




## Evaluation of tetanus cases presenting to the emergency department at a tertiary hospital in Somalia

### *Somali'de üçüncü basamak bir hastanenin acil servisine başvuran tetanos olgularının değerlendirilmesi*

Şule Yakar<sup>1</sup>  Nasteho Mohamed Sheikh Omar<sup>2</sup>  Funda İpekten<sup>3</sup> 

<sup>1</sup> Emergency Department, Kayseri City Training and Research Hospital, Kayseri, Türkiye

<sup>2</sup> Emergency Department, Somalia Türkiye Training and Research Hospital, Mogadishu, Somalia

<sup>3</sup> Biostatistics Department, Adıyaman University, Faculty of Medicine, Adıyaman, Türkiye

#### ABSTRACT

**Aim:** Tetanus is an infection characterized by muscle spasms and trismus caused by toxins produced by *Clostridium tetani*. Although tetanus is a vaccine-preventable disease, it continues to be a public health problem in developing countries with high mortality rates.

This study was conducted to evaluate the clinical profile and outcome of tetanus patients and determine the factors affecting the hospitalization unit, the length of hospital stay, and mortality.

**Materials and Methods:** This is a retrospective cross-sectional study conducted with patients diagnosed with tetanus in a tertiary care emergency department (ED) in Somalia. The relationship of demographic data, symptoms, laboratory findings, applied treatment methods with the hospitalization unit (regular inpatient floor/intensive care unit), length of hospital stay, and mortality were analyzed.

**Results:** Sixty-seven patients diagnosed with tetanus during a 4-year study period were included. The median patient age was 10.0 (5.0-13.0) years and 73,1% were males. Generalized muscle spasm (85,7%) was the most common symptom, benzodiazepines (95,5%) were the most commonly used medications, and the mean length of hospital stay was 10.73±8.15 days. The rate of patients hospitalized in the ICU was 20,9%. The overall mortality rate was calculated as 19,5%. The presence of opisthotonus, neck stiffness, risus sardonicus, generalized muscle spasm, and dyspnea significantly correlated with mortality ( $p<0.05$ ).

**Conclusion:** Tetanus remains a significant public health problem with high mortality in Somalia. Late-stage clinical findings at ED presentation are strongly associated with admission to the intensive care unit and mortality.

**Keywords:** Tetanus, treatment, mortality

#### ÖZ

**Amaç:** Tetanos, *Clostridium tetani* adlı bakterinin ürettiği toksinlerin neden olduğu kas spazmları ve trismusla karakterize bir enfeksiyondur. Tetanoz aşıyla önlenilebilir bir hastalık olmasına rağmen gelişmekte olan ülkelerde ölüm oranlarının yüksek olduğu bir halk sağlığı sorunu olmaya devam etmektedir.

Bu çalışma, tetanos hastalarının klinik profillerini ve sonuçlarını değerlendirmek, hospitalizasyon ünitesini, hastanede kalış süresini ve mortaliteyi etkileyen faktörleri belirlemek amacıyla yapıldı.

**Gereç ve Yöntem:** Bu çalışma; Somali'deki üçüncü basamak bir acil serviste tetanos tanısı alan hastalarla yürütülen retrospektif, kesitsel bir çalışmadır.

Corresponding author: Şule Yakar  
Emergency Department, Kayseri City Training and Research  
Hospital, Kayseri, Türkiye  
E-mail: suleeee85@hotmail.com  
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Demografik veriler, semptomlar, laboratuvar bulguları ve uygulanan tedavi yöntemleri ile hospitalizasyon ünitesi (servis/yoğun bakım ünitesi), hastanede kalış süresi ve mortalite ilişkisi analiz edildi.

