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Evaluation of an Anthrax Epidemic in Eastern Türkiye and Source Control

Türkiye'nin Doğusunda Bir Şarbon Salgınının Değerlendirilmesi ve Kaynak Kontrolü

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ABSTRACT

Introduction: *The present study reports anthrax cases who presented to Fırat University Hospital, and provides details of the surveillance data, contact tracing, and efforts to break the infection chain with an analysis of the garnered data.*

Materials and Methods: *A total of 174 individuals who had been in contact with two infected animals during and after their slaughter, whether through direct skin contact or exposure to their intestinal tract, were included in the study examining a recently identified anthrax outbreak in two locations within the city of Muş, Eastern Türkiye.*

Results: *A patient presented to our center with a preliminary diagnosis of ophthalmic periorbital cellulitis/necrotizing fasciitis. Following a preliminary diagnosis of anthrax, gram-positive bacilli were identified in the Gram stain of a sample obtained from the lesion, and the microbiological diagnosis was confirmed. An outbreak evaluation report was subsequently produced based on all the collected data. The outbreak was found to originate from two sources, 8.5 km apart, in two locations in the same city. Among the total 174 contact persons in two locations were, eight women (five nursing), one pregnant woman and two babies. The median age of the hospitalized patients was 41 years (24-71). Of the hospitalized patients, two were female (20%) and eight (80%) were male. Furthermore, seven were animal breeders (70%), two were housewives (20%) and one was a government official (10%). Contact was through the skin and the gastrointestinal system in ten (100%) patients. Lesions were on the face in one (10%) and in the upper extremity in nine (90%) patients.*

Conclusion: *A leading factor in prevention and infection control is to ensure coordination among all involved institutions. The Directorate of Agriculture in the city initiated animal vaccinations, and the region was placed under quarantine to prevent the entry or exit of infected animals until the outbreak subsided. Since anthrax spores can survive in soil for a long time, the most effective approach to preventing anthrax in both humans and animals is vaccination.*

Key Words: *Anthrax; Endemic; Outbreak*

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ÖZ

Türkiye'nin Doğusunda Bir Şarbon Salgınının Değerlendirilmesi ve Kaynak Kontrolü

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Giriş: *Bu çalışmada Fırat Üniversitesi Hastanesine başvuran şarbon vakaları raporlanmakta ve elde edilen verilerin analiziyle sürveyans verileri, filyasyon ve infeksiyon zincirini kırma çabalarına ilişkin ayrıntılar sunulmaktadır.*

Materyal ve Metod: *Muş ilinde iki lokasyonda yeni belirlenen şarbon salgınının araştırıldığı çalışmaya, infekte iki hayvanla kesim sırasında ve sonrasında deri veya bağırsak yoluyla temas eden toplam 174 kişi incelendi.*

Bulgular: *Merkezimize periorbital selülit/nekrotizan fasiit ön tanısıyla sevk edilen hastada şarbon düşünüldü. Şarbon ön tanısı sonrasında, lezyondan alınan örnekte Gram boyama ile gram-pozitif basil tespit edildi ve mikrobiyolojik tanı şarbonu doğruladı. Ardından, toplanan verilere dayanarak bir salgın değerlendirme raporu oluşturuldu. Salgının, aynı şehirdeki iki farklı yerde, birbirinden 8.5 km uzakta iki kaynaktan kaynaklandığı belirlendi. İki yerdeki infekte hayvanlarla temas kuran 174 kişi arasında sekiz kadın (beşi emziren), bir gebe ve iki bebek bulunmaktaydı. Hastanede yatan hastaların ortanca yaşı 41 (24-71) idi. Hastaneye yatırılan hastaların ikisi (%20) kadın, sekizi (%80) erkekti. Ayrıca yedisi (%70) hayvan yetiştiricisi, ikisi ev hanımı (%20) ve biri de devlet memuru (%10) idi. Temas 10 (%100) hastada deri ve gastrointestinal sistem yoluyla gerçekleşti. Lezyonlar bir (%10) hastada yüzde, dokuz (%90) hastada ise üst ekstremitedeydi.*

