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**RESEARCH ARTICLE**

# Assessment of the level of knowledge of rabies and prophylaxis for rabies among medical senior students

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**ABSTRACT**

**Objective:** Rabies is a zoonotic disease with acute, progressive viral encephalitis that affects both human and animal health. In our study, it was aimed to measure the level of knowledge about rabies and prophylaxis of senior students of the faculty of medicine.

**Methods:** The study population was 163 students in their final year during the academic year 2019–2020. The participants were interviewed face to face and filled the required questionnaire. The questionnaire was developed based on the Guide for Rabies Prophylaxis published in 2019 by the Republic of Türkiye Ministry of Health.

**Results:** In our study, 88.34% (n=114) of the participants did not have sufficient knowledge about rabies pre-contact indications. It was determined that 64.4% (n= 105) of the participants had insufficient knowledge about the effectiveness of post-exposure prophylaxis. In addition, it was determined that indications for starting antibiotics after rabies exposure of 66.24% (n=108) of the participants and 29% (n=) rabies vaccine/ human rabies immunoglobulin (HRIG) application indications and 46% (n=75) did not know the method of application and the area where it was applied.

**Conclusion:** It was determined that the senior students of the faculty of medicine did not have sufficient information about rabies and prophylaxis.

**Keywords:** Rabies, Prophylaxis, Medical senior students

**ÖZET**

**Tıp fakültesi son sınıf öğrencilerinin kuduz hastalığı ve profilaksisi hakkındaki bilgi düzeylerinin değerlendirilmesi**

**Amaç:** Kuduz, hem insan hem de hayvan sağlığını etkileyen zoonotik karakterli, akut, ilerleyici viral ensefalit tablosu ile seyreden bir hastalıktır. Çalışmamızda, tıp fakültesinde eğitim gören son sınıf öğrencilerinin kuduz hastalığı ve profilaksisi ile ilgili bilgi düzeylerinin ölçülmesi amaçlanmıştır.

**Yöntem:** Araştırmanın evrenini; 2019-2020 eğitim-öğretim yılında, Tıp Fakültesi son sınıfta eğitim gören 163 öğrenci oluşturdu. Katılımcılarla yüz yüze görüşme yapılarak, anket formları doldurudu. Anket formu; Türkiye Cumhuriyeti Sağlık Bakanlığı tarafından 2019 yılında yayımlanan Kuduz Profilaksi Rehberi esas alınarak oluşturuldu.

**Bulgular:** Çalışmamızda katılımcıların %88,34'nün (n=114) kuduz şüpheli temas öncesi endikasyonları hakkında yeterli bilgi düzeyine sahip olmasına rağmen, % 64,4'nün (n= 105) temas sonrası proflaksinin etkinliği hakkında ki bilgi düzeyleri yetersiz tespit edildi. Ayrıca katılımcıların % 66,24'nün (n=108) kuduz şüpheli temas sonrası antibiyotik başlama endikasyonlarını, %29'u (n=) kuduz aşısı/kuduz immünglobulini uygulama endikasyonlarını, % 46'sı (n=75) ise uygulama şekli ve yapıldığı bölgeyi bilmedikleri saptandı.

**Sonuç:** Tıp Fakültesi son sınıf öğrencilerinin kuduz hastalığı ve profilaksisi ilgili yeterli bilgi düzeylerine sahip olmadığı saptandı.

**Anahtar kelimeler:** Kuduz, Profilaksi, Tıp Fakültesi son sınıf öğrencisi

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## INTRODUCTION

Although the causative agent and pathogenesis of rabies was discovered nearly a hundred years ago, it remains a fatal disease. Approximately 250,000 cases of suspected contacts are reported annually in Türkiye, an endemic area for the disease, and on average, 1–2 cases of rabies occur annually. Rabies is best prevented by avoiding contact with the disease agent, and if exposure has occurred, appropriate post-exposure prophylaxis should be implemented promptly [1-6].

A Guide for Rabies Prophylaxis was prepared by the Republic of Türkiye Ministry of Health. and published after being updated in 2019. The guide includes information on approach to post-exposure prophylaxis, recommendations for pre-exposure prophylaxis, information about the disease, actions to be taken in case of suspected disease, and principles for reporting cases. The updated version of the guide contains new information that was not included in the previous version [3]. There are some challenging issues in post-exposure prophylaxis. Therefore, in the present study we aimed to measure the level of knowledge of rabies, and prophylaxis for rabies among the senior students of the faculty of medicine in Türkiye.

