

ORIGINAL RESEARCH

Knowledge of Emergency Medicine Residents in Relation to Prevention of Tetanus

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Abstract

Introduction: Knowledge of emergency medicine residents about the management of patients suspected of having tetanus-favoring wounds is very important due to their responsibility for the treatment of such patients. The aim of the present study was to evaluate this knowledge and making sure of the adequacy of instructions they have received in relation to prevention of tetanus. **Methods:** A reliable and reproducible questionnaire was used to evaluate knowledge of all the emergency medicine residents in Imam Hussein Hospital in Tehran, Iran, about conditions favoring tetanus (9 questions) and proper interventions in such conditions (12 questions). The questionnaires were completed and scored as poor and good. The Mann-Whitney U test was used to analyze data. Statistical significance was set at $P < 0.05$. **Results:** In the present study, 73 emergency medicine residents were evaluated (45.2% male). Knowledge of 31 (42.5%) residents in relation to conditions favoring tetanus and 41 (56.2%) residents in correct therapeutic interventions was in good level. The most frequent incorrect answer was related to diabetic ulcers and wounds in patients with sepsis. There was an increase in scores of conditions favoring tetanus ($P < 0.001$) and correct therapeutic interventions ($P = 0.001$) with an increase in educational years. However, age ($P = 0.64$), gender ($P = 0.31$), job experience ($P = 0.38$) and participation in educational courses ($P = 0.67$) had no effect on the knowledge level of emergency medicine residents. **Conclusion:** According to the findings of the present study, the knowledge of emergency medicine residents about correct management of patients suspected of tetanus was low, which emphasizes the necessity of providing further instructions on prevention of tetanus in wound management.

Key words: Tetanus; vaccines; immunoglobulin; emergency medicine; primary prevention

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Introduction:

Tetanus is an acute and life-threatening condition which is common in all the age groups and in all the geographic locations. Despite the fact that the condition is an international problem, hot and humid areas, which have a soil rich in organic materials, have the highest prevalence rate. In addition, the risk is higher in intravenous drug abusers, non-vaccinated individuals and immunocompromised patients (1). Tetanus-related mortality in developing countries is 135 folds higher than that in developed countries (2). The exact prevalence rate of the condition worldwide is not fully known, but based on estimates the incidence is 500,000 to 1,000,000 cases annually with a mortality rate of

20% to 45%. The majority of new tetanus cases arise in developing countries, with almost 50% of cases occurring in newborns. However, in developed countries, tetanus is rare and mostly occurs in the elderly (3, 4). It should be pointed out that tetanus is the only non-communicable infectious disease which can be prevented by vaccination (5).

The most important risk factor for the development of tetanus is lack of immunization; in this context, 72% of tetanus victims have not completed their initial vaccination (6). In taking care of wounds suspected of tetanus and use of prophylaxis for it, a history of patient's vaccination is very important because in individuals who have received five initial vaccination doses completely no particular intervention is necessary, except for cases in which the wound favours tetanus. However, if the patient's vaccination history is not available or the vaccination has been incomplete, therapeutic interventions

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are similar to those cases in which the patient is not immune to tetanus. In such cases, human tetanus immune globulin (TIG) and Booster vaccine are the most important therapeutic measures to prevent tetanus (7, 8).

Based on the above-mentioned, one of the measures, which is necessary in traumatic patients, is evaluation of their status and a judgment about the need to use TIG and vaccine. The evaluation is carried out in different ways, including clinical judgment, ELISA test and rapid diagnostic procedures (9-11). Limitations in the use of laboratory tests and sometimes low accuracy of these tests (12, 13) have made the physician's clinical judgment an important factor in decision-making processes. Unfortunately, lack of proper knowledge of physicians in this respect has resulted in indiscriminate and unnecessary use of the vaccine and immune globulin (8, 12). This lack of knowledge has increased patient treatment costs and the economic toll on the country's health system. On the other hand, if correct prophylactic measures are not taken in situations favouring tetanus, the patient is exposed to a high risk of this life-threatening disease, which will have tragic consequences. Therefore, the present study was undertaken to evaluate the knowledge of emergency medicine residents and the adequacy of education they have received in relation to prevention of tetanus.

Methods:

The present cross-sectional study was carried out from April 2012 to October 2012 in Imam Hussein Hospital in Tehran, Iran, a third-level university hospital with 60000 annual admissions. All the emergency medicine residents were evaluated. Exclusion criterion was unwillingness to participate in the study. The minimum sample size at $P=0.5$ (14), maximum permissible error of 0.05 ($d=0.05$) at confidence interval of 95% was 61 residents.

