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PRACTICE AND KNOWLEDGE LEVEL OF HEALTH PROFESSIONALS ON PREVENTION OF TETANUS

TETANOZUN ÖNLENMESİNDE SAĞLIK ÇALIŞANLARININ UYGULAMA VE BİLGİ DÜZEYLERİ ÜZERİNE BİR ARAŞTIRMA

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Abstract

Objective: In this study, it was aimed to evaluate the level of knowledge of health care professionals, who will assess tetanus immunization status of patients and implement the vaccine program, and non-health care professionals about tetanus.
Methods: This study is a descriptive survey. Interviews were conducted face to face with Antalya Education and Research Hospital staff. Personnel participating in the study were divided into three groups including physicians, nurses and non-health care professionals. The questionnaire contained three sections and 13 questions.
Results: Ninety three percentof physicians, 91% of nurses and 76% non-health care professionals knew that tetanus could be a deadly disease (p=0.002). Need for the booster dose after completion of primary vaccination program was known highly in all groups. But 45.7% (137/300) of all participants were vaccinated within the last 10 years. Of these individuals, 32.1% (44) were immunized due to pregnancy and 45.2% (62) due to injury; only 21.6% (31) followed a vaccination program. 73% of physicians, 64% of nurses and 44% of non-health care professionals knew the indication of tetanus immunoglobulin application. Statistically significant difference was observed between the groups (p=0.001). 61% of physicians, 80% of nurses and 64% of non-health care professionals think that a single dose prophylaxis should be applied regardless of previous vaccination with an open dirty wound.
Conclusion: In this study, it was found that the general level of knowledge of health care professionals, who will apply immunization, about tetanus is adequate, but they do not have sufficient knowledge about vaccination program and the correct application of tetanus prophylaxis in acute injuries. At the same time, lack of transformation of knowledge into attitude was detected among health care professionals.

Keywords:*Tetanus, tetanus vaccination program, questionnaire, knowledge level*

Öz

Amaç: Bu çalışmada hastaların tetanoz immünizasyon durumunu değerlendirerek aşı programını uygulayacak olan sağlık çalışanları ile sağlık dışı personelin tetanoz konusundaki bilgi düzeyini değerlendirmek amaçlandı.
Yöntem: Bu çalışma tanımlayıcı tipte bir anket çalışmasıdır. Antalya Eğitim Araştırma Hastanesinde çalışan personel ile yüz yüze görüşülerek uygulanmıştır. Çalışmaya katılan personel, hekimler, hemşireler ve sağlık dışı profesyonellerden oluşan üç gruba ayrıldı. Anket üç bölüm ve 13 soru içermektedir.
Bulgular: Tetanoz'un ölümcül bir hastalık olabileceğini doktorların %93'ü, hemşirelerin %91'i ve sağlık dışı profesyonellerin% 76'sı biliyordu (p=0,002). Primer aşılama programının tamamlanmasından sonra rapel dozuna duyulan ihtiyaç tüm gruplarda yüksek düzeyde bilinmektedir. Ancak tüm katılımcıların sadece % 45,7'si (137/300) son 10 yıl içinde aşılanmıştı. Bu bireylerin% 32,1'i (44) hamilelik nedeniyle % 45,2'si (62) yaralanma nedeniyle aşılanmıştır; sadece% 21,6'sı (31) bir aşılama programını izlemiştir. Hekimlerin% 73'ü, hemşirelerin% 64'ü ve sağlık dışı profesyonellerin% 44'ü tetanoz immünoglobulin uygulamasının endikasyonunu biliyordu. Gruplar arasında istatistiksel olarak anlamlı fark gözlendi (p=0,001). Doktorların% 61'i, hemşirelerin% 80'i ve sağlık dışı profesyonellerin% 64'ü, açık kirli bir yarada, önceki yapılan aşılamadan bağımsız olarak tek doz profilaksinin uygulanması gerektiğini düşünmekteydi.
Sonuç: Bu çalışmada immünizasyonu uygulayacak olan sağlık çalışanlarının tetanoz konusunda genel bilgi düzeyinin yeterli olduğu, fakat tetanoz aşılama programı ve akut yaralanmadan sonra tetanoz profilaksisini doğru uygulama konusunda yeterli bilgiye sahip olmadığı görüldü. Aynı zamanda sağlık çalışanlarında bilginin pratiğe dönüştürülmesinde eksiklik olduğu saptandı.