## MATERIALS and METHODS

The research was approved by the Ethics Committee of Scientific Research of our University (14/09/2020, protocol no: INCEF-BAEK 15/24). The study population was medical students in their final year during the academic year 2019–2020. No sampling method was chosen, and those who agreed to participate in the study were included. Eighty three students who refused to participate in the study were excluded. A total of 163 medical students, corresponding to 67% of the students in their final year, at Trakya University Faculty of Medicine who agreed to participate in the study underwent face-to-face interviews and filled the required questionnaire.

The questionnaire was developed based on the Guide for Rabies Prophylaxis (ISBN: 978-975-590-728-4) published in 2019 by the Republic of Türkiye Ministry of Health. General Directorate of Public Health, Department of Zoonotic and Vector-Borne Diseases [3].

The first part of the questionnaire consisted of 6 questions related to the descriptive characteristics of the participants (sociodemographic characteristics, pet ownership status, and history of being bitten by an animal and history of rabies prophylaxis).

The second part of the questionnaire assessed the respondents' level of knowledge of rabies, and it consisted of 38 statements divided into 4 main headings as follows: knowledge about definition of rabies and routes of transmission, approach to pre-exposure, contacts that do not require rabies prophylaxis, approach to post-exposure measures.

### Statistical Analysis

SPSS 19 (serial no: 10240642) statistical software suite was used for the statistical analysis of data obtained. Numeric data were presented as average, standard deviation, minimum and maximum, distribution (number of people), and % (percentage).

## RESULTS

Among the 163 6th year students (mean age, 24.02 ± 1.40 [22–31] years) included in the study, 82 (50.3%) of the respondents were men, 36 (22.2%) had at least one pet, and 34 (21.4%) reported having been vaccinated against rabies because of being bitten by an animal. Sociodemographic characteristics of the participants were shown in Table 1.

| n = 163 | | |
|---|---|---|
| **Age** (year) (mean ± SD) | 24.02 ± 1.40 (22–31) | |
| **Sex n (%)** | Male | 82 (50.3) |
| | Female | 81 (49.7) |
| **Sources of bites n (%) (n = 34)** | Cat | 18 (53) |
| | Dog | 14 (41.2) |
| | Other | 2 (5.8) |
| **Site of the bite n (%)** | Upper extremity | 19 (55.9) |
| | Lower extremity | 11 (32.3) |
| | Abdomen | 2 (5.9) |
| | Hip | 2 (5.9) |
| **Rabies vaccination status n (%)** | 3 doses | 13 (38.2) |
| | 4 doses | 9 (26.5) |
| | 5 doses | 12 (35.3) |
| **Time to hospital visit after exposure n (%)** | 0–12 hours | 28 (82.4) |
| | 12–24 hours | 2 (5.9) |
| | Over 24 hours | 4 (11.7) |

**Table 1:** Sociodemographic characteristics of the respondents

Analysis of the respondents' responses to the statements measuring their level of knowledge about rabies shows that the statements with the highest percentage of correct responses, in descending order, were as follows:

1. The main route of transmission is the bite of an infected animal.
2. The best way to be protected from rabies is to avoid contact with animals and to be vaccinated in case of a bite, scratch, or mucosal contact.
3. Rabies is a viral, zoonotic disease that causes encephalitis in most humans and mammals.

Participants knowledge levels about the causative agent, definition and routes of transmission of rabies were shown in Table 2.