In order to collect data, a questionnaire was designed, with the aim to evaluate the knowledge of the emergency medicine residents about the diagnosis and management of wounds and conditions suspected of tetanus. The questionnaire was designed using emergency medicine references and textbooks under the supervision of two emergency medicine specialists and one epidemiologist. Then the reliability of the questionnaire was confirmed by calculating Cronbach's alpha at 0.71. The questionnaire consisted of three sections. The first section consisted of questions on the residents' demographic data (age, gender, educational status, job experience and participation in educational courses on tetanus). The second section consisted of nine questions, each with three choices (Yes, No, I do not know) in relation to the knowledge of residents about conditions favoring tetanus. These nine questions concerned the odds of developing tetanus due to contaminated

wounds, deep wounds, and wounds more than 12 hours old, wounds in systemic septic patients, diabetic ulcerations, infection of the injection site in drug addicts, wounds inflicted in open areas (streets, parks etc), burns, and finally wounds requiring surgical intervention for debridement. The third section consisted of 12 questions with three choices (always, sometimes, never) on the knowledge of residents about the necessary interventions in cases suspected of tetanus. These questions were as follows: two questions in relation to the necessary interventions concerning the time elapsed since the patient's complete vaccination (more than 10 years, less than 10 years); administration of a Booster dose in the past; lack of access to patient's vaccination history; receiving only one dose of tetanus vaccine; and the necessary measures in immunocompromised patients. The questionnaires were handed in to the residents and each resident was given 30 minutes to answer the questions.

Scoring of the questions on the residents' knowledge about conditions favouring tetanus was carried out by giving one positive score to each correct answer and one negative score to each incorrect answer. The answer "I do not know" received no score (a score of zero). In scoring questions on correct measures during encounter with conditions favouring tetanus, too, each correct answer received a positive score and each incorrect answer received a negative score. Therefore, the subjects could receive a total score of -9 to 9 in the section on knowledge about conditions favouring tetanus and a total score of -12 to 12 in the section on correct intervention. A minimum score of 5 ($5 \geq$) in the section on conditions favouring tetanus and at least 6 ($6 \geq$) in the section on correct intervention were considered good knowledge level; scores less than these values were considered poor knowledge level.

Data collected from the questionnaires were entered into SPSS 21 software and then STATA 11.0 software was used for descriptive and analytical evaluation of data. Man-Whitney U test was used to evaluate the relationship between the scores and the demographic data. Statistical significance was set at $p < 0.05$.

Results:

In the present study, 73 emergency residents were evaluated (male: 45.2%). Mean and standard deviation of ages of the subjects was 33.3 ± 4.5 years. Of 37 residents in the present study 29 (39.7%), 23 (31.5%) and 21 (28.8%) were first-, second- and third-year residents, respectively. The majority of the subjects (52.1%) had job experiences of more than two years, before initiation of residency. Of all the residents under study, only 7 residents (9.6%) had participated in courses on tetanus and vaccination against tetanus (Table 1). Knowledge of 31 (42.5%) residents about the conditions favoring tetanus was at a good level (mean \pm



SD = 3.2 ± 2.4). The most frequent incorrect answer was related to diabetic ulcers. Despite the fact that such ulcers are not susceptible to tetanus, 46 residents (63%) believed it was; in contrast, 8 residents (11%) had no knowledge on the subject ("I do not know"). After diabetic ulcers, the most frequent incorrect answer was related to ulcers in patients with sepsis. Although this ulcer is susceptible to tetanus, 3 residents (31.5%) believed it was not and 10 residents (5.5%) had no knowledge on the subject ("I do not know"). [Table 2](#) presents the frequencies of residents' responses to each question separately.

In addition, knowledge of only 41 (56.2%) residents about correct therapeutic measures was at a good level (mean ± SD = 6.1 ± 2.7). The most frequent mistake of residents was related to injection of TIg in patients who have received complete vaccination. Fifty-eight residents (79%) had given incorrect answer to the first question (elapsing of more than 10 years since complete vaccination) and 97 (50.7%) residents had given incorrect answer to the next question (elapsing of less than 10 years since complete vaccination). Forty-three (58.9%) residents provided incorrect answers to question regarding necessity of TIg and 38 (52%) necessity of vaccine in immune compromised patients ([Table 3](#)).

The only factor affecting the knowledge of residents about conditions favoring tetanus was the educational level of the residents ($P < 0.001$), i.e. the residents' knowledge increased with an increase in educational level. Of first-, second- and third-year residents, 13.8%, 39.1% and 90.5% had good knowledge, respectively. However, other factors did not influence their knowledge about the conditions favoring tetanus. [Table 4](#) presents the relationship between these variables and the residents' knowledge level.

