



Epidemiological and Clinical Characteristics of Patients Admitted to the Pediatric Emergency Department After Exposure to the Risk of Rabies

Çocuk Acil Servisine Kuduz Riskli Temas Sonrası Başvuran Hastaların Epidemiyolojik ve Klinik Özellikleri

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Abstract

Objective: The aim of this study was to determine the clinical and epidemiological characteristics of children admitted to the emergency department after exposure to rabies risk.

Material and Methods: Patients admitted to the pediatric emergency department due to rabies risky contact between January 2010 and December 2020 was evaluated retrospectively. According to the National Rabies Prophylaxis Guidelines, patients' lesions were categorized between 1-4.

Results: A total of 840 patients were included in the study (mean age 5.6 ± 4 years; minimum 1-maximum 17; 76.1% males). Five hundred and fifty children (65.4%) were between the ages of 1-6. Five hundred and fifty (65.4%) of the contacts were with stray animals and 412 (49.1%) were due to dog bites in rural areas ($p < 0.001$). Six hundred and sixty (78.5%) of them were not accompanied by their parents at the time of contact. Five hundred and ten (60.7%) of the lesions were in the upper extremity. Seven hundred and fifty lesions (89.2%) were category 2 and 90 (10.7%) were category 3. Of 290 (34.5%) pets, none of them were fully vaccinated. Rabies vaccine was administered to all cases, and rabies immunoglobulin was additionally administered to 90 patients (10.7%). Rabies did not develop in any case. No side effects related to rabies prophylaxis were observed.

Conclusion: In order to reduce the risk of contact with rabies, small children should not be left alone in the open area, children should be taught the basic principles of communication with animals from a young age, and animals should be fully vaccinated.

Keywords: Rabies risky contact, dog bite, rabies prophylaxis

Öz

Giriş: Bu çalışmanın amacı, kuduz riskli temas sonrası acil servise başvuran çocuk hastaların klinik ve epidemiyolojik özelliklerinin belirlenmesidir.

Gereç ve Yöntemler: Ocak 2010-Aralık 2020 tarihleri arasında çocuk acil servisine kuduz riskli temas nedeniyle başvuran hastalar retrospektif olarak değerlendirildi. Ulusal Kuduz Profilaksi Rehberi'ne göre hastaların lezyonları 1-4 arasında kategorize edildi.

Bulgular: Toplam 840 hasta çalışmaya dahil edildi (ortalama yaş 5.6 ± 4 yıl; minimum 1-maksimum 17 yaş; %76.1 erkek). Beş yüz elli çocuk (%65.4) 1-6 yaş arasındaydı. Temasların 550 (%65.4)'si sahihsiz hayvanlar ile olup 412 (%49.1)'si kırsal bölgelerde köpek ısırıklarına bağlıydı ($p < 0.001$). Altı yüz altmışının (%78.5) temas sırasında yanlarında ebeveynleri bulunmuyordu. Lezyonların 510 (%60.7)'ü üst ekstremitededeydi. Yedi yüz elli lezyon (%89.2) kategori 2 ve 90 (%10.7)'i kategori 3'tü. İki yüz doksan (%34.5) evcil hayvanın hiçbirinin aşısı tam değildi. Olguların tamamına kuduz aşısı ve 90 (%10.7)'ine ek olarak kuduz immünglobulini uygulandı. Hiçbir olguda kuduz gelişmedi. Kuduz profilaksisine bağlı yan etki gözlenmedi.

Sonuç: Kuduz riskli temas riskini azaltmak için küçük çocukların tek başlarına açık alanda bırakılmamaları, çocuklara küçük yaştan itibaren hayvanlarla iletişimin temel prensiplerinin öğretilmesi ve hayvanlarının aşılarının tam olması gerekmektedir.

Anahtar Kelimeler: Kuduz riskli temas, köpek ısırığı, kuduz profilaksisi

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Introduction

Animal bites are common worldwide and are an important public health problem. They constitute approximately 1% of all emergency applications made annually in the United States (USA) and 4.6% of pediatric admissions in India (1,2). Animal bites can become infected if not properly treated and can cause disfigurement, functional disability, and death (1).

Most bites are caused by dogs and cats (3). Rabies infection transmitted through animal bites is caused by different variants and species of neurotropic viruses in the lyssavirus genus in the *Rhabdoviridae* family (4). Rabies is a lethal viral infection that causes acute encephalomyelitis with a mortality rate of approximately 100% after the appearance of neurological signs, unless timely prophylaxis is performed (5). It causes 70.000 deaths per year worldwide (6). According to the data of the General Directorate of Public Health of the Ministry of Health of Türkiye, it was reported that there were 246.547 rabies risky contact cases throughout the country in 2017 and one of them was diagnosed with rabies (7). Post-exposure prophylaxis is recommended as soon as possible to all individuals who have had a bite and/or contact with animals at high risk of rabies. In line with this recommendation, local wound care, rabies vaccine and rabies immunoglobulin are applied according to the risk classification in the rabies field guide guidelines published by the Ministry of Health of the Republic of Türkiye (8).