Anahtar Sözcükler: *Tetanoz, tetanoz aşılama programı, anket, bilgi düzeyi*

Introduction

Tetanus is an acute and fatal disease caused by exotoxin of Clostridium tetani. Although tetanus is a vaccine-preventable disease, it continues as a major problem in some countries where primary immunization program is not active, so approximate 800.000-1.000.000 deaths occur all over the world each year.[1-3]In our country, tetanus vaccination program began in 1937 and gained momentum in 1985 with the National Vaccination Campaign.[4] It is implemented in the whole country in the framework of Expanded Immunization Program of Ministry of Health of Turkey.[2] In addition, tetanus vaccine is implemented to pregnant women since 1990 within the elimination program of neonatal tetanus. Additionally, men were applied additional dose of monovalent tetanus vaccine during military service period.[5]

Another point related to the prevention of tetanus is application of tetanus prophylaxis to patients admitted to hospital with acute injury. In case of acute injuries, anti-tetanus prophylaxis schedule is applied based on patient's wound classification and immunization history according to United States Centers for Disease Control and Prevention (CDC) criteria. Patient's physician must provide tetanus immunization according to these criteria.[6]

In this study, we aimed to evaluate the level of knowledge of health care professionals, who will assess tetanus immunization status of patients and implement the vaccine program, and non-health care professionals about tetanus.

Methods

Personnel serving in Antalya Education and Research Hospital were included in this questionnaire study (Ethical approval: 18/12/2014, 51/6). The Antalya Education and Research Hospital is a 1000 bed referral and tertiary care community hospital in Turkey. Personnel participating in the study were divided into three groups. The first group was physicians, second group was nurses and the third group was non-health care professionals. Prior to the questionnaire, participants were given a brief summary of the overarching purpose of the study. The questionnaire (App. A) comprised 13 questions, mostly consisting of fixed-choice items in the form of a Likert-scale, and three sections.

Demographic data were evaluated in the first section, tetanus immunization of participants in the second section, participants' knowledge level about tetanus immunization schedule in the third section.

Data were evaluated using SPSS 17. Frequency, average value and percentages were calculated in statistical analysis. The chi-square test was used in comparison. p-value <0.05 was considered statistically significant in Chi-square test. All authors obey the rules of Helsinki declaration and no ethic problem exist in the manuscript.

Results

Three hundreds staff members working in Antalya Education and Research Hospital participated in our study. Participants were divided into three groups. The first group had 100 physicians; the second group 100 nurses and the third group 100 non-health care professionals. A hundred seventy three of the participants were female (57.7%) and 127 (42.3%) were male. The mean age of the participants was 34 ± 8 years (range, 17- 59 years).

App. A: Tetanus Vaccine Awareness and Knowledge Survey.

1.Age:				
2.Gender:		Male: □		Female: □
3.Profession:				
4.Education status:	Primary education: □	Middle-high school: □		College-university: □
5.Year in the profession:				
6.Have you had tetanus vaccine in childhood age (0-15 years)?		Yes □	No □	I do not know □
7.Have you had tetanus vaccine after the age of 15?		Yes □		No □
8.When was the last time you had tetanus vaccine?				
5 years ago: □	Between 5-10 years: □	Over 10 years: □	I do not remember: □	
9. Tetanus is a fatal disease		Yes: □	No: □	I do not know □
10. It is necessary that adults who had earlier three doses of tetanus vaccine be required to have booster dose (reminder dose) of tetanus vaccination.			Yes: □	No: □
11. Tetanus booster dose should be done every ……. years.		1 year	5 years	10 years
12. Tetanus immunoglobulin should be made only in open dirty wounds.			True: □	False: □
13. A single-dose prophylaxis should be done regardless of previous vaccination in case of open dirty wounds.			True: □	False: □