Statements with the highest percentage of incorrect responses, in descending order, were as follows:

1. The duration of antibiotic prophylaxis for children and adults is 7 days in case of wounds without visible contamination, and 14 days in case of contaminated wounds. All patients, including immunocompromised patients, should be re-evaluated after 7 days.

| | True | False | No answer |
|---|---|---|---|
| | n (%) | | |
| Rabies is a reportable disease. | 135 (82.8) | 25 (15.3) | 3 (1.9) |
| Rabies is a viral, zoonotic disease that causes encephalitis in most humans and mammals. | 151 (92.6) | 6 (3.7) | 6 (3.7) |
| The main route of transmission is the bite of an infected animal. | 156 (95.7) | 3 (1.8) | 4 (2.5) |
| Stray dogs are the most common source of exposure. | 121 (74.3) | 18 (11) | 24 (14.7) |
| Bites of animals that may be infected with rabies pose a risk for rabies (regardless of the site of the bite). | 135 (82.8) | 8 (4.9) | 20 (12.3) |
| The best method of protection against rabies is to avoid contact with animals, and to be vaccinated in case of biting, scratching, or mucosal contact. | 153 (93.9) | 4 (2.4) | 6 (3.7) |
| Rabies is not transmitted human-to-human. | 70 (42.9) | 65 (39.9) | 28 (17.2) |

**Table 2.** Participants knowledge levels about the causative agent, definition and routes of transmission of rabies

| | True | False | No answer |
|---|---|---|---|
| | n (%) | | |
| People who get into frequent contact with animals at risk of rabies need to receive pre-exposure prophylaxis. | 144 (88.3) | 6 (3.7) | 13 (8) |
| Pre-exposure prophylaxis is administered via a total of two doses of intramuscular vaccine on day 0 and 14. | 71 (43.6) | 21 (12.9) | 71 (43.5) |
| Immunocompromised or immunodeficient patients should receive a total of three doses of vaccine, with an additional dose on day 21 or 28. | 60 (36.8) | 17 (10.4) | 86 (52.8) |

**Table 3.** Participants knowledge levels about pre-exposure prophylaxis

| | True | False | No answer |
|---|---|---|---|
| | n (%) | | |
| No case of transmission to humans caused by consumption of raw meat and/or milk has been documented, so postexposure prophylaxis is not required in these cases. | 102 (62.5) | 13 (8) | 48 (29.5) |
| No postexposure prophylaxis is required for bites of mice, rats, squirrels, hamsters, guinea pigs, gerbils, rabbits, and hares. | 64 (39.3) | 33 (20.3) | 66 (40.4) |
| No postexposure prophylaxis is required after being bitten by a bat or after finding a bat in a house in Turkey. | 53 (32.5) | 58 (35.6) | 52 (31.9) |
| Postexposure prophylaxis is not required in case of bites of cold-blooded animals (snakes, lizards, and turtles, among others). | 85 (52.5) | 19 (11.7) | 58 (35.8) |
| Postexposure prophylaxis is not required in case of bites of or contact with a known and still intact cat or dog dating back 7 days or more. | 74 (45.4) | 58 (35.6) | 31 (19) |
| Postexposure prophylaxis is not required after being bitten by poultry. | 108 (66.3) | 10 (6.1) | 45 (27.6) |
| Feeding an infected animal, contact of intact skin with such animals' blood, milk, urine and/or feces, eating the cooked meat, drinking the boiled or pasteurized milk of infected animals, or consuming dairy products made with such milk do not require postexposure prophylaxis. | 89 (54.9) | 20 (12.4) | 53(32.7) |

**Table 4.** Participants knowledge levels about contacts that do not require postexposure prophylaxis

2. Pre-exposure prophylaxis consists of a total of two doses of vaccine, administered on day 0 and 14. Participants knowledge levels about pre-exposure prophylaxis were shown in Table 3.

3. The vaccine is injected intramuscularly in the anterolateral area of the thigh in adults and young children

Participants knowledge levels about contacts that do not require post-exposure prophylaxis in Table 4 and knowledge levels about post-exposure prophylaxis in Table 5 were shown.