**Bulgular:** Dört yıllık çalışma süresinde tetanos tanısı alan 67 hasta çalışmaya dahil edildi. Hastaların ortalama yaşı 10.0 (5.0-13.0) yıl olup %73,1'i erkekti. En sık görülen semptom jeneralize kas spazmı (%85,7), en sık kullanılan ilaç ise benzodiazepinler (%95,5) idi ve ortalama hastanede kalış süresi  $10,73 \pm 8,15$  gündü. Yoğun bakımda yatan hasta oranı ise %20,9 olarak saptandı. Toplam mortalite oranı ise %19,5 olarak hesaplandı. Opistotonus, boyun sertliği, risus sardonicus, jeneralize kas spazmı ve dispne varlığı mortalite ile anlamlı korelasyon göstermiştir ( $p < 0.05$ ).

**Sonuç:** Tetanos Somali'de mortalitesi yüksek, önemli bir halk sağlığı sorunu olmaya devam etmektedir. Acil servise başvuru sırasında geç dönem klinik bulgular olması, hastanın yoğun bakım ünitesine kabulü ve mortalite ile güçlü bir şekilde ilişkilidir.

**Anahtar Sözcükler:** Tetanos, tedavi, mortalite.

## INTRODUCTION

Tetanus; is a potentially life-threatening infectious disease caused by the *gram-positive Clostridium tetani bacillus*, associated with high mortality rates (1, 2). Tetanospasmin and tetanolysin toxins secreted by *Clostridium tetani* cause local inflammation by acting on the gangliosides in local nerve terminals (3). While trismus is mostly the first symptom, wrinkled facial expression (i.e., risus sardonicus), widespread muscle spasms with severe pain, drooling, urinary incontinence, stool incontinence, and spasm of the back muscles (i.e., opisthotonus) causing respiratory distress are the main clinical features (4).

Diagnosis is made clinically. Physical examination findings and immunization history aid in diagnostic management, but there are no definitive laboratory tests that can be helpful in diagnosis (5). On the other hand, treatment is based on the destruction of the organism with antibiotics such as penicillin G or metronidazole, neutralization of the toxin with tetanus immunoglobulin, and supportive measures such as mechanical ventilation, sedation, and muscle paralysis (6).

Tetanus is usually encountered in unvaccinated or under-vaccinated populations (4). It continues to be a public health problem in developing countries with high morbidity and mortality rates (7). Therefore, it is vital to know the relationship between clinical data and outcomes, including mortality due to its potentially fatal course.

This study retrospectively analyzed the clinical data and the factors affecting the length of hospital stay, the hospitalization unit, and mortality in patients diagnosed with tetanus in an emergency department.

## MATERIALS and METHODS

Patients who were clinically diagnosed with tetanus between January 2018 and December

2021 in the Emergency Department of Somalia Mogadishu Türkiye Training and Research Hospital and subsequently admitted were retrospectively analyzed. The diagnosis of tetanus was entirely clinical and based on the presence of one or more of the following: (i) rigidity of the neck and/or abdomen/neck stiffness, (ii) lockjaw, (iii) risus sardonicus (sustained spasm of the facial muscles) or generalized muscle contractions. Patients with acute hypertonia of other causes (e.g. meningitis, encephalitis) were excluded. Patients of all age groups were included in this study. However, it did not include the patients discharged from the ED, patients who voluntarily left the hospital against medical advice, or those who had a diagnosis other than tetanus after being hospitalized. In addition, patients with incomplete data were excluded. The study was approved by the Ethical Review Committee of the same institution (2022/9184). Data including the demographic characteristics of the patients, date of presentation, clinical findings on presentation such as opisthotonus, neck stiffness, lockjaw, risus sardonicus, generalized muscle spasm, dysphagia, dyspnea, and fever were retrieved from electronic patient folders and recorded to a computer database. This database also included data regarding hospitalization units (regular inpatient floor/intensive care unit), applied treatment methods, length of hospital stay, and mortality status. Since detailed information about the area and duration of the contact could not be obtained from hospital records and patient files, these data could not be included in the study. Since tetanus vaccination data of patients were not available, vaccination history of patients and information about the duration since the last vaccination were not included in the study. Since the patients' antibody information was not available in the records, they could not be included in the study.