Participants' working time in the profession was 7.8 ± 5.6 years among physicians, 13.4 ± 9 years among nurses and 10.4 ± 7 years among non-health care professionals. 73.7% (221/300) of participants had vaccine in childhood, while 4% (12/300) had not been vaccinated and 22.3% (67/300) did not remember. Sixty five percent 195/300) of participants had tetanus vaccine after the age of 15. There was no significant difference between groups (p=0.284). sixty seven percent of physicians and 75% of nurses had been vaccinated after the age of 15 (Table 1).

Table 1. Vaccination status of participants

Vaccination status	During childhood	After 15 years old
Doctor (%)	82	67
Nurse (%)	76	75
Non-health related personnel (%)	63	53
Total % (n)	%73.7(221/300)	%65(195/300)
p	0.012*	0.284

Forty seven and a half percent (137/300) of all participants were vaccinated within the last 10 years (p=0.054) (Table 2). Of these individuals, 32.1% (44) were immunized due to pregnancy and 45.2% (62) due to injury; only 21.6% (31) followed a vaccination program. Thirty eight percent of physicians and 51 % of nurses had a tetanus booster within the last 10 years.

Table 2. The date of the most recent tetanus vaccination

Group	Less than 10 years (n)	More than 10 years (n)	I do not remember (n)	Total (n)
Doctor	38	27	35	100
Nurse	51	19	30	100
Personnel	48	12	40	100
Total n (%)	137 (%45.7)	58 (%19.3)	105(%35)	300 (%100)

The overall awareness of participants about tetanus was presented in the Table 3. According to this, health care workers knew significantly higher that tetanus could be a fatal disease (p=0.002).

Table 3. The overall awareness of participants on tetanus

Question	Tetanus is a mortal disease	Rapel is required after the primary vaccination	The rapel dose of tetanus should be applied every 10 years
Doctor (n)	93	93	50
Nurse (n)	93	89	31
Non-health related personnel (n)	76	84	34
Total n (%)	260 (% 86.8)	266 (% 85)	115 (% 43)
p	0.002	0.158	0.114

Need for the booster dose after completion of primary vaccination program was known highly in all groups (p=0.158). Fifty percent of the physicians, 31% of nurses and 34% of non-health care professionals knew that these boosters should be done every 10 years (p=0.114) (Table 3). Seventy three percent of physicians, 64% of nurses and 44% of non-health care professionals knew that tetanus immunoglobulin should be applied in case with open dirty wounds who had not completed tetanus vaccine series or unknown history of tetanus immunization. Statistically significant difference was observed between the groups (p=0.001). Sixty one percent of physicians, 80% of nurses and 64% of non-health care professionals think that a single dose prophylaxis should be applied regardless of previous vaccination with an open dirty wound. No significant difference was observed between the groups (p=0.152).

Discussion

Tetanus is a disease with high mortality and that can be prevented by vaccination.[2] With the widespread use of tetanus vaccination programs, the incidence of tetanus is decreasing. Nowadays, tetanus is seen in old age when tetanus booster doses are not applied and consequently tetanus antibody levels are lost in the blood. Declarations made from different centers showed that tetanus was seen in patients over the age of45 years who suffered from injury and did not consult a health care provider. Also, primary immunizations of these patients were found to be missing.[7-10] There is no surveillance for tetanus vaccination in adults in Turkey According to surveillance data collected by the Department of Communicable Diseases, 46 of 62 reported cases of tetanus (74.2%) diagnosed between 2012 and 2016 were 45 years and older.[11] In Turkey, 3-dose vaccination is recommended for primary immunization in adults for tetanus protection by the Standing Committee on Vaccination. It should be at least 4 weeks between the first and the second doses and the third dose should be performed 6-12 months after the second dose. After completion of the primary vaccination, a booster dose is recommended every 10 years. In adults with unknown or incomplete primary vaccination, primary vaccination program should be started and should be completed.[11]

