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Investigation of Tetanus Vaccination Status and Tetanus Protection Levels of Cases Admitted with Burns

Yanıkla Başvuran KişilerinTetanoz Aşılama Durumlarının ve Tetanoz Koruyuculuk Düzeylerinin Araştırılması

Selma Tosun[1-2], Ahmet Deniz Uçar[3-4], Ömer Çağlıyan[3], Alpay Arı[1-2], Hülya Özkan Özdemir[1], Mehmet Yıldırım[3-4]

[1]University of Health Sciences, Turkey, Izmir Bozyaka Education and Research Hospital, Clinic of Infectious Diseases and Clinical Microbiology, Izmir, Turkey
[2]University of Health Sciences, Turkey, Izmir Faculty of Medicine, Department of Infectious Diseases and Clinical Microbiology, Izmir, Turkey
[3]University of Health Sciences, Turkey, Izmir Bozyaka Education and Research Hospital, Clinic of General Surgery, Izmir, Turkey
[4]University of Health Sciences, Turkey, Izmir Faculty of Medicine, Department of General Surgery, Izmir, Turkey

Abstract

Aim: It is very important to know the tetanus vaccine status in patients who present with the cause of burns. In this study, the vaccination status of patients presenting with burns was examined.

Materials and Methods: Tetanus vaccination status, vaccination at the first healthcare facility and serum antitoxin levels of the patients who applied to the burn treatment center due to burns were examined.

Results: A total of 91 patients, 50 of whom were female (55%), aged between 24 and 64, were included in the study. Tetanus antibodies were definitely negative in 15 patients (16%) and weakly positive in nine patients (10%), and these patients were predominantly 40 years of age and older. It was determined that only 42 (46%) of the patients were vaccinated against tetanus in the health institutions where they first applied. It was determined that the patients with negative tetanus antitoxin levels were predominantly middle-aged and elderly; most of them had not had a tetanus vaccine in the last 10 years, and their military service and last pregnancy dates were at least 10 years or more ago. Totally 43 of the patients (47%) stated that they did not know/remember whether they had a tetanus vaccine before.

Conclusion: It is often difficult and often impossible to obtain accurate information about the previous tetanus immunity status of burn patients when they first apply to a health institution. According to our study data, we believe that it would be appropriate to administer tetanus vaccination to burn patients who have not received a tetanus vaccine in the last 10 years, whose last pregnancy and/or military service date is older than 10 years, and who are over the age of 40, and to also evaluate the patients for immunoglobulin.

Keywords: Burn; tetanus; vaccination; immunization

Öz

Amaç: Yanık nedeni ile başvuran hastalarda tetanoz aşısı durumunun bilinmesi oldukça önemlidir. Bu çalışmada yanık şikayetiyle başvuran hastaların aşı durumları incelendi.

Gereç ve Yöntemler: Yanık nedeniyle yanık tedavi merkezine başvuran hastaların tetanoz aşı durumları, ilk sağlık kuruluşunda aşılanma durumları ve serum antitoksin düzeyleri incelendi.

Bulgular: Çalışmaya yaşları 24-64 arasında değişen 50'si kadın (%55) olmak üzere toplam 91 hasta dahil edildi. Tetanoz antikorları 15 hastada (%16) kesin negatif, dokuz hastada (%10) zayıf pozitifti ve bu hastalar ağırlıklı olarak 40 yaş ve üzerindeydi. Hastaların sadece 42'sinin (%46) ilk başvurdukları sağlık kuruluşunda tetanoz aşısı yaptırdığı belirlendi. Tetanoz antitoksin düzeyi negatif olan hastaların ağırlıklı olarak orta yaş ve yaşlı olduğu; çoğunun son 10 yılda tetanoz aşısı yaptırmadığı, askerlik ve son gebelik tarihlerinin en az 10 yıl ve daha önce olduğu öğrenildi. Hastaların toplam 43'ü (%47) daha önce tetanoz aşısı yaptırıp yaptırmadığını bilmediğini/hatırlamadığını belirtti.