Analysis of the respondents' knowledge of rabies showed that, on average, they provided 34.44 ± 6.70 correct responses. No significant association was found between pet ownership and history of being bitten, and their level of knowledge.

| Principles of postexposure prophylaxis | True | False | No answer |
|---|---|---|---|
| | n (%) | | |
| Postexposure prophylaxis is crucial since the disease does not have a specific treatment and is often fatal. | 144 (88.3) | 11 (6.8) | 8 (4.9) |
| Being bitten or scratched by a rabid patient, or contact of the mucosa or open wounds with the saliva of rabid patients requires postexposure prophylaxis. | 143 (87.7) | 6 (3.7) | 14 (8.6) |
| Contact of open wounds, cuts, mucous membranes with potentially infected material is considered as non-bite exposure. | 142 (87.1) | 5 (3.1) | 16 (9.8) |
| Postexposure prophylaxis is administered in people wounded on the face or in immunocompromised patients regardless of the time elapsed. | 120 (73.6) | 10 (6.1) | 33 (20.3) |
| Prophylaxis is not required in people who have had full doses of postexposure prophylaxis in the last 6 months. | 79 (48.5) | 12 (7.3) | 72 (44.2) |
| Postexposure prophylaxis is 100% effective if administered promptly and in line with the recommendations. | 58 (35.6) | 56 (34.4) | 49 (30) |
| Exposures should be categorized and appropriate prophylaxis should be started after exposure regardless of the time elapsed. | 132 (81) | 13 (8) | 18 (11) |
| If an animal that has bitten carries virus in its saliva, it is expected to die within 10 days. In animals other than cats and dogs, such a time period is not prescribed and observation is not recommended. | 56 (34.4) | 60 (36.8) | 47 (28.8) |
| Wound care | | | |
| Since the virus can remain in the bite site for a long time, the site of the bite should be washed regardless of the time elapsed. | 138 (84.7) | 7 (4.3) | 18 (11) |
| After washing, alcohol or iodine antiseptics should be used. | 51 (31.3) | 64 (39.3) | 48 (29.4) |
| Since the aim is to mechanically remove the virus, use of antiseptics alone cannot replace washing with plenty of water and soap. | 139 (85.28) | 9 (5.52) | 15 (9.2) |
| It is best to avoid sutures and similar interventions. In deep and extensive wounds, cosmetic factors, and risk of infection should be evaluated. | 142 (87.12) | 7 (4.29) | 14 (8.59) |
| If sutures are needed in addition to postexposure prophylaxis, it should be done 2 hours after administering rabies immunoglobulin around and inside the wound to minimize the risk of inoculation into the nerve, and with as few sutures as possible. | 110 (67.48) | 11 (6.75) | 42 (25.77) |
| Cleaning the wound with 20% soap after suspicious exposure or bite and, if necessary, debriding it can reduce the risk of developing the disease by 90%. | 115 (70.6) | 10 (6.1) | 38 (23.3) |
| Antibiotic prophylaxis | | | |
| Antibiotic prophylaxis should be given in all human bites. | 57 (34.97) | 47 (28.83) | 59 (36.2) |
| If a patient presents after the first 8 hours and has no clinical sign of infection, there is no need to give antibiotics. | 55 (33.74) | 25 (15.34) | 83 (50.92) |
| The duration of antibiotic prophylaxis for children and adults is 7 days in case of visibly contaminated wound, and 14 days in case of contaminated wounds. | 73 (44.79) | 14 (8.59) | 76 (46.63) |
| Postexposure immunization | | | |
| After exposure, vaccination should be started as quickly as possible. | 155 (95.1) | 3 (1.8) | 5 (3.1) |
| It is not recommended to administer other vaccinations simultaneously unless absolutely necessary. | 85 (52.2) | 7 (4.3) | 71 (43.5) |
| Vaccines are never injected into the gluteal region or around the abdomen. | 29 (17.8) | 44 (27) | 90 (55.27) |
| The vaccine is injected to the anterolateral area of the thigh in adults and young children. | 88 (54) | 22 (13.5) | 53 (32.5) |

**Table 5.** Participants knowledge levels about postexposure prophylaxis

## DISCUSSION

Rabies is an acute and progressive zoonotic disease that affects both humans and animals, and is accompanied by viral encephalitis. All warm-blooded animals can be infected with *rabies virus* (*Rhabdoviridae* family). Most wild and domestic animals can be sources of the disease. However, in developing countries, dogs are the most important source. Human-to-human transmission by cornea, kidney, liver, and intestinal transplantation has also been reported [1,3,7].