Sonuç: *Önlem ve infeksiyon kontrolünde önde gelen faktörlerden biri ilgili tüm kurumların koordinasyonunun sağlanmasıdır. Kentte Tarım Müdürlüğü hayvan aşılarına başladı ve salgın geçene kadar infekte hayvanların giriş çıkışını önlemek amacıyla bölge karantinaya alındı. Şarbon sporları toprakta canlılığını uzun süre koruyabildiğinden hem insanlarda hem de hayvanlarda şarbonun önlenmesinde en etkili yaklaşım aşılardır.*

Anahtar Kelimeler: *Şarbon; Endemi; Salgın*

INTRODUCTION

The early identification of cases and the presence of a surveillance system for epidemic control may prevent the eruption of new cases and the development of an outbreak. In surveillance, data is collected, analyzed, and shared with the necessary units to make an assessment, evaluate practices targeting the protection of society, and support the development of new approaches.

Infectious diseases remain challenging in Türkiye and around the world in terms of mortality and morbidity[1,2]. The deaths and economic loss linked to the COVID-19 pandemic have brought the importance of infectious diseases back to the agenda[3]. Anthrax, one of the earliest known zoonotic diseases in the world is an important infectious disease[4]. *Bacillus anthracis*, the causative agent of anthrax, can persist for centuries in grass, where it contaminates the environment with its spores[4]. Anthrax is a disease of herbivorous animals, and pasture contaminated with anthrax spores is the most common source of infection in ruminants, while humans are subsequently infected through contact with infected animals[5]. Türkiye is among the countries in which anthrax is endemic, although the number of cases decreased between 1960 and 2005[6]. A total of 1744 human anthrax cases were reported between 2007 and 2019, as well as 10 deaths, although the incidence of anthrax decreased to 0.04 from 0.09 in 2019. Anthrax cases are most commonly seen in August and September, and all cases were reported to be of agricultural origin[7].

Bacterial spores entering the human body through the skin, gastrointestinal tract, inhalation, and intravenous drug use can result in the development of anthrax and septicemia[4]. The high-risk groups for anthrax include animal breeders in endemic regions, butchers, veterinarians, leather manufacturers, laboratory workers, raw meat consumers, and intravenous drug users[7,8]. The present study reports two cases of anthrax who presented to our hospital

and provides details of the surveillance data, contact tracing, and efforts to break the infection chain with an analysis of the garnered data.

MATERIALS and METHODS

A total of 174 individuals who had been in contact with two infected animals during and after their slaughter, whether through direct skin contact or exposure to their intestinal tract, were included in the study examining a recently identified anthrax outbreak in two locations within the city of Muş, Eastern Türkiye. Contacts were identified through anamnesis. Contact tracing was performed by the primary care physicians and the local health authority of the city of Muş per the legislation of the Ministry of Health of the Turkish Republic. The individuals were coded using a combination of letters and numbers to create a schema for contact tracing. The first digit indicated the town (X, Y), the second was the number given to the first contact person, and the third was a letter given to the family member.

IBM SPSS Statistics (Version 22.0. Armonk, NY: IBM Corp.) was used for the statistical analysis. Continuous variables were expressed as median (minimum-maximum) and categorical variables as frequency and percentages.

Ethics approval was obtained from the Non-Interventional Ethics Board of the Fırat University, Faculty of Medicine (18.11.2021-2021/12-11). An official letter was sent to the Muş City Health Directorate. The study was carried out following the principles of the Helsinki Declaration.

RESULTS

A case of anthrax was diagnosed and reported after a patient was referred to our center from a city in eastern Türkiye, which covers an area of 2604 km^2 and has an altitude of 1350 meters. An outbreak was confirmed following an assessment, and further spread was prevented. A patient presented to our center with a preliminary diagnosis of ophthalmic periorbital cellulitis/necrotizing fasciitis on July 12, 2021. After a preliminary diagnosis of anthrax, gram-positive bacilli were identified in the Gram stain of a sample taken from the lesion, confirming the microbiological diagnosis. The patient was informed about anthrax and was encouraged to provide an accurate anamnesis. An outbreak evaluation report was subsequently produced based on all the collected data.