Sonuç: Yanık hastalarının sağlık kuruluşuna ilk başvurduklarında önceki tetanoz bağışıklık durumu hakkında doğru bilgi edinmek çoğu zaman zor veya imkansızdır.

Çalışma verilerimize göre son 10 yıl içinde tetanoz aşısı yaptırmamış, son hamileliği ve/veya askerlik tarihi 10 yıldan eski olan ve 40 yaş üstü yanık hastalarına tetanoz aşısı yapılmasının uygun olacağı ve immünglobulin yönünden de değerlendirmenin uygun olacağı kanısındayız.

Anahtar sözcükler: Yanık; tetanoz; aşılama; bağışıklık

Corresponding Author: Selma Tosun
University of Health Sciences, Turkey, Izmir Bozyaka Education and Research Hospital,
Clinic of Infectious Diseases and Clinical Microbiology, Izmir, Turkey
E-mail: selma.tosun@yahoo.com
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INTRODUCTION

The most important factor in the decrease in tetanus cases is widespread vaccination programs. Within the scope of the national vaccination program implemented in our country, primary vaccination of infants is followed by adult-type diphtheria-tetanus (Td) vaccination at the ages of 4 and 13. In addition, there is tetanus vaccination during pregnancy and military service. Antibodies obtained with tetanus vaccination decrease over time and may disappear completely in older ages. Therefore, it is recommended that adults receive a booster every 10 years, and if possible, one of the booster doses should be adult-type diphtheria-tetanus and acellular pertussis vaccine (TdAp) (1-5).

As a result of these practices in our country, a significant decrease in neonatal tetanus cases has been observed over the years, although adult tetanus cases are seen in a small number. At the beginning of the vaccination program, a total of 550 adult tetanus cases were seen between 1980-1984, while this number dropped to 77 between 2013-2017. Later, there were no cases in 2018, and 18 adult tetanus cases were seen in 2019.

This situation suggests that tetanus cases seen in adulthood still continue to be a problem in our country. For this reason, careful evaluation in terms of tetanus should be done, especially in dirty injuries where anaerobic environment may occur, and adequate and timely immunization for individuals should not be neglected.

For any reason, the tissue integrity of the burned people deteriorates, and an anaerobic environment may occur in the burn wound as a result of contact with contaminated environments. For this reason, as a general trend, tetanus vaccine is also applied to people with burns. However, since the previous immunity status of the person for tetanus is not known, data on whether the person really needs a vaccine, whether a single dose is sufficient, or whether tetanus immunoglobulin should be required with the vaccine is not sufficient.

There is no study on this subject in the literature. In this study, it was aimed to investigate whether there is protection against tetanus in the blood samples of patients with burn diagnosis who applied to Burn Center by ELISA method and to evaluate the individuals together with their vaccination history.

MATERIALS and METHODS

Following the approval of the ethics committee (September 20,2019/7), the patients who applied/ were brought to the Burn Unit were informed about the issue and their consents were obtained, and a face-to-face questionnaire was applied first, and their sociodemographic data and information about vaccination were obtained. Later, while routine blood tests were taken from patients who agreed to participate in the study, an additional 5 cc blood sample was taken and tetanus antibodies were studied.

Tetanus antitoxin levels were studied in the blood samples taken by EIA method in accordance with the recommendations of the kit manufacturer. Protection levels in individuals according to the determined antitoxin titers <0.01 IU/mL was accepted to be negative (no protection), between 0.11-0.5 was insufficient (weak positive), between 0.6-0.9 sufficient and ≥1was accepted as positive.

Statistics: In this study, the Pearson chi-square test and Fisher's Exact test were used for the analysis of categorical data, while the t-test was employed to compare the means between two groups. A p-value of <0.05 was considered the threshold for statistical significance, and the results were interpreted accordingly.

The test results of the individuals were notified to them both verbally and in writing, and those with insufficient or deficient vaccination levels were completed in the Adult Vaccination Policlinic of our hospital.