According to the Public Health Code, rabies is a reportable disease. Under the same code, physicians are obliged to report suspected cases of contact, and information about those who die from rabies to the provincial health directorates [8]. Cases of exposure are also forensic cases and physicians must report them to the forensic agency as well. A study con-

ducted in Türkiye has reported that 97.8% of physicians know that rabies is a reportable disease, and 92.4% know that rabies is a viral disease [9]. A study with 151 general practitioners conducted in Pakistan reported that 77.5% of physicians knew about the causative agent of rabies, whereas another study conducted by S. Bhalla et al. with 100 general practitioners in India reported this rate at 62% [10-11]. In our study, 92.64% of the respondents knew rabies to be a viral disease, and 82.8% knew it to be a reportable disease. The data obtained show that nearly a fifth of the respondents did not know that rabies is a reportable disease, which is thought-provoking. Medical students should be clearly informed, through relevant training, about the obligation to report this disease to avoid potential legal issues.

Notably, the majority of the respondents answered correctly the questions about the source of the disease and the routes of transmission. The present study also found that 43% of the respondents did not know that rabies could be transmitted between humans.

Since rabies is fatal, prevention is lifesaving. Therefore, people who get into frequent contact with animals at risk for rabies must get pre-exposure prophylaxis [2,12]. Pre-exposure prophylaxis is recommended for people at increased risk for rabies owing to professional or other reasons. Pre-exposure prophylaxis consists of a total of two doses of vaccine, administered intramuscularly, one dose on day 0 and another on day 7. Immunocompromised or immunodeficient individuals must get a total of three doses of vaccine, with an additional dose on day 21 or 28 [2,3,12]. In our study, the vast majority of the respondents, 88.34% (n = 114), knew who should receive pre-exposure prophylaxis, whereas more than half of them did not know how it should be administered (schedule of vaccination).

Bites of animals that may be infected with rabies pose a risk for rabies, regardless of the site of the bite. Contact of open wounds, cuts, and mucous membranes with potentially infected material such as saliva, other nervous tissue and live oral vaccine baits, as well as scratching are considered as non-bite exposures [1-3]. Our study found that the vast majority of the respondents, 87.12% (n = 142) exactly, had accurate knowledge of non-bite exposures.

Effective, appropriate, and prompt interventions after exposure are known to be lifesaving. In this connection, one of the most challenging issues which cause hesitation among physicians working in the field is contacts that do not require post-exposure prophylaxis. Inadequate knowledge among physicians on this topic results in administration of unnecessary prophylaxis in many cases. A study from Türkiye found that 72.9% of physicians did not have accurate knowledge of animals that may be infected with rabies. Of note, physicians considered animals such as rodents, mice, guinea pigs and rabbits to be at risk and wrongly recommended post-exposure prophylaxis for those bitten by these animals [9]. Another similar study with 84 physicians in Türkiye's Şanlıurfa province reported that 66.7% of the respondents knew that mice, rats and hamsters were not sources of exposure to rabies [13].

Similarly, only 39.2% of the respondents in our study stated that bites of animals such as mice, rats, squirrels, hamsters, guinea pigs, gerbils, and rabbits do not require post-exposure prophylaxis. Again, in our study, 66.3% of the respondents said that post-exposure prophylaxis is not required in bites of poultry, 52.5% said it is not required in bites of cold-blooded animals (snakes, lizards, and turtles, among others), 32.5% said it is not needed in bites of bats, and 55% stated that consuming cooked or pasteurized products of a rabies-infected animal does not transmit rabies. Therefore, the vast majority of the respondents did not have accurate knowledge of situations that do not require prophylaxis. We suggest that accurate knowledge on this topic should be shared with medical students through training programs before graduation.

Another point that should be emphasized is that in cases that do not require post-exposure prophylaxis (including human bites), appropriate treatment approaches such as wound cleaning, antibiotherapy, tetanus prophylaxis should never be overlooked. All exposures, regardless of whether or not rabies prophylaxis is administered, must be recorded [3,8,9].

Post-exposure prophylaxis is crucial since the disease does not have a specific treatment and is often fatal. Post-exposure procedure consists of care for wounds, antibiotic prophylaxis, tetanus prophylaxis, administration of rabies vaccine and rabies immunoglobulin [2,3,6,9,12-16].

