



Original Article

Tetanus immunity status among adult trauma patients in an ED



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ABSTRACT

Objectives: Tetanus is a vaccine-preventable infectious disease. It is caused by the bacterium *Clostridium tetani*. The aim of this study was to investigate tetanus immunity among adult trauma patients.

Material and methods: This study was performed with 267 trauma patients who were admitted to the emergency department of Tepecik Training and Research Hospital in İzmir City, Turkey over a six month period. After obtaining a written informed consent from each patient, a questionnaire concerning demographic information and tetanus vaccination history was filled in by the physician. Patients' blood samples (4–5 cc) were drawn into a test tube while creating an intravenous (IV) access prior to making any attempt for therapy. And the tetanus antibody level (IgG) was measured using the enzyme-linked immunosorbent assay method. Tetanus antibody levels ≥ 0.1 IU/mL were considered protective.

Results: Among 267 patients, 192 and 75 of the cases (71.9% and 28.1%) were male and female, respectively. The median age of the patients was 39 (IQRs = 28–52). Seventy-five percent of the patients (n = 201) had protective immunity rates for tetanus.

Discussion and conclusion: In our study, which was conducted among adults, it was found that the protective ratio of tetanus immunity decreased with age with an additional, significant decline in elderly patients.

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1. Introduction

Tetanus is the only vaccine-preventable disease, and it is acquired by environmental contamination. Tetanus vaccinations are part of the Expanded Immunization Program (EIP) in Turkey. The Turkish Ministry of Health conducts an EIP, and routine booster injections are recommended every 10 years. Booster injections in Turkey are typically administered at the age of 18 months, at 7 and

14 years (at the 1st and 8th class of primary school, respectively), at the age of 20/21 for males when they join military service, and to females during the second trimester of pregnancy.¹

While the estimated global diphtheria-tetanus-pertussis (DTP3) coverage among children <12 months in 2013 was 84%, this ratio was 98% in Turkey. In our country, despite the success in primary immunizations, in a trial completed in 2001, the protective ratio against tetanus was found to be as low as 35.7% for individuals who are >50 years. Therefore, low immunity to tetanus is a public health issue in elderly people in Turkey.^{2–4}

In the emergency department (ED) trauma services, which are an important location for administering boosters to adult patients, it is very important to apply the vaccinations properly.

The aim of this study was to investigate tetanus immunity among adult trauma patients.

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2. Materials and methods

2.1. Study design and setting

This prospective, observational study was conducted between the dates of December 1, 2014 and May 31, 2015 in the Hospital Emergency Department, which serves as a tertiary urban ED with an annual admission rate of nearly 200,000. Our institution is the reference hospital in our region and has a 4-year emergency medicine education program. Local ethics committee approval was obtained.

2.2. Selection of participants and sample size

Inclusion criteria for the study included five main parameters: 1) patients who were >18 years of age; 2) presented to the ED with any type of traumatic injury; 3) were determined by the physician to have the need for prophylactic tetanus vaccination; 4) were able to sign a written consent form; and 5) have already vein access. Consecutive patients were included, informed about the study, and allowed to sign the consent form of their free will.

Patients who were transferred from other hospitals, those who presumably received a booster injection, and patients who were unable to be reached by phone or other means were excluded. Individuals who didn't sign an informed consent were also excluded.

Patients' blood samples (4–5 cc) were drawn into a test tube while obtaining an intravenous (IV) access prior to making any attempt for therapy.

2.3. Methods and measurements

Patients' demographic data, their educational levels, vaccination histories, military service, any vaccinations during pregnancy, locations of the injury, types and duration of wounds, and the presence of wound infections were recorded.

IgG antibody levels against *Clostridium tetani* were determined using commercial test kits. An anti-tetanus toxoid enzyme-linked immunosorbent assays (ELISA) were performed on a Euroimmun Analyzer I (Euroimmun, Germany). Tetanus antibody levels ≥ 0.1 IU/mL were considered protective.