RESULTS

A total of 91 patients including 41 males, aged between 18-77 (42.3 ± 12.3) were recruited in our study. The ages of the female patients were between 18-69 (43.2 ± 12), and 24-77 (41.25 ± 12.9) for male patients.

The detected antibody titers were minimum 0.003 IU/mL and maximum 4.692 IU/mL (mean 1.74 ± 1.38). The decrease in protective antibody titers was found to be statistically significant as the age got older (p: 0.003186, χ^2: 15.8788) (Table 1).

The distribution of the detected tetanus antitoxin levels according to the ages when the test results are evaluated is shown in Table 2.

Second degree public hospitals (50 patients) and 3rd degree education research hospitals (25 patients) are the leading centers where patients first apply; this is followed by family medicine health centers with six patients, university hospitals and private hospitals with five patients.

While tetanus vaccine was administered to 42 (46%) of the patients in the health institutions they applied for the first time after the event, 42 (46%) were not vaccinated, and it was not learned whether seven patients (8%) were vaccinated.

When the patients were asked when they last had the tetanus vaccine, 41 patients (45%) stated that they did not know/remember whether they had been vaccinated tetanus so far, while 50 patients (55%) stated that they had been vaccinated at any time.

Table 1. Distribution of tetanus antibody levels of burn cases by age groups

Age Groups (n: 91)	≤0.01 IU/mL Negative (No immunization)	0.11-0.5 IU/mL Weak Positive	0.6-0.9 IU/mL Sufficient	≥1 IU/mL Positive	Total
18-40 Age	4 (8.5%)	1 (2.1%)	5 (10.6%)	37 (78.8%)	47
41-60 Age	6 (16.7%)	8 (22.2%)	5 (13.9%)	17 (47.3%)	36
≥61 Age	5 (62.5%)	0	1 (12.5%)	2 (25%)	8
Total	15 (%16)	9 (%10)	11 (%12)	56 (%62)	91

* no patients between 0.02-0.1 IU/mL

Table 2. Previous tetanus vaccination status of cases

	Working In A Profession At Risk For Tetanus	Her/His Profession Is Not Risky For Tetanus				P=
Is The Profession Risky For Tetanus? (N:91)	11 (%12)	80 (%88)				p>0.05
	Made	Not Done				
Was A Tetanus Shot Given Before The Burn? (N:91)	41 (%45)	50 (%55)				p>0.05
	She/He doesn't remember	In the last 12 months	13 months-5 years	6-10 years	11 years and older	
Date Of Tetanus Vaccination If Previously Given (N:81)	41 (%51)	19 (%23)	9 (%11)	8 (%10)	4 (%5)	P=0.000688
	Made	Not Done	She/He doesn't remember	Never been pregnant before		
Has A Tetanus Vaccine Been Administered During Pregnancy? (N:42)	17 (%40)	6 (%14)	15 (%36)	4 (%10)		p>0.05
	Made	Not done	She/He doesn't remember			
Has A Tetanus Vaccine Been Administered During Military Service? (N:36)	25 (%69)	1 (%3)	10 (%28)			p>0.05
	No	Yes				
Has There Been Any Tetanus Risk Injury In The Last 5 Years? (N:91)	76 (%84)	15 (%16)				p>0.05
	No	Yes	She/He doesn't remember			
Does He/She Get A Tetanus Shot Every 10 Years? (N:91)	52 (%57)	2 (%2)	37 (%41)			p>0.05

Table 3. Centers where burn patients first applied and their vaccination status in these centers

The First Center To Meet	Number Of Patients Who Received Tetanus Vaccine	Number Of Patients Not Vaccinated	Number Of Patients Whose Vaccination Is Unknown	Total
Family Medicine Health Center	2	3	1	6
Public Hospital	23	24	3	50
Education And Research Hospital	14	8	3	25
University Hospital	3	2	0	5
Private Hospital	0	5	0	5
Total	42 (%46)	42 (%46)	7 (%8)	91

Of the 50 patients who said they had been vaccinated, 19 stated that they were vaccinated in the last one year, six in the last two years, nine in the last five years, eight in the last 6-10 years, and four patients at a date before 10 years (Table 2,3). Characteristics of patients with nonprotective (negative) and weakly positive tetanus antitoxin levels are shown in Tables 4 and 5.

