



## Cutaneous Anthrax: Evaluation of 27 Cases

### Deri Şarbonu: 27 Olgunun Değerlendirilmesi

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#### ABSTRACT

**Introduction:** While the incidence of anthrax is decreasing in Turkey, it is still endemic in some regions of the country. In this study, it was aimed to develop preventive methods by determining the characteristics of cutaneous anthrax after assessing the literature over the last six years (2013-2019) of cutaneous anthrax cases in Turkey.

**Materials and Methods:** The studies carried out in the last six years on cutaneous anthrax were examined retrospectively. Diagnosis, physical examinations, vital signs, laboratory results, medical treatments of the evaluated cases were performed and tables on demographic characteristics were developed.

**Results:** Patients' age ranged from 8 to 65 years. A total of 13 patients (48.1%) who were assessed were males. The source of infection was contact with infected animal and its products in 23 cases (85.2%), husbandry in 2 cases (7.4%), contact with infected blood in one case (3.7%), and being in the same environment with an anthrax diagnosed patient in one case (3.7%). As a result of microbiological investigations, it was found out that 10 patients (37%) had *Bacillus anthracis*. All patients received penicillin treatment. Only three patients were surgically treated. Treatment resulted in recovery in 26 cases.

**Conclusion:** In order to prevent the disease, preventive measures such as training of risky individuals dealing with animal husbandry and vaccination of animals will reduce the incidence of the disease.

**Key Words:** Cutaneous anthrax; *Bacillus anthracis*; Turkey

#### ÖZ

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**Giriş:** Şarbon, Türkiye'de insidansı azalmakla beraber, ülkemizin bazı bölgelerinde halen endemik olarak karşılaşılan bir zoonozdur. Bu çalışmada Türkiye'de görülen deri şarbonu vakalarının son altı yıldaki (2013-2019) literatür taraması yapılarak deri şarbonunun karakteristiğinin belirlenmesi ve önleyici girişimlerin geliştirilmesi amaçlanmıştır.

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**Materyal ve Metod:** Deri şarbonu ile ilgili son altı yılda yapılan çalışmalar geriye dönük olarak incelenmiştir. Değerlendirilen olguların fizik muayeneleri, vital bulguları, laboratuvar sonuçları, tıbbi tedavileri ve demografik özellikleri ile ilgili tablolar oluşturulmuştur.

**Bulgular:** Hastaların yaşları 8-65 yaş arasında değişmektedir. Değerlendirilen 27 olgunun 13'ü (%48.1) erkek hastadır. 23 olguda (%85.2) hayvan ve hayvan ürünleriyle temas, iki olguda (%7.4) hayvancılık, bir olguda (%3.7) şarbon tanısı almış hasta kanı ile temas, bir olguda (%3.7) ise şarbon tanısı almış hasta ile aynı ortamda bulunma öyküsü vardır. Mikrobiyolojik incelemeler sonucu 10 hastada (%37) şarbon basili saptanmıştır. Hastaların tümüne antibiyotik tedavisi uygulanmış, üç hastaya da cerrahi olarak müdahale edilmiştir. Tedavi 26 olguda şifa ile sonuçlanmıştır.

**Sonuç:** Hastalığın önlenmesi amacıyla hayvancılık ile uğraşan riskli bireylerin eğitilmesi, hayvanların aşılması gibi önleyici tedbirler hastalığın görülme sıklığını azaltacaktır.

**Anahtar Kelimeler:** Deri şarbonu; *Bacillus anthracis*; Türkiye

## INTRODUCTION

Anthrax is an infection caused by *Bacillus anthracis*, it is essentially an infection of herbivorous animals (e.g. sheep, goat or cattle), and it can infect people through contact with meat and meat products of infected animals<sup>[1]</sup>. The incidence of anthrax cases in the world is going down, but after the anthrax spores sent to the United States by mail in 2001, it has come up again<sup>[2,3]</sup>. Anthrax occurs mainly in three different clinical forms in humans; lung, gastrointestinal and cutaneous<sup>[4]</sup>. Pulmonary (lung) anthrax is caused by the inhalation of *Bacillus anthracis* spores, and gastrointestinal anthrax is seen as a result of consuming infected meats<sup>[5]</sup>. Cutaneous anthrax occurs when spores are inoculated into small wounds, abrasions, etc. on the skin after direct contact with the infected animal's skin, flesh and wool<sup>[6]</sup>. In some cases, *Bacillus anthracis* may blend into the circulation and this may result in some deadly diseases such as pneumonia, meningitis and antrax sepsis. Cutaneous anthrax is the most common and benign type with a rate of 95%. It is reported that 10-20% of cutaneous anthrax cases may result in death if they are not treated<sup>[7]</sup>. In typical cutaneous anthrax cases, lesions are seen in the contact area after an incubation period of 1-9 days<sup>[8]</sup>. In cases of severe anthrax, oedema may occur in the extremities or on the entire trunk from the neck to the groin. This condition is called malignant oedema, and it is associated with inflammation of the skin<sup>[9]</sup>. In untreated patients, gram-positive bacilli may be seen in the Gram staining of the lesion and the diagnosis is confirmed<sup>[8]</sup>.