Our study found that only 35.6% of the respondents believed that prompt and appropriate post-exposure prophylaxis is 100% effective. In post-exposure prophylaxis, the most important step is care for wounds, which should be done as soon as possible. A good care for wounds is the most effective method for reducing infection with *rabies virus* [2,3,16]. In case of exposure, the wound site should be thoroughly washed with plenty of water and soap immediately. After washing, alcohol or iodine antiseptics should be used. Since the aim is to mechanically remove the virus, use of antiseptics alone cannot replace washing with plenty of water and soap [3].

84.66% of the students who responded knew that washing should be done first. However, only 31.3% knew that alcohol or iodine antiseptics should be used after washing. A similar study conducted in Türkiye reported that 67% of physicians did not use iodine antiseptics after washing with soap and

water [9]. Also, a study by Dodet et al. [17] with 4377 patients reported that wound cleaning was done with water and soap/detergent in 49% of patients, and only with water in 12% of them.

Another principle of wound care in post-exposure approach involves avoiding sutures and similar interventions as much as possible. In the presence of deep and extensive injuries, sutures may be required for cosmetic factors and due to risk of infection [8]. Paschos et al**.** [18] conducted a randomized controlled study with 168 patients with primary suture versus non-closure of dog bite wounds, and reported an overall infection rate of 8.3%, with no difference in the infection rate between the primary suturing and non-suturing group, but the cosmetic appearance of the sutured wounds was significantly better. If sutures are planned, it can be done 2 hours after delivering human rabies immunoglobulin around and inside the wound, and with as few sutures as possible [2,3]. In the present study, 67.5% of the students who responded provided a correct response to this statement.

Antibiotic prophylaxis should be given in all human bites. Additionally, in animal bites, antibiotic prophylaxis should be given in following cases (regardless of the time elapsed) immunodeficient individuals, bites involving the face and hands, bites with possible bone and joint penetration, bites close to prosthetic joints, injuries of the genital area, bites with deep penetration (especially in cats), and wounds that require suturing. In case of other wounds, antibiotics are not required in the absence of clinical signs of infection. Duration of antibiotic prophylaxis is 3 days in uncontaminated wounds, and 5 days in case of contaminated wounds [3]. A study conducted in Türkiye found that, although 34% of patients admitted to the emergency room after exposure had bite wounds on their hands, only a fifth of them were started on antibiotherapy [19]. In the present study, the vast majority of the respondents provided an incorrect response to questions about indications for antibiotherapy and the duration of therapy. Only 34.9% of the respondents stated they would start antibiotic prophylaxis in human bites. These results are indicative of an inadequate level of knowledge of this issue among medical students in their final year.

The second important point in post-exposure prophylaxis is about the administration of rabies vaccine and human rabies immunoglobulin after exposures or bites [3,9,15,16]. Since the incubation period in rabies varies a lot, the exposure should be categorized and appropriate prophylaxis should be started regardless of the time elapsed after exposure. In the present study, 81% of the respondents had accurate knowledge of this.

The vaccine is injected into the anterolateral area of the thigh in adults and young children [3]. 46% of the respondents did not have accurate knowledge of how and where (on which site) the vaccine should be administered, and of note, 27% stated that the vaccine can be administered to the gluteal and abdominal area. In the literature reviews on this subject, a study from Pakistan reported that 56.3% of physicians did not know about the method of administering the rabies vaccine and 76.2% did not know about the sites for injection. Another study in India found that 28% of physicians did not know about the method of injection, and 66% did not know about the sites for injection [10,11]. A study conducted in Türkiye reported that 40% of physicians administered the rabies vaccine incorrectly [9].

In case of suspicious bites of cats and dogs, it is recommended that the animal be kept under observation for rabies for 10 days, if possible [3,9]. In animals other than cats and dogs, such a period of time cannot be prescribed, and observation is not recommended. Our study found that 66% of the respondents did not have knowledge of this period.

**Limitations**

The current study was limited by the small sample size and the use of only one region in Türkiye. Since the results obtained do not represent the entire universe, other studies with multiple centers and larger numbers of participants are needed to better clarify this topic.

**Conclusions**

Analysis of the medical students' responses to the statements in the present study has shown an inadequate level of knowledge of rabies; we believe more frequent training programs are needed. Moreover, students should also closely follow the current guidelines on diseases.

There is no abuse, plagiarism and similar problems related to the content of the article.

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