The outbreak was found to originate from two sources, 8.5 km apart, in two locations in the same city. The first location, town X, is approximately 8.5 km from the city center and is composed of five districts, with a total population of around 7000. The town's economy relies on agriculture and animal breeding, supplemented by three textile mills. Town Y, situated 3 km from the city center, is home to approximately 2000 residents and sustains its economy primarily through agriculture and animal breeding.

Contacts

A person in town X (1A) slaughtered an animal that had not undergone veterinarian controls and had no lug marks before falling ill. Two other persons were involved in the slaughter on 05.07.2021, and the meat was distributed to relatives, while some was sold. At this stage, 16 people had come into contact with the animal. Among the meat that these people took home, the ones with contact were evaluated. The first persons who came into contact with the source were coded A, and those in their homes were coded using letters, respectively.

Person 1A had also taken the meat home and became ill on July 12, 2021, resulting in their presentation to our center. Person 7B, who lives in 7A's house, had a bloody bone fragment splattered on his face while chopping meat and then presented to the center with a significant swelling and lesion on his face. Person 10A distributed the bones of the meat he took home to stray animals, so that stray animals came into contact with the contaminated material. Those residing in the home of 11A poured the meat on the stray when they heard that the slaughtered animal had been sick, thus contacting the stray animals. Persons 15A and 16A came into contact through their involvement in the slaughter of the animal (Table 1).

A total of 93 persons (49 female, 44 male) and an uncertain number of stray animals were contacted in town X. Prophylaxis was started in 39, with ciprofloxacin 750 mg b.i.d. and amoxicillin clavulanate 1000 mg b.i.d. in adults,

Table 1. The individuals who had initial contact during the slaughter of the animal in town X, as well as those who came into contact after the meat was taken home

First contacts	Contacts within the household
1A	1B, 1C
2A	2B, 2C, 2D
3A	3B, 3C, 3D, 3E, 3F, 3G, 3H, 3I (three months old baby)
4A	4B (suspicious skin lesions), 4C, 4D, 4E, 4F, 4G, 4H, 4I
5A	5B, 5C, 5D, 5E (2 month-old baby)
6A	6B, 6C
7A	7B, 7C, 7D, 7E, 7F, 7G, 7H, 7I, 7J, 7K, 7L, 7M, 7N
8A	8B, 8C, 8D
9A	9B, 9C, 9D, 9E, 9F, 9G, 9H, 9I, 9J
10A	10B, 10C, 10D, 10E, 10F, 10G, 10H
11A	11B, 11C, 11D, 11E, 11F, 11G, 11H
12A	12B, 12C, 12D, 12E, 12F
13A	13B, 13C, 13D, 13E
14 A	14B, 14C
15A	
16A	

and in nursing women and children, respectively. Antibiotic dosage adjustment for children was made based on kilograms.

A person in town Y (1A), slaughtered an animal that had not been subject to veterinarian controls and that suddenly fell ill. Two other people were involved in the slaughter and the meat was distributed to relatives, while the remaining parts were sold. A total of 14 people had come into contact with the source at this phase. Person 1A also took meat home and presented to our center on July 14, 2021, after becoming ill. Person 10A gave the bones of the meat that he had taken home to stray animals, and so the stray animals were also contacted. 11A poured the meat on the stray when he heard that the slaughtered animal had been ill, causing further stray animals to be contacted. 13A and 14A were also actively present during the slaughter (Table 2).

Total number of contacts

Among the total 174 contact persons in two locations were, eight mothers (five nursing), one pregnant woman, and two babies.

Prophylaxis was started with ciprofloxacin 750 mg b.i.d. and amoxicillin clavulanate 1000 mg b.i.d. in adults, nursing women, and children, respectively. Antibiotic dosage adjustment for children was made based on kilograms.

During the field research, the houses of those who had come into contact were visited together with the town's family physician. The meat of the sick animals was collected and delivered to the Provincial Directorate of Agriculture. Residents were advised to clean any refrigerators and surfaces that had come into contact with the meat using a 1% sodium hypochlorite solution and to allow the bleach to remain on the surfaces for two hours. All houses were instructed to be properly ventilated. The family physicians monitored individuals who had been in contact for five days to observe any development of symptoms. The areas where the meat had been left for stray animals were cleaned with a 1% sodium hypochlorite solution. X4B, X7B, Y2C, Y6B, Y8D, and Y9B were referred to the hospital after developing skin lesions.