In addition, educational level affected knowledge about correct therapeutic measures ($P = 0.001$). Good knowledge level was higher (85.7%) in third-year residents than that in first-year (31.0%) and second-year (52.5%) residents ($P < 0.001$). However, age ($P = 0.64$), gender ($P = 0.31$), job experience ($P = 0.38$) and participation in educational courses ($P = 0.67$) had no effect on the knowledge level of emergency medicine residents ([Table 5](#)).

Discussion:

The results of the study showed that the knowledge of emergency medicine residents about the diagnosis of conditions favoring tetanus and correct measures in such cases was poor. The most important factor affecting this knowledge was educational years during residency, i.e. the third-year residents had higher knowledge compared to first- and second-year residents. The most common error of the residents in the diagnosis of conditions favoring tetanus was deeming diabetic foot ulcerations (63.0%), a factor leading to

Table 1: Baseline characteristics of residents [↑](#)

Variable	Frequency (%)
Gender	
male	33(45.2%)
female	40(54.8%)
Educational status	
first year	29(39.7%)
second year	31(31.5%)
third year	21(28.8%)
Job experience	
less than a year	13(17.8%)
1-2 years	22(30.1%)
more than 2 years	38(52.1%)
Participation in educational courses	
no	66(9.6%)
yes	7(90.4%)

tetanus. On the other hand, the most common error in relation to therapeutic intervention for suspected ulcers was administration of TIg in patients who have been completely vaccinated. In addition, 52.9% and 52% of residents were not aware about the necessity of administering TIg and vaccine in immunocompromised patients, respectively. The results of the present study showed the necessity of providing further instructions for emergency medicine residents on the diagnosis and management of suspected tetanus cases.

Dabas et al showed that the knowledge of physicians in relation to the vaccination of adults was low and only 48.3% of physicians knew the correct indications and cases of tetanus vaccine (15). A study by Brand et al, too, showed that 23% of cases suspected of tetanus were not treated correctly, with 6% of inadequate administration and 17% of excessive prophylactic measures against tetanus (16). A study by Adeboye and Sangowawa in Britain, in which 40 emergency unit personnel, consisting of physicians and nurses were evaluated, showed that only 17 personnel (42.5%) were aware of new prophylactic guidelines against tetanus (17). A study by Chowdhury et al showed that the majority of interns did not have sufficient knowledge about conditions favoring tetanus and proper therapeutic measures (18). A study by Talan et al showed the inadequacy of the therapeutic measures in 35% of cases suspected of tetanus (19).

As discussed above, awareness about conditions favoring tetanus and techniques used to tackle them have been at an unfavorable level in the majority of studies; based on these studies the prevalence of diagnostic and therapeutic errors in this disease condition is much higher than that in other clinical problems (12, 15, 17-19). These findings show a great disparity between



Table 2: Answers given by the residents to questions on conditions favoring tetanus [↑](#)

Questions	Is the wound susceptible to tetanus? (%)			Classification
	Yes	No	I do not know	
Deep wound	57 (78.1)	13 (17.8)	3 (4.1)	susceptible
Contaminated wound	72 (8.6)	1 (1.4)	0 (0.0)	susceptible
Wound older than 12 hours	47 (64.4)	22 (30.1)	4 (5.5)	susceptible
Wound in sepsis patients	40 (54.8)	23 (31.5)	10 (5.5)	susceptible
Diabetic ulcer	46 (63.0)	19 (26.0)	8 (11.0)	not susceptible
Infection of injection site in drug addicts	55 (75.3)	11 (15.1)	7 (9.6)	susceptible
Wounds produced in open environments	53 (72.6)	18 (24.7)	2 (2.7)	not susceptible
Burns	68 (93.2)	4 (5.5)	1 (1.4)	susceptible
Wounds requiring debridement	50 (68.5)	17 (23.3)	6 (8.2)	susceptible

Table 3: Responses of residents in relation to correct measures in wounds favoring tetanus [↑](#)