Table 4. Previous tetanus vaccination history of patients with negative tetanus antibodies (n:15)

Gender And Age Groups	Woman	Man		
	9	6		
	24-40 years old	41-60 years old	>61 years old	
	4	6	5	
The First Institution To Apply For Burns	Family health center	State hospital	Education and research hospital	Private hospital
	3	5	6	1
Was A Tetanus Vaccine Administered At The First Institution Where The Burn Victim Was First Admitted?	Made	Not done	He/She doesn't remember	
	9	5	1	
When Was The Last Tetanus Shot Given?	He/She doesn't remember	In the last 1 year	In the last 2-5 years	More than 10 years ago
	10	3	1	1
Has A Regular Tetanus Booster Been Given Every 10 Years?	No	Yes		
	15	0		
Have You Been To A Health Facility Due To A Tetanus Risk Injury In The Last 5 Years?	No	Yes		
	15	0		
Have Male Patients Received A Tetanus Shot While Serving In The Military? (N:6)	Yes	He doesn't remember	No response	
	2	2	2	
How Many Years Ago Did Male Patients Complete Their Military Service? (N:6)	1-10 years ago	11-20 years ago	30 years and older	
	0	1	5	
Have Female Patients Been Vaccinated Against Tetanus During Pregnancy? (N:9)	Never been pregnant	Her last pregnancy is more than 10 years old	Her last pregnancy is more than 20 years old	
	3	2	4	

Table 5. Previous tetanus vaccination history of patients with weakly positive tetanus antibodies (n:9)

Have You Had A Tetanus Shot?	He/She Was Vaccinated At The First İnstitution He Applied To Due To Burns.	Not Vaccinated	He/She Doesn't Remember	
	5	3	1	
When Was The Last Tetanus Shot?	He/She doesn't remember	In the last 1 year	In the last 2-5 years	More than 10 years ago
	5	2	1	1
Has A Regular Tetanus Booster Been Given Every 10 Years?	No	Yes		
	9	0		
Have You Had A Tetanus Risk İnjury İn The Last 5 Years?	No	Yes		
	7	2		
Have Male Patients Received A Tetanus Shot İn The Military?	Yes	He/She doesn't remember		
	3 (one 9 years ago, two 20 years ago)			
Have You Had A Tetanus Vaccine During Pregnancy?	Never been pregnant	Her last pregnancy is more than 10 years old	Her last pregnancy is more than 20 years old	
	1	1	4	

No statistically significant relationship was found between tetanus vaccination at the first health institution visited after burns, a history of risky tetanus injury within the last five years, and tetanus antibody levels ($p>0.5$).

A statistically significant relationship was found between the use of tetanus vaccine in the last 10 years and tetanus antibody levels (*p*: 0.000688). Although there is no statistically significant relationship between female patients' pregnancy status less than 10 years ago and men having military service in the last 10 years and their tetanus antibody levels ($p>0.5$), women who have recently become pregnant and who have also recently performed military service in the past It was determined that tetanus antibody titers were higher in males.

DISCUSSION

In many studies, it is known that the level of tetanus antitoxin decreases with age, especially in persons over 50-60 years of age, and sometimes becomes completely negative. However, compliance with the booster dose application, which should be repeated every 10 years in adulthood, is low both in the world and in our country. In a study conducted in Korea, which included 1193 people, the protective level of anti-tetanus IgG antibody positivity was 92% in the 11-20 age group, while this rate increased to 95.7% in the 21-30 age group, but this rate was significantly low in higher age groups. ($p<0.001$) (6). In a field study conducted in our country where 361 people were included in which tetanus antibody levels were evaluated, it was reported that protective antibody titer was not detected in 35% of the participants, and protective antitoxin levels decreased significantly especially over the age of 50 (7). Again, in another recent study conducted in our country, it was emphasized that tetanus antibodies decrease significantly with age and that booster administration every 10 years is not common (8). In another study evaluating the tetanus immunity of 267 adult patients admitted to the emergency department with trauma, the protection rate was found to be 88.2% in individuals under the age of 50, while it was found to be 45.7% in individuals over the age of 50, and the difference was statistically significant ($p<0.001$) (9).