Hospitalized Patients

X1A, X7B (splashed by a bloody bone), X12F, X14B, X15A, X16A, Y1A, Y2A, Y6A and Y11A were hospitalized.

Table 2. The individuals who had initial contact during the slaughter of the animal in town Y, as well as those who came into contact after the meat was taken home

First contacts	Contacts from the household
1A	1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I
2A	2B, 2C (suspicious skin lesions), 2D, 2E, 2F (nursing mother)
3A	3B, 3C, 3D, 3E
4A	4B, 4C, 4D, 4E (nursing mother), 4F, 4G, 4H
5A	5B, 5C, 5D, 5E (nursing mother), 5F, 5G, 5H, 5I
6A	6B (skin lesions), 6C, 6D, 6E, 6F
7A	7B, 7C, 7D, 7E, 7F, 7G (nursing mother)
8A	8B (six months pregnant), 8C, 8D (suspicious skin lesions)
9A	9B (suspicious skin lesions), 9C, 9D, 9E, 9F
10A	10B, 10C, 10D (nursing mother)), 10E, 10F, 10G, 10H
11A	11B, 11C, 11D, 11E, 11F, 11G, 11H
12A	12B, 12C
13A	
14 A	
15A	
16A	

The median age of the hospitalized patients was 41 years (24-71). The median (min-max) laboratory parameters of the patients are presented in Table 3. Of the hospitalized patients, two were female (20%) and eight (80%) were male. Furthermore, seven were animal breeders (70%), two were housewives (20%) and one was a government official (10%).

Table 3. Laboratory values of hospitalized patients on the day of admission and day 5

	Day 1.		Day 5.	
Parameter	**Median**	**Min-Max**	**Median**	**Min-Max**
WBC (mm^3)	11.395	5.410-15.010	8.830	5.620-12.510
Hb (g/dL)	15.35	14.30-16.50	14.40	12.50-15.60
Platelet (mm^3)	236.5	154-376	282	229-377
Neutrophils (%)	74.25	33.70-90.20	63.90	43.90-73.00
Lymphocytes (%)	16.55	5.00-39.90	27.20	13.10-44.50
Eosinophils (%)	0.75	0.20-35.60	2.70	0.30-7.10
Urea (mg/dL)	30	23.00-41.00	28	10-42
Creatinine (mg/dL)	0.98	0.65-1.07	0.95	0.64-1.03
AST (U/L)	23	8-41	24	9-51
ALT (U/L)	24	8-50	32	10-106
ESR (mm/h)	21	5-60	21	3-34
CRP (mg/L)	29.50	5.22-112.00	12.50	3.46-86.10
Procalcitonin	0.18	0.12-0.29	0.31	0.23-0.40

WBC: White blood cell, Hb: Hemoglobin, ALT: Alanine aminotransferase, AST: Aspartate aminotransferase, ESR: Erythrocyte sedimentation rate, CRP: C-reactive protein.

Contact was through the skin and the gastrointestinal system in ten (100%) patients. None of the contacted patients developed gastrointestinal anthrax symptoms. Lesions were on the face in one (10%) and in the upper extremity in nine (90%) patients. Steroid treatment was added to the antibacterial treatment in two patients (20%). One patient was treated with intravenous penicillin (10%), four with ciprofloxacin (40%), three with penicillin and ciprofloxacin (30%) and two with a meropenem + ciprofloxacin + linezolid (20%) combination.