In cases of naturally transmitted anthrax, strains of *Bacillus anthracis* are susceptible to penicillin. Thus, penicillin, ampicillin, cefazolin and macrolides may be used for treatment<sup>[10,11]</sup>. Anthrax is a public health problem in Turkey, especially in areas where traditional farming is performed<sup>[12]</sup>. Anthrax cases are common in our country, in Eastern and Southeastern Anatolia regions where animal husbandry is widespread<sup>[13]</sup>. According to the latest data from Turkey Vector and Zoonotic Diseases Department in 2017, eight cases were declared in Kars which is a province in Eastern Anatolia Region, where stock farming is widely carried out<sup>[14]</sup>. This problem, which still continues today, has a significant place in terms of public health.

In this study, it was aimed to determine the characteristics of cutaneous anthrax cases which are endemic in Turkey. It was also aimed to develop preventive methods in order to increase the awareness and information levels of people who are at risk of getting the disease.

## MATERIALS AND METHODS

From the 14 different studies evaluated, a total of 27 cutaneous anthrax cases were examined. Sex of the cases, the area of transmission and whether the cases had any history of contact with the source of infection were all examined. Clinical signs and symptoms, treatment methods, microbiology results of the patients were recorded, and evaluation results were tabulated based on patient characteristics.

Cutaneous anthrax, *Bacillus anthracis* and Turkey keywords were scanned between the dates of

September 2018 and February 2019. Cutaneous anthrax cases in the last six years (2013-2019) in Google Academic and Chrome databases were found enough, and 27 different cutaneous anthrax cases were evaluated.

## RESULTS

Demographical and clinical features of the evaluated cutaneous anthrax cases were summarized in Table 1, Table 2 and Table 3. In Table 1, there are data on the sex, infection sources and lesion localizations of the cases. The total

number of cases assessed in the study was 27, and 13 of them (48.1%) were males. Four of the assessed cases gave no information about their ages, yet, the given age range was between 8-65. Infection sources were histories of contact with animals and their products in 23 cases (85.2%), animal husbandry in 2 cases (7.4%), contact with diseased blood in one case (3.7%) and being in the same circumstances with the patient who was diagnosed with anthrax in one case (3.7%). Localization of the lesion was the head and neck region in three cases (11.1%),

**Table 1. Findings on sex, the infection source and localization of the lesions in 27 cases of cutaneous anthrax**

	Number of patients (n= 27)	Percentage (%)
Male	13	48.1
Female	14	51.9
Infection source		
Contact with the infected animal and animal products	23	85.2
Husbandry	2	7.4
Contact with the blood of anthrax diagnosed patient	1	3.7
Having the same environment with the infected patient	1	3.7
Lesion localization		
Head-neck	3	11.1
Hand-arm	23	85.2
Abdomen	1	3.7

**Table 2. Vital signs, laboratory findings, microbiologic examination and treatment methods of the 27 cutaneous anthrax cases**

	Number of patients (n= 27)	Percentage (%)
Clinical findings and laboratory		
Temperature	12	44.4
Arterial blood pressure (< 120/80)	1	3.7
Neutrophilia (> 50-70%)	3	11.1
AST (> 0-35 U/L)	5	18.6
ALT (> 0-45 U/L)	3	11.1
LDH (> 0-248 U/L)	2	7.4
Total bilirubin (> 0.3-1.2 mg/dL)	1	3.7
Direct bilirubin (> 0-,0-0.2)	1	3.7
Sedimentation (> 20 mm/s)	7	25.9
CRP (> 5-10 mg/L)	10	37
WBC (> 10.000/mm <sup>3</sup> )	12	44.4
Microbiologic examination		
Gram-positive stain	7	25.9
Polimerase chain reaction	3	11.1
Treatment		
Antibiotics	27	100
Surgery	3	11.1
Recovery	26	96.3