The patients were divided into two groups based on the hospitalization unit as regular inpatient floor (RIF) and the intensive care unit (ICU). Firstly, two groups were compared concerning demographic data and clinical findings. Subsequently, the patients were divided into two groups according to mortality status. Finally, to determine the factors affecting the length of hospital stay and mortality, the demographic and clinical patient data, including admission year and applied treatment methods, were analyzed.

### Statistical Analysis

The conformity of the data to the normal distribution was evaluated with histogram, Q-Q plots, and Shapiro-Wilk test. The homogeneity of variance was tested with Levene's test. Mann-Whitney U test and independent two-sample t-test were used to compare quantitative variables

between two groups. Pearson  $\chi^2$  analysis and Fisher exact  $\chi^2$  test were used for comparing categorical data. The data analysis was performed by the software R 4.0.0 ([www.r-project.org](http://www.r-project.org)). The significance level was accepted as  $p < 0.05$ .

### RESULTS

Overall, 67 patients were included in the study. Among these patients, 73,1% were male, and the median patient age was 10.0 (5.0-13.0) years. In our retrospective review, it was seen that the highest number of patients (n:21, 31.3%) were hospitalized in 2018. Analysis concerning symptoms and signs elucidated that generalized muscle spasm was the most common clinical finding with a rate of 55.2%.

**Table-1.** Demographic and clinical data of patients.

	n (%): 67
<b>Gender</b>	
Female	18 (26.9)
Male	49 (73.1)
<b>Application year</b>	
2018	21 (31.3)
2019	20 (29.9)
2020	10 (14.9)
2021	16 (23.9)
<b>Clinical findings</b>	
Opisthotonus	9 (13.4)
Neck stiffness	26 (38.8)
Lock jaw	27 (40.3)
Risus sardonicus	22 (32.8)
Generalized muscle spasms	37 (55.2)
Dysphagia	12 (17.9)
Dyspnea	20 (29.9)
Fever	11 (16.4)
<b>Treatment options</b>	
Tetanus toxoid	44 (65.7)
Tetanus immunoglobulin	26 (38.8)
Benzodiazepine	64 (95.5)
Baclofen	47 (70.1)
Penicillin G	47 (70.1)
Metronidazole	60 (89.6)
Magnesium sulfate	11 (16.4)
<b>Hospitalization unit</b>	
Pediatric service	46 (68.7)
Neurology service	3 (4.5)
Infectious Diseases service	3 (4.5)
Neonatal ICU	8 (11.9)
Pediatrics ICU	4 (6)
Adult ICU	3 (4.5)

\* Data are expressed as n (%).

\*\* ICU: Intensive Care Unit

**Table-2.** Comparison of demographic and clinical of patients with hospitalization units.

	<b>RIF n:53 (79.1%)</b>	<b>ICU n:14 (20.9%)</b>	<b>p</b>
<b>Age</b>	10 (6-13)	0 (0-15.5)	<b>0.041</b>
<b>Gender</b>			
Female	12 (22.6)	6 (42.9)	0.129
Male	41 (77.4)	8 (57.1)	
<b>Clinical findings</b>			
Opisthotonus	4 (7.5)	5 (35.7)	<b>0.015</b>
Neck stiffness	20 (37.7)	6 (42.9)	0.967
Lock jaw	20 (37.7)	7 (50)	0.599
Risus sardonicus	21 (39.6)	1 (7.1)	<b>0.025</b>
Generalized muscle spasms	26 (49.1)	11 (78.6)	0.07
Dysphagia	8 (15.1)	4 (28.6)	0.257
Dyspnea	11 (20.8)	9 (64.3)	<b>0.003</b>
Fever	9 (17)	2 (14.3)	0.999

\* Data are expressed as n (%) and median (1st quartile-3rd quartile).