DISCUSSION

Anthrax has been known since old ages and still maintains its importance[9]. The primary approach to its prevention is the removal of the bacilli from pastures, to have animals followed up by a veterinarian, and to eradicate any sick animals properly. Feeding infected waste to stray animals should be avoided to prevent the spread of infection to other animals and the passing of the bacilli to the ground. Secondary approaches include the early diagnosis and prevention of further contact after an outbreak. A leading factor in prevention and infection control is to ensure coordination among all involved institutions[10]. In the present study, two animals without lug marks, which had not been followed up or vaccinated, were slaughtered, and parts of the sick animals were left on the street. This practice was identified as hazardous during the outbreak evaluation. Early diagnosis, treatment, and follow-up were identified as the key limiting factors during the outbreak. It was noted that the involved institutions worked in coordination to address the outbreak. The city Health Board convened and made decisions on the prevention and control of the outbreak. Recurrent anthrax outbreaks have been reported in unvaccinated animals[11]. Outbreaks of anthrax resulting from the slaughter and eating of sick and unvaccinated animals have been observed[12]. In the outbreak described in the present study, two animals were slaughtered after becoming ill.

Contact tracing and surveillance play crucial roles in early diagnosis, follow-up of contacts, administration of prophylactic treatments, early diagnosis and treatment of affected individuals, and raising public awareness[12]. In a study in an endemic area, the majority of people did not know the causative agent, or spread control/prevention methods[5]. The declaration was made upon diagnosis of the initial cases identified during the evaluation of this outbreak. Raising public awareness of anthrax was given due attention during the contact tracing and surveillance studies. The majority of patients admitted to the hospital were the first people contacted, and all those who came into contact with the infected animals/meat were followed up regularly.

The first contacts were animal breeders or slaughterers, while other people in society were potentially exposed to hazardous conditions after the meat was distributed to different houses. Similarities were noted with the outbreak under evaluation in this study, where the majority of hospitalized patients were male. This was attributed to the fact that animal slaughter is primarily carried out by males. Additionally, the prophylactic measures likely helped prevent the spread of the disease within households, particularly among women who handled or consumed the distributed meat.

Cutaneous anthrax is the most common form of the disease. Lesions are generally located on flat areas of the body, such as the hands, arms, face and neck[13]. Adults constitute the majority of patients, and the most frequently affected bodily regions are the hands and fingers[14,15]. Quinolones and doxycycline are the preferred antibiotics for the treatment of cutaneous anthrax without systemic involvement, although amoxicillin or penicillin may also be used[16]. Antibiotic treatments do not affect the progression of cutaneous lesions, but they do reduce the risk of systemic disease development. In the present study, the 10 people who were infected during the outbreak were treated with antibiotics, while steroid treatment was initiated in two cases due to the development of serious bullous lesions and respiratory problems[16,17].

Considering the positive effects of steroids in pneumococcal meningitis, it is suggested that

steroids could be used for anthrax meningitis to reduce cerebral edema and elevated intracranial pressure. When life-threatening severe edema causes tracheal obstruction, or in cases of massive pleural effusion and severe acidosis, administering steroids is deemed acceptable, even in the absence of controlled studies.

CONCLUSION

An outbreak of anthrax occurred after two animals in two different locations within the same city were slaughtered upon falling ill, and their meat was subsequently distributed or sold. The people who contracted the disease were treated and steps were taken to prevent the further spread of the outbreak. The Directorate of Agriculture in the city started animal vaccinations, and the region was quarantined to prevent the entry or exit of infected animals until the outbreak subsided. *B. anthracis* spores can remain viable in soil for extended periods, highlighting the importance of vaccinations as the most effective approach for preventing anthrax in both humans and animals. Another crucial aspect is to educate the public about anthrax transmission routes and how to handle sick animals. Conducting educational meetings for the public is essential to raise awareness on these matters.

ETHICS COMMITTEE APPROVAL

This study was approved by the Fırat University Non-Invasive Research Ethics Committee (Decision no: 2021/12-11, Date: 18.11.2021).

CONFLICT of INTEREST

The authors have no conflicts of interest to declare that are relevant to the content of this article.

