

Tetanus Immunity in Individuals Aged 50 Years or Older in Kashan, Iran

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Abstract- Tetanus can be only prevented by vaccination because immunity against this disease is rarely acquired, even by natural infections. To maintain long-term protective immunity against tetanus, booster immunization is essential for adolescents and adults. Most hospitalized cases and virtually all deaths occur in people over 60 years of age. The purpose of this study was to investigate the degree of protective tetanus immunity among 50 years of age and older people in Kashan city, Iran. This cross-sectional study carried out on 180 randomly individuals aged 50 years or older who were visiting a central laboratory for health examinations in 2008. Participants' serum levels of tetanus antitoxin were measured by enzyme linked immunosorbent assay. A standard questionnaire was used to collect demographic data and information about risk factors. The prevalence of protective tetanus immunity in various age groups was described and sociodemographic factors that potentially influenced the degree of tetanus immunity were analyzed. Overall, 180 persons were included. Of these, 72 (40%) had never received a toxoid booster, while 47 (26.1%) had received a booster at least once. Among all participants, 30 (16.7%) had protective tetanus antitoxin levels (≥ 0.11 IU/mL), and 34 (18.9%) had protective antitoxin levels without the need of an immediate booster ≥ 0.51 IU/mL. Among 86 participants aged >60 years, 6 (7%) had protective antitoxin levels $\geq 0.1-1$ IU/mL, and 5 (5.8%) had protective antitoxin levels ≥ 1 IU/mL. Male gender and prior receipt of toxoid booster(s) were associated with protective tetanus immunity. Tetanus antitoxin levels declined with age. It appears that most 50 years of age and older adults do not have protective levels of tetanus antitoxin because of inadequate vaccination coverage. There is a need to improve the immunity levels of this age group. It is recommended to vaccinate elderly people against tetanus.

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Introduction

Tetanus is a vaccine-preventable, infectious disease with significant morbidity and mortality. Contamination of a wound with soil containing spores of *Clostridium tetani* usually result in tetanus, spore of *Clostridium tetani* can germinate and release neurotoxin. Spread from person to person does not occur and herd immunity plays no role in its control. Tetanus is rare in people with history of complete vaccination course. Most hospitalized cases and virtually all deaths occur in people over 60 years of age (1). There is different status of serological immunity against tetanus between countries because of different national vaccination policies and methods. A wide range of protective immunity against tetanus has been reported in different studies for example 15.7% of nursing home residents in Karabay survey and 25.3% among adults

over 40 years of age in survey of Ozturk in Turkey, 27.8% and 31% of people aged >70 years in survey of Gergen and McQuillan in the USA respectively, 53% of aged >60 years in England and Wales in survey of Maple and 80% of old man and 56% of old women's in Sweden in survey of Christenson, and $<75\%$ of Australians aged >50 years in survey of Gidding, , 91% of elderly in the Czech Republic were immune to tetanus in survey of Matousková (2-9). Frequency of injuries, possible lack of vaccination history, and decrease of general as well as specific immunity in elderly people make them vulnerable group for tetanus infection (10).

In 2009, WHO and UNICEF reported the incidence of tetanus in Iran to be 8 cases while in 2008, the incidence was 10 cases (11). The age of the most tetanus patients in study of Vahdani and *et al.*, in Iran was between 45 to 60 years (12). In Iran, immunization

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against diphtheria, tetanus and pertussis has been applied since 1950 using a local vaccine manufactured by Razi Institute (Razi-DTwP) (13). It appears that many elderly people especially in rural parts of the country are unvaccinated, and have no protective immunity against tetanus. In most countries, booster immunization of diphtheria and tetanus is recommended to be performed every 10 years in people who had completed DTP vaccination at 4-5 years old. Booster Td vaccine is recommended to start at the age of 11-12 years old.

We are not aware of any published data addressing the level of tetanus immunity among the elderly population in Iran. Thus, the purpose of this study was to investigate the degree of protective tetanus immunity among 50 years of age and older people in Kashan, which may provide valuable information for recommendations for tetanus vaccination strategy.

Materials and Methods

A prospective study was performed in central Boali laboratory, between March 2008 and December 2008, Individuals aged ≥ 50 years who were visiting a central laboratory for check up examinations were invited to

participate. Inclusion criteria were age ≥ 50 years and lack of underlying disease and immunodeficiency. After obtaining informed consent, blood samples were collected from people, and sera were stored at -20°C until use. Meanwhile a standard questionnaire, including items of demographic data, occupation, and history of tetanus vaccination, was filled in based on face to face interviews. Serum level of tetanus antitoxin was measured by an enzyme-linked immunosorbent assay (ELISA) (Novatec, Germany) method. An antitoxin concentration ≥ 0.1 IU/mL was regarded as protective level of antibody. Statistical analysis was performed using the SPSS#14 software. Categorical variables were compared using either Chi-square test and Pearson coefficient correlation.

Results

180 persons were enrolled in the study. Non protective (<0.1 IU/ml) titer of antibody was found in 116 (64.4%) of individuals and 64 (35%) of participants possessed protective titers of antibody against tetanus immunity. 63.6% of urban and 67.6% of rural participants had no protective immunity (Table 1).