Questions on knowledge about correct measures	Always	Sometimes	Never	Classification
10 years elapsed after complete vaccination				
Tlg	34 (46.6)	24 (32.9)	15 (20.5)	never
Vaccine	67 (91.8)	6 (8.2)	0 (0.0)	always
<10 years elapsed after complete vaccination				
Tlg	9 (12.3)	28 (38.4)	36 (49.3)	never
Vaccine	28 (38.4)	37 (50.7)	8 (10.9)	sometimes
Complete vaccination plus a Booster dose				
Tlg	3 (4.1)	20 (27.4)	50 (68.5)	never
Vaccine	9 (12.3)	31 (42.5)	33 (45.2)	sometimes
No vaccination history is available				
Tlg	57 (78.1)	12 (16.4)	4 (5.5)	always
Vaccine	70 (95.9)	3 (4.1)	0 (0.0)	always
One vaccination dose received				
Tlg	40 (54.8)	24 (32.9)	9 (12.3)	always
Booster	58 (79.5)	10 (13.7)	5 (6.8)	always
Immunocompromised				
Tlg	30 (41.1)	34 (46.6)	9 (12.3)	always
Booster	35 (48.0)	30 (41.1)	8 (10.9)	always

*Tlg: Tetanus immune globulin

these guidelines and what actual happens in the clinic. Therefore, due to the low knowledge of residents in the present study and other similar studies, measures should be taken to define and prepare guidelines to promote awareness of physicians about prevention of tetanus. Medical education groups, especially emergency medicine group, should play a key role in this respect because emergency medicine specialists, during their education and after graduation, are the first physicians who carry out therapeutic interventions (20, 21). In addition, the high prevalence of accidents and other cases of traumas in our country (22, 23) on one hand and the need to provide correct care for such traumas on the other hand show the great importance of proper and up-to-date knowledge of physicians in relation to the management of wounds.

In the present study, irrespective of educational years, what attracts attention is the low scores of residents in the diagnosis and management of wounds favoring tet-

anus. As discussed in the results section, the means and standard deviations of the residents' scores in the present study in relation to conditions favoring tetanus and correct therapeutic procedures were 3.2 ± 2.4 and 6.1 ± 2.7 , respectively. Based on these data, since the maximum attainable scores in these two sections were 9 and 12, respectively, unfortunately the scores gained by the residents were very low. These findings reflect the shortcomings of the educational system, which might be attributed to deficiencies of the educational structures, inappropriate educational environments, lack of attention of the educational system to the needs of the community and the students and finally presentation of a large volume of educational materials in a short time. Therefore, different reasons have led to the inadequacy of the instructions provided, which include the inadequacy of the educational structure and system, inappropriate teaching environment and a lack of consistency between the educational programs and the



Table 4: The relationship between knowledge about tetanus risk factors and demographic factors [↑](#)

Variable	Poor knowledge		Good knowledge		P
	n	%	n	%	
Gender					
male	7	21.2	26	78.8	0.69
female	7	17.5	33	82.5	
Educational status					<0.0001
first year	25	86.2	4	13.8	
second year	14	60.9	9	39.1	
third year	2	9.5	19	90.5	
Job experience					0.38
less than a year	3	23.1	10	76.9	
1-2 years	2	9.1	20	90.9	
> 2 years	9	23.7	29	76.3	
Participation in educational courses					0.61
no	12	18.2	54	81.8	
yes	2	28.6	5	71.4	

Table 5: Relationship between knowledge about correct therapeutic measure and demographic factors [↑](#)

Variable	Poor knowledge		Good knowledge		P
	n	%	n	%	
Gender					
male	10	30.3	23	69.7	0.31
female	8	20.0	32	80.0	
Educational status					0.001
first year	20	69.0	9	31.0	
second year	11	47.8	12	52.2	
third year	3	14.3	18	85.7	
Job experience					0.38
less than a year	4	30.8	9	69.2	
1-2 years	4	18.2	18	81.85	
> 2 years	10	26.3	28	73.7	
Participation in educational courses					0.67
no	17	25.8	49	74.2	
yes	1	14.3	6	85.75	

needs of the community and the students. Therefore, the existing educational system should be thoroughly revised.

One of the limitations of the present study was the absence of an educational intervention. If an educational intervention had been available, it would have been possible to evaluate the effect of education on improving the knowledge of residents. On the other hand, the resident's awareness of the fact that he or she was under evaluation might have resulted in bias, affecting the results of the study, showing an increase in knowledge of residents in a false manner. However, since the mean knowledge level of the residents was low, the authors believe that the results are valid and reliable largely. Nevertheless, it is suggested that in future studies, the emergency medicine residents' knowledge be evaluated

in a double-blind manner next to the patient bed and then an educational program be designed and the residents' knowledge be evaluated again so that the effect of education on promoting knowledge can be evaluated.

Conclusion:

According to the findings of the present study, the knowledge of emergency medicine residents about correct management of patients suspected of tetanus was low, which emphasizes the necessity of providing further instructions on prevention of tetanus in wound management.

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