AUTHORSHIP CONTRIBUTIONS

Concept and Design: KT, AST

Analysis/Interpretation: KT, AST, MAA

Data Collection or Processing: KT, AST, MAA, TÖK

Writing: KT, AST, MAA, TÖK

Review and Correction: AA, KD

Final Approval: AA, KD, KT, AST, MAA, TÖK

REFERENCES

1. *Wang L, Wang Y, Jin S, Wu Z, Chin DP, Koplan JP, et al. Emergence and control of infectious diseases in China. Lancet (London, England) 2008;372:1598-605. https://doi.org/10.1016/S0140-6736(08)61365-3*
2. *Velavan TP, Meyer CG. The COVID-19 epidemic. Trop Med Int Health 2020;25:278-80. https://doi.org/10.1111/tmi.13383*
3. *Ciotti M, Ciccozzi M, Terrinoni A, Jiang W-C, Wang C-B, Bernardini S. The COVID-19 pandemic. Crit Rev Clin Lab Sci 2020;57:365-88. https://doi.org/10.1080/10408363.2020.1783198*
4. *Doganay M, Demiraslan H. Human anthrax as a re-emerging disease. Recent Pat Antiinfect Drug Discov 2015;10:10-29. https://doi.org/10.2174/1574891X10666150408162354*
5. *Romha G, Girmay W. Knowledge, attitude and practice towards anthrax in northern Ethiopia: A mixed approach study. BMC Infect Dis 2020;20:814. https://doi.org/10.1186/s12879-020-05544-z*
6. *Öğütlü A. Şarbon. J Exp Clin Med 2012;29:155-62. https://doi.org/10.5835/jecm.omu.29.s3.011*
7. *Topluoğlu S. Türkiye'de şarbon mevcut durum raporu. Turk Hij Den Biyol Derg 2020;77:1-20.*
8. *Price EP, Seymour ML, Sarovich DS, Latham J, Wolken SR, Mason J, et al. Molecular epidemiologic investigation of an anthrax outbreak among heroin users, Europe. Emerg Infect Dis 2012;18:1307-13. https://doi.org/10.3201/eid1808.111343*
9. *Wenner KA, Kenner JR. Anthrax. Dermatol Clin 2004;22:247-56. https://doi.org/10.1016/j.det.2004.03.001*
10. *Mansingh A, Choudhary HR, Shandilya J, Bhattacharya D, Kshatri JS, Parai D, et al. A qualitative exploratory study using One Health approach for developing an intervention package for elimination of human anthrax in an endemic district of Odisha, India. Indian J Med Res 2021;153:394-400. https://doi.org/10.4103/ijmr.IJMR_646_21*
11. *Islam MS, Hossain MJ, Mikolon A, Parveen S, Khan MS, Haider N, et al. Risk practices for animal and human anthrax in Bangladesh: An exploratory study. Infect Ecol Epidemiol 2013;3. https://doi.org/10.3402/iee.v3i0.21356*
12. *Bazeyo W, Lukwago L, Wamala J, Obayo S, Bua J, Ecumu J, et al. Suspected outbreak of cutaneous anthrax in Kasese district, the investigation and response, April to May 2007. East Afr J Public Health 2009;6:235-9.*
13. *Doganay M. Anthrax. In: Infectious Diseases. 3rd ed ed. China: Mosby-Elsevier; 2010. https://doi.org/10.1016/B978-0-323-04579-7.00128-3*
14. *Demirdag K, Ozden M, Saral Y, Kalkan A, Kilic S, Ozdarendeli AJI. Cutaneous anthrax in adults: A review of 25 cases in the eastern Anatolian region of Turkey. Infection 2003;31:327-30. https://doi.org/10.1007/s15010-003-3169-3*
15. *Denk A, Tartar AS, Ozden M, Demir B, Akbulut AJC, toxicology o. Cutaneous anthrax: Evaluation of 28 cases in the Eastern Anatolian region of Turkey. Cutan Ocul Toxicol 2016;35:177-80. https://doi.org/10.3109/15569527.2015.1067818*

16. *Martin Gregory J FAM. Bacillus anthracis (anthrax). In: Bennett JE, Dolin R, Blaser MJ, eds. Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases. 9th ed. Philadelphia: Elsevier; 2020.*

17. *Hendricks KA, Wright ME, Shadomy SV, Bradley JS, Morrow MG, Pavia AT, et al. Centers for disease control and prevention expert panel meetings on prevention and treatment of anthrax in adults. Emerg Infect Dis 2014;20:e130687. https://doi.org/10.3201/eid2002.130687*

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