis, acute renal failure, pneumonia, acute respiratory failure, DIC syndrome, toxic hepatitis, and acute liver failure. Diagnosis was confirmed by PCR. Despite treatment, patient died due to anthrax sepsis.

Karaganda region is situated in the territory with a moderate risk of anthrax. A total of 114 unfavorable by anthrax settlements and 137 epizootic and epidemic foci were seen in region. From 1944 to 2016, 115 animal anthrax cases and 2883 animal anthrax cases were registered. In 2016, eight anthrax cases (two with lethal outcome) were registered in June and three cases in August (7). In June, three people participated in the slaughter of a sick cow; four chopped up the carcass of a sick animal; and one person was probably bitten by a black fly. In August, one patient participated in the slaughter of a sick male calf; one man made semi-finished meat products; and one chopped up the carcass of a sick animal.

CONCLUSION

Anthrax is an endemic disease in rural areas of Kazakhstan. Clinical presentation of cutaneous anthrax is mostly mild; it may be sometimes severe and complicated such as sepsis, toxemic shock, and other organ involvement. These clinical forms are life threatening. Early diagnosis and initiating supportive treatment with appropriate antimicrobial therapy can save life. Physicians, working not only in an endemic area for anthrax but also in Western coun-

tries, should be aware of all clinical forms of anthrax. Controlling anthrax in humans depends on controlling the infection in animals. Educating animal owners, following good veterinary (appropriate burying or cremation of animal carcasses as well as decontamination and disinfection procedures), ensuring close surveillance, and regular immunization of animals against anthrax may control infection in endemic and hyperendemic areas.

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