**Table 3. Contamination region of 27 cases and distribution according to years.**

Contamination region	Number of patients (n= 27)		Distr. acc. to years	Number of patients (n= 27)	
		Percentage (%)			Percentage (%)
Trabzon	3	11.1	2013	9	33.2
Van	1	3.7	2014	1	3.7
Edirne	1	3.7	2015	3	11.1
Gaziantep	5	18.6	2016	5	18.6
Kayseri	1	3.7	2017	3	11.1
Ankara	2	7.4	2018	5	18.6
Hakkari	1	3.7	2019	1	3.7
Siirt	1	3.7			
Yozgat	1	3.7			
Erzurum	6	22.2			
Bursa	1	3.7			
Diyarbakır	4	14.8			

hand and arm region in 23 cases (85.2%) and abdominal region in one case (3.7%). Vital signs, laboratory findings, microbiological examination and treatment methods were given in Table 2. On the evaluation of vital signs, 12 patients (44.4%) were recorded as having high fever. Arterial blood pressure was below normal values in a patient (3.7%). Neutrophil values were found to be higher than normal values (50-70%) in three patients (11.1%). Of the five patients (18.6%) whose liver enzymes were checked, AST level was found to be high (normal value 0-35 U/L) and ALT (normal value 0-45 U/L) was found to be high in three patients (11.1%). Another liver enzyme LDH (normal 0-248 U/L) was found to be high in two patients (7.4%). Total bilirubin (normal 0.3-1.2 mg/dL) was high in one patient (3.7%). Direct bilirubin (normal 0.0-0.2 mg/dL) was high in one patient (3.7%). Sedimentation levels of seven patients (25.9%) with known sedimentation levels exceeded the normal value (> 20 mm). Among the assessed cases, 10 of them (37%) were reported as having a high CRP value (C-reactive protein) (normal value 5-10 mg/L). White blood cell (WBC) values of 12 patients (44.4%), whose values were known, were found to be higher than 10.000/mm<sup>3</sup>. As a result of microbiological examinations, a total of 10 patients (37%) had final diagnosis. All the patients were given antibiotic treatment. Three of them (11.1%) had surgical operation as well as antibiotic treatment. One of the patients (3.7%) lost his life while 26 of them (96.3%) recovered. Table

3 shows the distribution of cutaneous anthrax between the years 2013-2019 and the place of contamination. On examining the contamination places, it was seen that six (22.2%) of the 27 cases were in Erzurum province. Other patients were in Trabzon, Van, Edirne, Gaziantep, Kayseri, Ankara, Hakkari, Siirt, Yozgat, Bursa, Diyarbakır. When cases were examined according to years, it was seen that there were nine cases (33.2%) in 2013, one case (3.7%) in 2014, three cases (11.1%) in 2015, five cases (18.6%) in 2016, three cases (11.1%) in 2017, five cases (18.6%) in 2018 and one case (3.7%) in 2019.

## DISCUSSION

Upon the examination of demographical features of 27 cases, it is seen that sex differences and ages may have an association with anthrax cases and not only adults but also children may get infected. In our study, it is noteworthy that three of the 27 cases were children, and that the children were also at risk. In a study by Aydın et al. (2018), 48 children have been evaluated in the pediatric emergency and infection outpatient clinics in the region upon the death of a 36-year-old patient from *Bacillus anthracis* sepsis<sup>[15]</sup>. Even if people do not deal with slaughter and similar works, the fact that sick animals and their wastes are not left in the area causes this risk. In the study of Yeşilbağ and Kader (2014) including the case of a 16-year-old male patient diagnosed with anthrax, it has been emphasized that some measures should be taken, such as

quarantine and burying the dead anthrax infected animals, in order to prevent an epidemic<sup>[6]</sup>. Mwakapeje et al. (2018), in their case-control study to prevent cutaneous anthrax risk factors and cutaneous anthrax in Northern Tanzania, have noted that dead anthrax infected animals should be destroyed (preferably incineration) by appropriate methods<sup>[16]</sup>. Both studies support our results asserting that contact with the animals and taking precautions should be taken seriously.