2.4. Statistical analysis

For data analysis, the statistical software Statistical Package for the Social Sciences (IBM SPSS Statistics Armonk, NY, USA) version 22 program was used. Categorical variable were defined as the number of observations and percentage, while continuous variables were given as interquartile range (IQR) and minimum–maximum values. To compare categorical variable, the chi square test was used. Values of $p < 0.05$ were considered statistically significant.

3. Results

During the six month study period, 10,239 trauma patients presented to the ED. A total of 274 patients were included in the study; seven patients were excluded because the serum samples were hemolyzed or inadequate. As a result, 267 patients were evaluated in this study.

Patients' median age was 39 (IQRs = 28–52). One hundred ninety-two patients (71.9%) were male, and 75 (28.1%) were female.

The median level of tetanus antibody titers was 0.56 IU/ml (IQRs = 0.11–1.57).

In aggregate, 75.3% ($n = 201$) of patients had protective tetanus immunoglobulin (Ig) G levels (≥ 0.01 IU/ml). Of 35.6% of the

patients, long term protective antibody levels (>1 IU/ml) were detected.

The wound types and characteristics of patients are given in Table 1.

There was a statistically significant difference in protective antibody rate (the rate of immunity) between females (64%) and males (79.7%) ($p = 0.007$) (Table 2). A statistically significant difference in protective antibody rates was also detected among age groups ($p < 0.001$). The antibody level in patients between 18 and 24 was 94.1%, while it was only 26.4% at ages ≥ 65 . The dispersion of the protective antibody levels among age groups are shown in Fig. 1. In addition, in our study, individuals <50 years had a level of protective immunity ratio of 88.2% ($n = 164$), while subjects >50 years had 45.7% ($p < 0.001$).

There were no statistically significant differences in protective antibody rates among different education levels ($p = 0.107$) (Table 2). Patients who had no education had a protective ratio of 68.3%, while others who were educated to any degree were under coverage with 76.5% ($p = 0.26$).

There were statistically significant differences between the groups who had protective antibody titers after having their last boosters <5 years ago, between 5 and 10 years ago, or > 10 years ago ($p = 0.005$) (Table 2). There were no significant differences in protective antibody rates between the patients whose tetanus vaccination histories were known or unknown ($p = 0.144$) (Table 2).

No significant differences were found between the subjects who knew/didn't know their vaccination status during pregnancy ($n = 44$) ($p = 0.540$). Similarly, there were no statistically significant differences between subjects who remembered/did not remember their vaccination history during military service ($n = 186$) ($p = 0.89$).

4. Discussion

In this research, 75.3% of patients had protective tetanus antibody. Male patients had higher immunity rates than females. Rate of immunity declined rapidly starting at the age of 50 years. No

Table 1
The wound types and characteristics.

	n	%
Localization of wound		
Head/Neck	73	27.3
Thorax	4	1.5
Abdomen	2	0.7
Perineum	10	3.7
Upper extremity	108	40.4
Lower extremity	68	22.5
>1 localization	10	3.7
Type of wound		
Laceration	95	35.6
Abrasion	41	15.4
Incised wound (cut/stab)	57	21.3
Puncture (nail)	19	7.1
Bite wound (dog/cat)	34	12.7
Firearm injury	4	1.5
Crush injury	13	4.9
Burn wound	4	1.5
Depth of wound		
Superficial	100	37.5
Subcutaneous	145	54.3
Fascia/tendon	16	6
Bone/joint	6	2.2
Duration of injury		
<6 h	226	84.6
6–12 h	13	4.9
13–24 h	12	4.5
>24 h	16	6

Table 2
Relationship between education level, gender, age groups and immunization status.

	Tetanus immunization status		p ^a
	IgG ≥0.1 IU n(%)	IgG <0.1 IU n(%)	
Gender			
Female	48(64)	27(36)	0.007
Male	153(79.7)	39(20.3)	
Age groups			
18–24 years	48(94.1)	3(5.9)	<0.001
25–34 years	51(92.7)	4(7.3)	
35–44 years	49(84.5)	9(15.5)	
45–54 years	31(72.1)	12(27.9)	
55–64 years	16(50)	16(50)	
≥65 years	6(21.4)	22(78.6)	
Education level			
Did not finish school	28(68.3)	13(31.7)	0.107
Primary school	74(69.2)	33(30.8)	
Secondary school	40(81.6)	9(18.4)	
High school	43(82.7)	9(17.3)	
College	16(88.9)	2(11.1)	
Vaccination history			
Unknown	77(70.6)	32(29.4)	0.144
Known	124(78.5)	34(21.5)	
Last booster ≤5 y	19(86.4)	3(13.6)	0.005
Last booster 5–10 y	49(90.7)	5(9.3)	
Last booster >10 y	56(68.3)	26(31.7)	