In this study, it was aimed to determine the clinical and epidemiological characteristics of pediatric patients who applied to the emergency department after exposure to rabies risk.

Materials and Methods

In this study, children admitted to the pediatric emergency department due to rabies risky contact between 01.01.2010 and 31.12.2020 were evaluated retrospectively. According to the ICD-10 classification, medical records of the cases diagnosed with animal bites with the coding of A82.0, A82.1, A82.9, Z20.3, Z24.2 were scanned. Patients' age, sex, presence of parents at the time of the incident, dog and cat ownership status, the provocation of the animal before the bite, the location and characteristics of the injury, and the medical treatments applied were recorded. The presentation of the cases included in the study within one year after their application to the emergency department due to rabies risky contact were also analyzed. In this review, possible rabies, drug side effects and development of secondary bacterial infection were investigated.

Patients whose first presentation was to another hospital and who came only for vaccination and for whom adequate epidemiological information could not be obtained from the records were excluded from the study.

Medical records of the contacted cases were reviewed, and risk category of the skin lesions was determined according to the 2019 Rabies Prophylaxis Guidelines of the Ministry of Health of the Republic of Türkiye (8):

- **Category 1:** Touching and feeding the animal; licking of firm skin
- **Category 2:** Slight scraping of bare skin, minor scratching or bruising without bleeding
- **Category 3:** Single or multiple bites or scratches that injure the skin; contact of mucous membranes or open wounds with animal saliva; the lesion is located in places where nerve endings are dense, such as the head, neck, fingertips
- **Category 4:** Risky contact with wild animal species at risk of contracting rabies

The pediatric emergency department, where the study was conducted, is located within the body of a full-fledged children's hospital that provides the highest level of medical service in the region. The average number of pediatric patients admitted daily at the time of the study was 1244.

Statistical Analysis

Statistical Package for Social Sciences (SPSS) for Windows 21 program was used for statistical analysis. Categorical variables were expressed as numbers and percentages, and continuous variables were expressed as mean \pm standard deviation. Pearson's chi-square test was used to compare categorical variables. $p < 0.05$ was considered statistically significant.

Approval was obtained from Diyarbakir SBU Gazi Yaşargil Training and Research Hospital Clinical Research Ethics Committee for the study (7.05.2021/755).

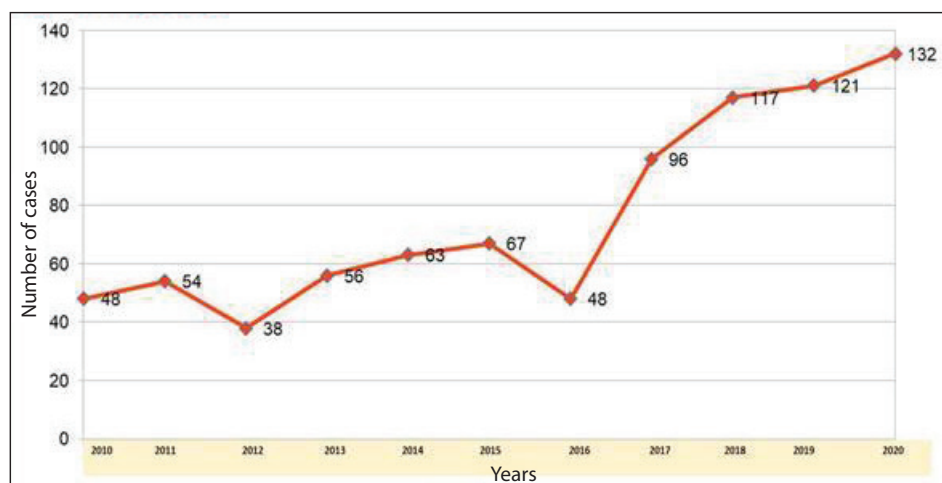
Results

Medical records of a total of 958 patients were reviewed retrospectively. However, 118 patients were excluded from the study due to the fact that their first vaccination was done in another center ($n = 104$) and because of the lack of records ($n = 14$). Mean age of 840 patients included in the study was 5.6 ± 4.0 years (minimum: 1, maximum: 17), and 640 (76.1%) were males ($p < 0.001$). A total of 550 children (65.4%) were between the ages of 1-6. Three hundred and forty-four (40.9%) of the contacts with rabies risk were seen in the summer season. The most common animal bite was dog bite ($n = 570$, 67.8%), and stray dogs were responsible for the majority of these ($n = 340$, 40.5%). It was determined that 412 (49.1%) of the contacts occurred as a result of dog bites in villages ($p < 0.001$). In 660 (78.5%) of the children, their parents were not present at the time of contact (Table 1). Applications to the emergency department of cases with rabies risky contact have increased markedly, especially since 2017 (Figure 1).