Human to human transmission is rarely seen, yet there is still a possibility of contamination by indirect and direct contact with infected wounds and discharge<sup>[6]</sup>. In our study, a patient who was diagnosed with cutaneous anthrax although she was not in direct contact with the animal was infected by contact with the infected blood. Another patient was diagnosed with cutaneous anthrax although she had no direct contact, she was reported just to live in the same area with the infected people and she was treated accordingly. It was seen that there were contact with sick animals in 23 of the cases. It was seen that there was husbandry in two cases. Cutaneous anthrax cases are generally reported as occupational diseases and they occur in farmers, butchers, wool separators, veterinarians, animal and animal hair dealers who are in direct contact with animal and animal products<sup>[17]</sup>. Lesions on the skin generally appear in the exposed areas of the body such as hands, arms, face and neck<sup>[18]</sup>. In the cases as for the cases in our study, localization of lesions was seen in the head and hands in three cases (11.1%), in hands and arms in 23 (85.2%) cases, in the abdominal region in one case (3.7%). As the findings offer, the lesion was more frequently seen in the hands; which can be attributed to the active use of hands and arms when dealing with animal meats. At the same time, the presence of cuts on the hands during contact with animal products may increase the risk of anthrax<sup>[19]</sup>.

Vital signs of the cases were interpreted according to the values of fever, pulse blood pressure and respiration. When vital signs were evaluated, it was seen that fever values of 12 patients were high. Laboratory findings of four patients in a study have been reported as normal. A patient, whose blood pressure was known, died as

a result of cardiac arrest; his low arterial pressure could be attributed to anthrax-induced sepsis. The values of patients with known blood pressure, pulse and respiratory values were not associated with anthrax. Özkol et al. (2014) have stated that although there was no specific laboratory findings other than Gram staining and culture, C-reactive protein (CRP), sedimentation rate and white blood cell values were generally high in some studies, which supported our study<sup>[8]</sup>. Accordingly, CRP values were reported above the normal values (normal value 5-10 mg/L) in 10 cases (37%) in our study. WBC values were reported to be higher than 10.000/mm<sup>3</sup> in 12 cases (44.4%). Sedimentation rates of 7 patients (25.9%) whose sedimentation rates were known exceeded the normal values (> 20 mm). High fever in 12 patients may be associated with these blood values. Clinical diagnose of cutaneous anthrax may be possible with the help of epidemiological history of the cases and the existence of characteristic lesions. Definite diagnosis is made by examining the samples taken from the lesions<sup>[20]</sup>. As a result of microbiological examinations for definite diagnosis, three patients had positive polymerase chain reaction and seven patients had positive Gram staining results. Treatment with antibiotics was planned in all patients.

Anthrax is not a resistant bacterium unless it is transmitted by natural means and there are genetic manipulations for bioterrorism, so penicillin and its derivatives are the first drugs to be preferred in treatment<sup>[21]</sup>. Three patients underwent surgery in addition to antibiotic treatment. One of the cases was diagnosed with anthrax and was admitted to the anesthesia intensive care unit and cardiopulmonary resuscitation was applied to the patient on the second day of hospitalization. Despite all interventions, the patient died due to the development of *Bacillus anthracis* sepsis following cutaneous anthrax (Table 1). Cutaneous anthrax may progress up to 20% of septicemia cases if it is not treated and it may have fatal consequences<sup>[22]</sup>. When the reviewed cases are examined, it is seen that antibiotic treatment upon exposure to anthrax requires surgical intervention in some cases, even if it is seen as endemic. It is also a serious public health problem that may result in



death. When the distribution of cutaneous anthrax is examined according to years, it is clear that it still poses a current problem in our country.

### CONCLUSION

In conclusion, anthrax, which should be compulsorily reported, is an infectious disease widely seen as a result of broad husbandry in our country. Although we are a developing country, the rise in cases of anthrax is posing a threat to Turkey, as well as a problem in terms of public health. Necessary measures should be taken to prevent the disease in order to decrease the mortality and morbidity related to the disease. Cattle, sheep, goats, equidae and pigs in the region where infection occurs should all be vaccinated over the course of five years<sup>[23]</sup>. The most important field of activity of the Ministry of Health in order to reduce the incidence of anthrax cases is based on the principle of public education and awareness. Thus, studies in this direction are carried out in parallel with in-service trainings<sup>[24]</sup>. This gives a great responsibility to family physicians and public health nurses as it is a risk for public health.

### ETHICS COMMITTEE APPROVAL

This type of study is not required ethical approval.

### CONFLICT of INTEREST

The authors declare that they have no conflict of interest.

### AUTHORSHIP CONTRIBUTIONS

Concept and Design: TŞ, AÇ

Data Collection or Processing: TŞ, AÇ

Analysis/Interpretation: TŞ, AÇ

Literature Search: TŞ, AÇ

Writing: TŞ

Final Approval: TŞ, AÇ

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