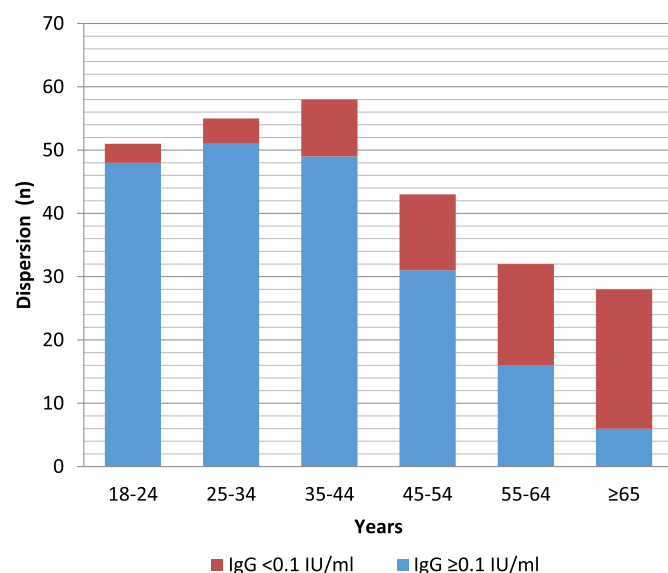
Bold represents p < 0.05.

^a p = chi-square.

significant relationship was found between tetanus immunity rates and any other parameters such as education level, vaccination history, history of military service and pregnancy.

Tetanus is still an important community health problem in Turkey. Discontinuing the immunization program is the main factor for re-emergence of tetanus. The aims of our study were to detect specific types of situations dictating the need for tetanus vaccinations and also to determine the risk factors for patients who received prophylactic tetanus vaccines at our ED.

In the United States, most tetanus cases occur in people who are >65 years and have no idea of their medical histories.⁵ This situation may take occur as a result of aging and its related effects such as the reduction in the amount of tetanus antibodies or because of having less boosters than young people.⁶ In our study and previous

**Fig. 1.** The dispersion of the protective antibody levels among age groups.

Turkish studies it has been shown and proven that lower tetanus immunity rates occur in older people.^{7,8}

Vaccination rates are commonly accepted as a measure of protection as a result of the vaccination. Measurement of serum antibody levels has been shown to be a more objective criterion for monitoring protection levels.⁶ In 2001, Ergönül et al. reported a rate of only 35.7% as protective antibody rate for the people >50.⁴ In our study, this ratio was 45.7%. Concurrently, in our study, it was noted that after the age of 44, tetanus immunity rates declined to <80%, and in subjects > 65, this number declined even further.

In our study, male patients had higher immunity rates than females. This result may have been due to more boosters in men as a result of work-related accidents. And it can be also due to the military service.

Some studies, which have been conducted separately in Turkey and US, have shown that protective antibody levels increase in different proportions according to education levels.^{6, 9–11} In our study, however, this type of relationship was not observed. This situation can be attributed to the idea that most uneducated people work in heavier and riskier jobs than educated workers. This type of working condition may facilitate more injuries; therefore, these people receive post-exposure wound prophylaxis boosters more frequently.

4.1. Limitations

This research was conducted only on a small size of population who were admitted to the emergency department in Izmir City over a six month period. Therefore, to generalize the results for our country, the study should have involved more patients at different regions.

5. Conclusion

In our study, the protective tetanus immunity rates significantly decreased after 50 years of age. This margin seemed to increase even further and to a significant degree in elderly people. For tetanus vaccinations administered in the ED, where high risk patients apply for it, it is extremely important to administer prophylactic tetanus vaccinations and to inform the patients and/or redirect them about their follow up process.

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