In the studies performed, the levels of protective antibodies against tetanus were found to be sufficient in children and adolescents; whereas in 50% of patients over the age of 40, protective antibody titer against tetanus had been found to be insufficient.[5,13,14] In a recent study in our country; sufficient tetanus antibody was detected in 140 (39.3%) of 356 patients. Protective antibody ratios were found as 49 (70.0%) in 30-40 age group, 39 (54.9%) in 41-50 age group, 22 (31.0%) in 51-60 age group, 16 (22.2%) in 61-70 age group and 14 (19.4%) in >71 age group. Tetanus immunity ratios were significantly reduced with aging.[16]

This situation is related to booster doses not being applied. Unfortunately adult booster dose of tetanus vaccination, is not mandatory sanctions such as childhood immunization, is advisory. Therefore, adult tetanus vaccination rate does not reach the desired level. Similarly, tetanus immunity is lower in the world compared to the young population.Böhmer et al. had reported proper tetanus vaccination rate in adults as low as 73.1% in Germany.[15] In another study in Italy Rapisarda et al. reported tetanus seropositivity in Italy as 97% in 18-27 age group, 86% in 28-37 age group, 76% in 38-47 age group, 62% in 48-57 age group, and 49% over 57 age group.[17]

In order to reach the targeted vaccination rates, the society should be informed about tetanus and vaccination to be protected from tetanus and ensuring sustainability of immunization in individuals with appropriate vaccination programs is the most important step. Same study stated that the majority of people following tetanus vaccination program made own vaccination decision after a physician's recommendation.[15]

In our study, when the level of general knowledge about tetanus was examined, 86.8% of the participants knew that tetanus could be a fatal disease. Especially level of knowledge was high in physicians and nurses compared to non-health care professionals as expected. Besides there is no statistical difference regarding vaccination program, need for the booster dose after completion of primary vaccination program was known highly in all groups.

Most important problem related to tetanus immunization is encountered in acute wounds. An important point for protection against tetanus in case with acute injuries is to interrogate tetanus vaccination schedule of patients admitted to health facilities and application of tetanus prophylaxis according to the algorithm. Therefore, in acute injuries, determining primary immunization status of patients is the most important step. In a study performed in our country, 59.7% of patients admitted to the emergency room due to injury were determined not to remember vaccination status.[6]

If the patient's vaccination history or previous vaccination date is not known, it should be accepted that patient has not received tetanus toxoid (TT) doses. In these patients, after cleaning and debridement of the wound, tetanus immune globulin (TIG) together with TT is applied in case of a dirty and large wound. If the wound is clean and small, active immunization with TT is sufficient. In our questionnaire, knowledge levels of health care professionals about necessity of tetanus immunoglobulin application in open and dirty wounds were found to be statistically significantly higher than non-health care professionals; 73% of physicians and 64% of nurses were to know. In a study conducted in India, it was shown that less than half of the physicians and one-third of the nurses knew about this subject.[19,21] In order to ensure correct immunization in an acute injury, knowledge level of health personnel, who will follow indications of TT and tetanus immunoglobulin application, must be high.

In recent studies, it was shown that the health care workers choose to apply TT after every injury regardless of previous vaccination status of patients. Correction of this misinformation is very important because TT or early booster dose after each injury may cause unwanted side effects such as Arthus-type hypersensitivity reactions.[18-20] In the studies by Kumar and his colleagues.[19] 22.2% of nurses

and 38.3% of physicians argued that the vaccine was required after every injury, whereas in our study, the rates were 80% and 61%, respectively. In our study, these higher ratios may be due to patients with acute injury having no clear information about their tetanus immunization schedule and therefore application of first vaccine by health care professionals in the daily practice to avoid putting these patients at risk and making this pattern a habit. Unlike that, in a study by Yoon and his colleagues, 58.8% ofhealth care professionals stated that they do not apply vaccination as they think that injured patients have immunity for tetanus.[22] All these results suggest that health care professionals need to update their information about determination of immunization status of patients with acute injuries and establishment of appropriate immunization schedule according to wound classification.