To understand whether individuals are protected from tetanus, the level of tetanus antitoxin in the blood can be measured by ELISA method (10-12). Although it may differ according to different commercial test kits, ≤0.01 IU/mL absolute negative (no immunization), 0.02-0.1 IU/mL very low positive (insufficient immunization), 0.1-0.5 IU/mL weakly positive, ≥1U/mL is considered as positive (immunized). The higher the titer, the longer the

duration of protection. However, since the test takes time and it is costly to test for one person, it is practically not possible to apply this test every time a burn case applies. Therefore, some algorithms have been created for the management of these cases. Church et al. stated that 250-500 U of human tetanus immunoglobulin should be administered together with the vaccine in burn cases whose primary vaccination scheme was not completed or who were vaccinated more than the last 10 years (13). Since it is difficult to adequately assess whether a burn wound is at risk for tetanus, Rhee et al. recommends immunoglobulin in combination with tetanus vaccine for individuals with an uncertain vaccination history, regardless of whether the last vaccine is older than 10 years and whether the wound is at risk for tetanus (14).

Organizations that offer vaccination recommendations such as the American Academy of Pediatrics Advisory Committee on Immunization Practices (APA) and Advisory Committee on Immunization Practices (ACIP) also recommend taking the patient's vaccination history and accordingly, tetanus vaccine or immunoglobulin in burn cases, regardless of whether the wound is at risk for tetanus (3). In the burn guide of the Dermatology Association published in 2016, it is emphasized that prophylaxis is required for tetanus following the removal of foreign bodies in the burn wound and wound debridement.

In this guideline, it is mainly recommended to question the vaccine history and if vaccination is older than 10 years, and if the vaccination history of a patient with a dirty wound is uncertain, immunoglobulin is recommended in addition to the vaccine (15). According to our study data, the antitoxin levels preventing tetanus in our patients decrease statistically significantly with age, and this becomes evident especially after the age of 40 and 60. It was learned that almost half (46%) of the institutions where the patients first applied to were not given tetanus vaccine, and we think this is an important deficiency.

It is often difficult for people to remember their vaccination history, and since adult vaccination is a concept that has been increasing in recent years, the number of people with vaccination cards is not yet sufficient. In such cases, the Vaccine Tracking System (ATS) data, which is a method that can safely access vaccine data of individuals and has been actively used since 2016, can be used. However, ATS records do not cover older years; Since the ATS system is not yet available in units such as pharmacies, workplaces, private hospitals where vaccines are administered outside hospitals, data such as the person's age, educational status, vaccination history, military service and pregnancy history can give an idea about their immune status.

When the previous vaccination status of 15 individuals with non-protective (negative) tetanus antitoxin levels was examined, nine were female and six were male; in terms of age groups, four were 18-40 years old, six were 41-60 years old, and five were 61 years old and older. Tetanus vaccination was administered to nine patients at the first health institutions they applied to when they had a burn, and five were not. When these individuals were asked when they last had a tetanus vaccination, three stated that they had been vaccinated within the last year, one stated that they had been vaccinated within the last 2-5 years, and one stated that they had been vaccinated more than 10 years ago, and the remaining 10 stated that they did not remember whether they had had a tetanus vaccination. None of these patients had received a regular tetanus vaccination every 10 years, and none of them had a dirty injury in terms of tetanus in the last five years and had not applied to a health institution. All 6 male patients in this group had served in the military for at least 11 years or more. When the female patients were asked about their last pregnancy dates, it was learned that three patients had never been pregnant, two patients had been pregnant more than 10 years ago, and four patients had been pregnant more than 20 years ago. When these details were evaluated, we believe that some clues can be used to estimate the previous tetanus status of a patient who applied/was brought with a burn injury. As can be seen, the case of negative tetanus antibody levels is more common in the middle-aged and elderly groups, most of these people do not have a history of tetanus vaccination in the last 10 years; their pregnancies and military service dates are also more than 10 or 20 years ago. Therefore, if these conditions are detected in a patient, we think that it would be an appropriate approach to give the person a tetanus vaccine, assuming that the tetanus antibody level may be low or negative, and to also give immunoglobulin to an elderly patient.