**Table-3.** Factors affecting mortality.

	<b>Alive (n:54)</b>	<b>Dead (n:13)</b>	<b>p</b>
<b>Age</b>	10 (5-13)	8 (2.5-12)	0.357
<b>Gender</b>			
Female	14 (25.9)	4 (30.8)	0.724
Male	40 (74.1)	9 (69.2)	
<b>Clinical findings</b>			
Opisthotonus	3 (5.6)	6 (46.2)	<b>&lt;0.001</b>
Neck stiffness	17 (31.5)	9 (69.2)	<b>0.012</b>
Lock jaw	22 (40.7)	5 (38.5)	0.88
Risus sardonicus	22 (40.7)	0 (0)	<b>0.005</b>
Generalized muscle spasms	25 (46.3)	12 (92.3)	<b>0.003</b>
Dysphagia	10 (18.5)	2 (15.4)	0.791
Dyspnea	11 (20.4)	9 (69.2)	<b>0.001</b>
Fever	8 (14.8)	3 (23.1)	0.47
<b>Treatment options</b>			
Tetanus toxoid	37 (68.5)	7 (53.8)	0.317
Tetanus immunoglobulin	21 (38.9)	5 (38.5)	0.977
Benzodiazepine	51 (94.4)	13 (100)	0.612
Baclofen	40 (74.1)	7 (53.8)	0.152
Penicillin G	36 (66.7)	11 (84.6)	0.204
Metronidazole	49 (90.7)	11 (84.6)	0.517
Magnesium sulfate	10 (18.5)	1 (7.7)	0.344

\* Data are expressed as n (%) and median (1st quartile-3rd quartile).

The comparison of treatment modalities, including vaccination, administration of immunoglobulins, drugs used for sedation and muscle spasms (i.e., benzodiazepine, baclofen, magnesium sulfate), and antibiotics (i.e., penicillin G, metronidazole), showed that benzodiazepine (i.e., diazepam or midazolam) treatment was the most frequently performed

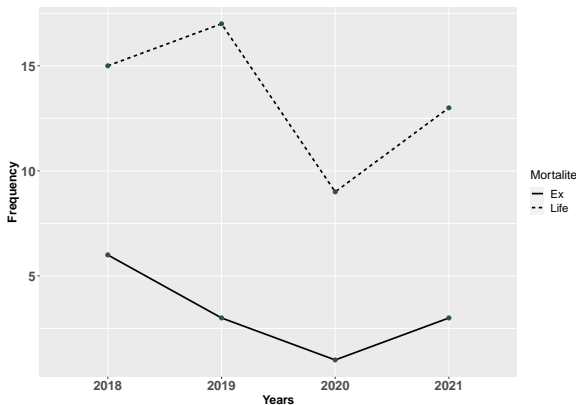
therapeutic method (95.5%). While 79.1% of the patients were admitted to the RIF, 20.9% were referred to the ICU. It was also determined that most of the RIF admissions were to the pediatrics department (68.7%), and the highest rate of ICU admissions was to the neonatal ICU (11.9%). The demographic data, clinical findings, applied treatment methods, and outcomes of the patients

are displayed in Table-1. Our analysis also included comparing the data between patients admitted to RIF and ICU. The results of this comparison are displayed in Table-2.

Our comparative analysis revealed that RIF and ICU patient groups were significantly different regarding age, presence of opisthotonus, risus sardonicus, and dyspnea ( $p < 0.05$ ). The mean length of hospitalization was calculated as  $10.73 \pm 8.15$  days. Analyses were made regarding the factors affecting the hospitalization duration; applied treatment methods such as benzodiazepine, baclofen, metronidazole, and magnesium sulfate were related to the length of hospital stay ( $p < 0.05$ ).

A review concerning post-hospitalization survival status elucidated that 80.5% of the patients were discharged from the hospital, while the in-hospital mortality rate was 19.5%. Furthermore, the survival and mortality rates did not differ according to admission year ( $p > 0.05$ ) (Figure-1).

Our analysis also included a comparison based on mortality status. The results of this comparison are displayed in Table-3. Analysis concerning factors affecting mortality elucidated that opisthotonus, neck stiffness, generalized muscle spasm, and dyspnea at the time of initial presentation to ED were associated with high mortality ( $p < 0.05$ ).