In our survey, 73.7% of participants had completed their childhood vaccination schedule; childhood immunization rates of physicians and nurses were 82% and 76% respectively.These rates were found to statistically significantly higher than non-health care professionals. This situation may be associated with economic, cultural and educational level of families. However, 65 % of participants had tetanus booster dose after the age of 15. In a similar study, tetanus booster dose rate of medical school students after the age of 15 were 70.97%.[24] In our country, absence of a vaccine follow card for adults and implementation of family physician system, which are responsible for public health, since 2009 may be the cause of these results. Especially family physicians have a big responsibility in this issue, and the start of this training from the adolescent period is appropriate.[23]

In our study, only 43% of participants knew that a tetanus booster should be made every 10 years, in parallel, only 45.7% (137/300) of participants had tetanus booster dose in last 10 years. Thirty-two percentof them (44) had been vaccinated during pregnancy, 45.2% (62) after injury, and only 21.2% (29) had followed vaccination program. In addition, this ratio was 38% in physicians and 51% in nurses. In similar studies, this rate has been reported as low as 7% in physicians (18) and 4.4% in nurses (16). Although our results are better, it is still not at the desired level. This result showed that knowledge level of participants about tetanus vaccination program was inadequate and at the same time this knowledge was not converted into attitudes.

Conclusion, in this study, it is found that the general level of knowledge of health care professionals, who will apply immunization, about tetanus is adequate, but they do not have sufficient knowledge about vaccination program and the correct application of tetanus prophylaxis in acute injuries. At the same time, lack of transformation of knowledge into attitude was detected among health care professionals. Therefore, regular training programs to health care professionals should be provided to increase the compliance rates to tetanus immunization schedule. Informative and reminder prophylaxis schemes to areas where tetanus prophylaxis is administered should be put to keep up to date info.

Conflict of Interest

No conflicts of interests to disclose.

Compliance of Ethical Statement

The compliance of this study with ethical standards has been approved by Antalya Education and Research Hospital (18/12/2014, decision no: 51/6).

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Author Contributions

IB, ABY, FG: The hypothesis of the study; IB, FY, FG: Study design; IB, FY, MD: Data collection; IB, ABY: Accusation of resources, materials; FY, FG, MD, MA: Literature search; IB, FY, AA: Data analysis and interpretation; IB, FY, NK, MD: Manuscript drafting/writing/editing; FY, MD, AA: Experimental review; IB, ABY: Resources.