Table 1. Demographic information of the participants and protective tetanus antitoxin

Variables	Protective tetanus antitoxin		Total	P value		
	Yes	No				
Age	50-59 year	53(56.9)	40(43.1)	93	<0.001	
	60-69	8(18.2)	36(81.8)			44
	70-79	2(5.4)	35(94.6)			37
	≥ 80	0(0)	5(100)			5
Gender	Male	38(43.7)	49(56.3)	87	0.028	
	female	26(27.9)	67(72.1)	93		
Living place	Urban	53(36.3)	93(63.7)	146	0.665	
	Rural	11(32.4)	23(67.6)	34		
History of vaccination	Positive	27(57.5)	20(42.5)	47	<0.001	
	Negative	13(18.1)	59(81.9)	72		
	unknown	24(39.3)	37(60.7)	61		
Job	Housekeeper	26(28)	67(72)	93	0.297	
	worker	7(46.7)	8(53.3)	15		
	Retired	14(33.3)	28(66.7)	42		
	farmer	1(20)	4(80)	5		
	employee	6(100)	0(0)	6		
	other	10(52.6)	9(47.4)	19		
Total	64(35.6%)	116(64.4%)	180(100%)			

Table 2. Geometric mean titers (GMT) of tetanus antibody in 180 individuals aged 50 years or older in Kashan, Iran

	Age	50-59	60-69	70-79	≥80	Total	
Titer of antibody (IU/mL)							
<0.1		40(43)	36(83.7)	35(94.6)	5(100)	116(64.4)	r=-0.338
0.1-1		24(25.8)	4(8.9)	2(5.3)	0	30(16.7)	P value<0.001
1-2		14(15.05)	3(6.7)	0	0	17(9.5)	
2-3		9(9.7)	0	0	0	9(5)	
≥3		6(6.5)	1(2.2)	1(2.7)	0	8(4.4)	
Total		93(100)	43(100)	38(100)	5(100)	180(100)	

There was significant statistical association between age, sex and history of vaccination with protective immunity ($P<0.05$) but there was no association between living place or job with protective immunity. There was a significant decline in the prevalence of immunity with increasing age. None of the participants 80 years of age and older had protective immunity against tetanus (Table 2).

Pearson coefficient correlation showed negative correlation between age and titers of antibody ($r=-0.338$, $P<0.001$).

Discussion

Among all participants, 16.7% had protective tetanus antitoxin levels ($>$ or $=$ 0.11 IU/mL) and 18.9% had protective antitoxin levels without the need of an immediate booster, i.e. $>$ or $=$ 0.51 IU/mL. Non protective tetanus antitoxin levels (<0.1 IU/ml) titer of antibody was found in 64.4% of cases. The level of immunity to tetanus was significantly lower in the subjects above 80 years compared to the other age groups. 40% of cases had never received a toxoid booster, while 26.1% had received a booster at least once.

Results of previous surveys show that between 64% and 80% of persons above the age of 60 years have no protective levels of tetanus antitoxin, compared to 7% of adults between the ages of 18 and 30 years (14). Gergen *et al.*, in the USA showed serological evidence of immunity declining from over 80% among persons aged 6–11 years to 27.8% among persons aged 70 years or older (4).

Waning immunity to tetanus was observed after primary tetanus vaccination or toxoid booster in study of Wu *et al.*, in Taiwan. Among 70 participants aged >60 years, 89% had protective antitoxin levels \geq 0.11 IU/mL, and 31% had protective antitoxin levels \geq 0.51 IU/mL (15).

Thus, the rate of 64.4% in the present study reflects that about more than half of our aged population is still at risk of infection with tetanus.

In our study male subjects had higher immunity against tetanus than female subjects; this is in agreement with studies published by Gergen *et al.* and Wu *et al.* (4,15). Possible explanations are higher accident rates among men which increase the probability of receiving a tetanus booster and immunization during military services (15).

Iranian Ministry of Health runs a childhood immunization program, and routine booster injections are recommended every 10 years to maintain protective immunity against tetanus. Booster injections in Iran are typically administered to adolescents at the age of 12 or 14 years and to males at the age of 19 or 21 years when they enter military service and to female at 7th and 8th month of pregnancy. While the rate of primary immunization in Iran is high but the rate of booster immunizations is estimated to be low. In this study, 42.5% of individuals with positive history of vaccination had no protective level of antibody. A report from the USA showed that only 27–36% of peoples aged 65 or older, had history of tetanus vaccination during the previous 10 years (16). Although vaccines are the most effective means for prevention against infectious diseases, but currently, only suboptimal immunity is induced by some vaccines, so booster dose of vaccines to produce a sustained level of protective response is necessary (17). Because of the immunity after the basic scheme is lasting up only to 10 years and further revaccination is needed and since tetanus immunization history is a poor predictor of immune status in the elderly, for rising the rate of protective immunity against tetanus, the policy of immunization should be focused on administration of a single booster every 10 years or at least at the age of 40 or 50 years in parallel to improving primary immunization (18). In conclusion, regarding to high rate of nonprotective tetanus antitoxin levels in

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people aged ≥ 50 year old and since tetanus immunization history is a poor predictor of immune status in the elderly, Simple and practical serological tests should be used to determine the level of immunity to tetanus in persons with a poor or unknown immunization history and a single-dose booster every 10 years or at least at the age of 40 or 50 years should be administered.

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