**Figure-1.** Mortality graph for years.

## DISCUSSION

Tetanus: is a vaccine-preventable disease that remains a common cause of acute critical illness in low- and middle-income countries due to a lack of immunization (2, 8). It has a high morbidity and mortality rate due to complications such as acute kidney injury, gastrointestinal bleeding, sepsis, extensive intravascular coagulation, nosocomial pneumonia, subglottic stenosis due to long-term

hospitalization, and mechanical ventilation use (6).

The Diphtheria Tetanus Toxoid and Pertussis (DTP) containing vaccine 3rd dose rate for Somalia is 42% which is based on the latest WHO/UNICEF Estimates of National Immunization Coverage (WUENIC) in 2023 (9). The World Health Assembly recommends that at least 80% of pregnant women should be vaccinated with at least two doses of tetanus toxoid-containing vaccines and that at least 80% of women of reproductive age in high-risk areas should be vaccinated with at least three rounds of tetanus toxoid-containing vaccine; but in Somalia, this rate remained at 58% as of 2019 (10). In Somalia, overall immunization rates are low due to a weak health system, inadequate immunization services, and vaccine refusal. As a result, vaccine-preventable diseases continue to occur in this region.

The mean age and gender distribution of the patients included in our study aligned with the literature (11, 12). The most common clinical finding in the presentation to the ED was generalized muscle spasm, probably due to delayed admissions to the hospital in this region. In line with this, Wang et al. found in their retrospective multicenter study that the most common symptom in tetanus patients was generalized muscle spasm (11). On the other hand, it has been reported that trismus was the most common initial symptom in these cases (4). Since tetanus is characterized by the generalization of the spasms if left untreated, we believe that Wang et al. worked on late-stage tetanus cases as we did in our study.

Treatment in tetanus cases aims to monitor the patient's condition, provide respiratory support, eliminate the source of the toxin, neutralize the unbound toxin, and prevent muscle spasms (1). In addition, tetanus immunoglobulin (TIG) neutralizes the circulating toxins, and tetanus toxoid (TT) provides active immunization (5).

Our study determined that 38% of the patients were treated with TIG and more than half with TT. Since detailed immunization data of the patients could not be reached, we do not know how the selection between TIG or TT treatments was made. In the study of Dafallah et al., diazepam was used in all patients, and baclofen was used in half of the patients for tetanus-related muscle spasms (13). Similarly, in our study, diazepam was used in almost all patients,



and baclofen was used in more than half. Diazepam was preferred by approximately 90% of patients in our study; it is thought to be widely used, primarily due to its easy accessibility and cost-effectiveness. Magnesium sulfate infusion is an adjunct to benzodiazepines for muscle spasms, especially in autonomic dysfunction (6). The low rate of magnesium sulfate in our study; may be related to a lower incidence of autonomic dysfunction symptoms such as fever, dyspnea, and the effectiveness of benzodiazepine monotherapy in the treatment of muscle spasms. It was reported in the literature that the use of metronidazole slowed disease progression and reduced mortality (4). We used metronidazole in most patients; however, we found that the selected treatment method did not affect mortality.

In a study performed in Tanzania by Chalya et al., 82.4% of the patients were referred to the ICU (14). The ICU admission rate was 20.9% in our study. Our cohort's low ICU hospitalization rate may be related to the lower mean patient age and less need for mechanical ventilator support.

In the study by Dafallah et al., the length of hospitalization was shorter than in our study (13). The inclusion of patients with late-stage clinical symptoms probably led to the prolongation of the treatment period. Also, we suggest that the relatively higher mortality rate in our study can be ascribed to the same reason (15, 16). Hasnain et al. found that the mortality rate was 28.6% in

patients with tetanus, and these authors reported a significant positive correlation between age and mortality (17). Nevertheless, our analysis revealed that age, gender, and selected treatment method did not affect patient mortality.

### **Limitations**

The most important limitation of the study is its retrospective and single-center design. Moreover, a more detailed analysis, including the vaccination status and the mechanisms of disease transmission, could not be made due to incomplete data.

### **CONCLUSION**

Although tetanus is a vaccine-preventable disease, it is still prevalent in low- and middle-income countries with high mortality rates. Therefore, early diagnosis and treatment are essential for reducing ICU hospitalization and mortality rates.

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