References

1. Amdu A, Alamneh A, Tadege Aet al. Clinical profile of tetanus patients attended at Felege Hiwot Referral Hospital, Northwest Ethiopia: a retrospective cross sectional study. *Springerplus.* 2016;5(1):892. doi:10.1186/s40064-016-2803-3.
2. Öner S, Buğdaycı R, Kurt AÖ, Öztürk C, Şaşmaz T. Tetanus Seroprevalence Among Women 15-49 Years Old, in Mersin, Turkey. *Turkiye Klinikleri J Med Sci.* 2008;28(6):839-846.
3. Hassel B. Tetanus: Pathophysiology, Treatment, and the Possibility of Using Botulinum Toxin Against Tetanus-Induced Rigidity and Spasms. *Toxins.* 2013;5(1):73-83. doi: 10.3390/toxins5010073
4. Ceylan A, Çöplü N, Saka Get al. Tetanus Seroprevalence Among Pregnant Women in Ben-u Sen Health Center in Diyarbakir. *TAF Prev Med Bull.* 2011;10(4):481-486.
5. Dundar V, Yumuk Z, Dunder D, Erdogan S, Gacar G. Prevelans of Tetanus Immunity in the Kocaeli Region, Turkey. *Jpn J Infect Dis.* 2005;58(5):279-282.
6. Şimşek G, Armağan E, Köksal Ö, Heper Y, Pozam SE, Durak VA. Analysis of Appropriate Tetanus Prophylaxis in an Emergency Department. *Turkish Journal of Trauma & Emergency Surgery.* 2013;19(4):320-326.doi: 10.5505/tjtes.2013.05014
7. Anuradha S. Tetanus in Adults - A Continuing Problem: An Analysis of 217 Patients Over 3 Years from Delhi, India, with Special Emphasis on Predictors of Mortality. *Med J Malaysia.* 2006;61(1):7-14.
8. Saltoglu N, Tasova Y, Midikli D, Burgut, IH. Prognostic Factors Affecting Deaths From Adult Tetanus. *Clin Microbiol Infect.* 2004;10(3):229-233. doi: 10.1111/j.1198-743X.2004.00767.x
9. Kuzucuoglu T, Ital I, Alatlı I. Follow-up and Treatment of a Severe Tetanus Case in the Intensive Care Unit. *J Kartal TR.* 2011;22(1):45-48.
10. Kömür S. Tetanus: Evalution of Six Patients. *Mediterr J Infect Microb Antimicrob.* 2013;2:7-10.
11. Sahan S, Demirbilek Y, Sonmez C, Temel F, A Sencan. Epidemiological Study of Tetanus Seropositivity Levels in Different Age Groups in Ankara Province, Turkey, 2017. *Jpn J Infect Dis.* 2019;72(1):14-18. doi: 10.7883/yoken.JJID.2018.222
12. del Corro MR, Vargas-Román MI, García RI, Prieto RG, de Miguel ÁG. Tetanus vaccination in adult population. *Human Vaccines.* 2009;5(2):98-104. doi: 10.4161/hv.5.2.6588
13. Kurtoglu D, Gozalan A, Coplu Net al. Community Based Seroepidemiology of Tetanus in Three Selected Provinces in Turkey. *Jpn J İnfect Dis*. 2004;57(1):10-16.
14. Coplu N, Esen B, Gozalan Aet al. Tetanus antibody assay combining in house elisa and particle agglutination test and its rosesurvey application in a province in Turkey. *Jpn J Infect Dis.* 2004;57(3): 97-102.
15. Böhmer MM, Walter D, Krause G, Müters S, Gösswald A, Wichmann O. Determinants of Tetanus and Seasonal Influenza Vaccine Uptake in Adults Living in Germany. *Hum Vaccin.* 2011;7(12):1317-1325. doi: 10.4161/hv.7.12.18130
16. Alkan İ, Öztürk CE, Çalışkan E, Akar ND. Investigation of Tetanus Antibody Levels in Adults. *Duzce Medical Journal.* 2019;21(2):98-102.

17. Rapisarda V, Bracci M, Nunnari G, Ferrante M, Ledda C. Tetanus immunity in construction workers in Italy. *Occup Med.* 2014;64(3):217-219. doi: 10.1093/occmed/kqu019
18. Kumar R, Taneja DK, Dabas P, Ingle GK, Saha R. Knowledge About Tetanus Immunization Among Doctors in Delhi. *Indian J Med Sci.* 2005;59(1):3-8.
19. Kumar R, Taneja DK, Dabas P, Ingle GK. Practice and Knowledge Regarding Prevention of Tetanus Among Nursing Personnel in Delhi. *Indian J Public Health.*2007;51(1):73-74.
20. Dabas P, Agarwal CM, Kumar R, et al. Knowledge of General Public and Health Professionals about Tetanus Immunization. *Indian J Pediatr.*2005;72(12):1035-1037.
21. Kumar R, Taneja DK, Dabas P et al. Practice and Knowledge Regarding Prevention of Tetanus Among Doctors in Delhi. *Asia Pac J Public Health.*2006;18(3):30-32.
22. Yoon YH, Moon SW, Choi SH et al. Clinician Awareness of Tetanus-diphtheria Vaccination in Trauma Patients: A Questionnaire Study. *Scand J Trauma Resusc Emerg Med.* 2012;20(1):35-38.
23. Basher MS. Knowledge and Practice About TT Vaccination Among Undergraduate Female Medical Students. *Mymensing Med J.* 2010;19(4):520-523.
24. Balemans R, Devroey D, Van De Vijver E et al. Knowledge and Attitudes About Vaccinations Among Adolescents. *J Prev Med Hyg.* 2011;52(2):64-72.