CONCLUSION

The limitation of the study is the small number of patients, but we think it is suggestive. As a result; It would be beneficial to apply tetanus vaccine and, if necessary, immunoglobulin, to those who applied with burns, paying particular attention to their age and questioning their previous tetanus vaccination history; In addition, we think it would be meaningful and beneficial to conduct a more comprehensive study across the country on this subject.

Author's Contribution

The authors declare no conflict of interest.

All authors declared their contribution to the study at all stages and approved the final version of the manuscript.

All authors declared that this manuscript has not been published before and is not currently being considered for publication elsewhere.

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REFERENCES

1. WHO Tetanus https://www.who.int/health-topics/tetanus#tab=tab_1 (accessed 9 October 2024).
2. Tetanus vaccines: WHO position paper. Wkly Epidemiol Rec. 2017;92:53-76.
3. CDC-Clinical Guidance for Wound Management to Prevent Tetanus https://www.cdc.gov/tetanus/hcp/clinical-guidance/(accessed 9 October 2024).
4. Havers FP, Moro PL, Hunter P, Hariri S, Bernstein H. Use of tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccines: updated recommendations of the advisory committee on immunization practices - United States MMWR Morb Mortal Wkly Rep. 2020;69:77-83.
5. Yen LM, Thwaites CL. Tetanus. Lancet. 2019; 393:1657-68.
6. Sung H, Jang MJ, Bae EY, Han SB, Kim JH, Kang JH, et al. Seroepidemiology of tetanus in Korean adults and adolescents in 2012. J Infect Chemother. 2014;20:397-400.
7. Tosun S, Deveci S, Yücetürk M, Dönmez ABY. Kırk yaşın üzerindeki insanlarda tetanoz antitoksin titre düzeylerinin araştırılması. Turkiye Klinikleri J Med Sci. 2012;32:301-7.
8. Taşbakan MI. Durusoy R. Tosun S. Akyol D. Pullukçu H. Yamazhan T. Relationship between tetanus antitoxin titration level and vaccination history. J Clin Exp Invest. 2017;8:104-9.
9. Toker I. Kilic, TY. Kose S. Yesilaras M. Caliskan F. Atilla, et al. Tetanus immunity status among adult trauma patients in an ED. Turk J Emerg Med. 2017;17:95-8.
10. Simonsen O, Bentzon MW, Heron I. ELISA for the routine determination of antitoxic immunity to tetanus. J Biol Stand. 1986;14:231-9.
11. WHO Expert Committee on Biological Standardization https://www.who.int/biologicals/WHO_TRS_980_WEB.pdf (accesed 17 February 2021)
12. Birch TB, Bleck TP. Tetanus (*Clostridium tetani*). In Douglas M, Bennett J (eds). Principles and Practice of Infectious Diseases,10th Edition, Elsevier.;2020. p. 2948-53.
13. Church D, Elsayed S, Reid O, Winston B, Lindsay R. Burn wound infections. Clin Microbiol Rev. 2006;19:403-34.
14. Rhee P, Nunley MK, Demetriades D, Velmahos G, Doucet JJ. Tetanus and trauma: a review and recommendations. J Trauma. 2005;58:1082-8.
15. Yoshino Y, Hashimoto A, Ikegami R, Irisawa R, Kanoh H, Sakurai E, et al. Wound, pressure ulcer and burn guidelines-6: guidelines for the management of burns, second edition. J Dermatol. 2020;47:1207-35.