Table 1. General characteristics of the children with risky rabies contact

		Number (n)	Percentage (%)
Sex	Boy	640	76.1
	Girl	200	23.8
Age	1-6 years	550	65.4
	7-11 years	170	20.2
	12-17 years	120	14.2
Season	Summer	344	40.9
	Spring	221	26.3
	Fall	163	19.4
	Winter	112	13.3
Presence of a parent during contact	Present	180	21.4
	Absent	660	78.5
Dog	Stray	340	40.4
	Owned	230	27.3
Cat	Stray	210	25.0
	Owned	60	7.1
Residential area	Rural area	Dog	412 (49.1%)*
		Cat	201 (23.9%)
	Urban center	Dog	158 (18.8%)
		Cat	69 (8.2%)

*: Chi-square test, dog bite at the village is the source of the difference ($p < 0.001$).

**Figure 1.** Change of animal bite admissions to the pediatric emergency department during the years.

All contacts had occurred outside the home. All patients included in the study were admitted to the hospital within the first day. Five hundred and ten (60.7%) of the lesions were in the upper extremity, and the lesion site was on the hands in all contacts with the cat. Seven hundred and fifty (89.2%) of the wounds were category 2. None of the cases were evaluated as categories 1 and 4. There were no signs of injury in the genital area, bones and joints. All category 2 lesions were caused by contact with unprovoked stray dogs. Two hundred and ninety

(34.5%) of the bitten animals were owned cats and dogs, and it was determined that all of these animals were not vaccinated regularly. All bites by animals with owners occurred after provocation (Table 2).

In all patients, the lesion site was washed with saline and then dressed with an antiseptic solution. Primary closure was performed in 80 (9.5%) of the cases in the emergency department. Surgical closure was performed by the pediatric

Table 2. Clinical characteristics of risky rabies contacts and medical interventions applied in the emergency service

		Number (n)	Percentage (%)
Contact region	Lower extremity	267	31.7
	Upper extremity	510	60.7
	Back-truncus	10	1.1
	Head-neck	21	2.5
	Gluteal region	32	3.8
Contact category	Category 1	0	0
	Category 2	750	89.2
	Category 3	90	10.7
	Category 4	0	0
Medical interventions applied in the emergency service after contact	Rabies vaccination	840	100
	Rabies immunoglobulin	90	10.7
	Tetanus vaccination	140	16.6
	Tetanus immunoglobulin	0	0
	Antibiotic prophylaxis	790	94

surgeon under operating room conditions for 10 cases (1.1%) with multiple bites, including the facial region. All patients received rabies vaccine and human rabies immunoglobulin in addition to 90 cases (10.7%) being evaluated as category 3. Tetanus prophylaxis was administered to 140 (16.6%) of the patients. There was no patient who received tetanus immunoglobulin. No local or systemic complications related to vaccine and immunoglobulins were observed. Antibiotic prophylaxis was given to 790 cases (94%); according to the records, oral amoxicillin-clavunate was preferred in all of these cases. No secondary bacterial infection developed at the wound site in the follow-up (Table 2).

Two hundred and ninety (34.5%) owned cats and dogs were followed for 10 days after contact. Because these animals did not develop any signs of rabies, the planned vaccination applications were stopped. No rabies cases were encountered during the study.

Discussion

In this study, rabies risky contact cases who applied to a pediatric emergency service serving a very large population over a period of 11 years were examined in terms of their epidemiological and clinical characteristics. Especially since 2017, there has been a significant increase in presentation. Majority of the cases were boys younger than six years old. In the countryside, unaccompanied children were attacked by dogs without any provocation. In one third of the cases, contact was made by provoking animals that had been vaccinated by their owners. About 10% of the lesions were severe. We think that these findings provide useful information for the prevention of rabies risky contacts in children.

Studies have reported an increase in animal bites over the

years, as in our study (9,10). We think that the reason for this increase is the increase in the cat and dog population and the increase in the awareness of the society about animal bites.

Boys are more likely to be bitten by animals because they are more frequently involved in outdoor activities (11). In the literature, there are publications reporting that rabies-risky contacts are common in children aged 10 and over, those over the age of six or children aged 5-9 years (12-14). In our study, in accordance with the literature, most of the risky contacts were seen in boys, and they were usually younger than six years old. We think that the reason for this is that most of the children in the study area live in rural areas and spend time outside the home without parental supervision from an early age. We think that the high frequency of these contacts is due to the fact that children in rural areas come into contact with stray animals at an early age, that children have not yet completed their physical development, and that they do not know how to treat animals. The fact that the majority of our cases applied to the emergency department in summer and spring is also consistent with the literature (12-14). We are of the opinion that these different results in the literature, especially regarding the affected age group, are due to the unique conditions of the regions where the studies were conducted.

In studies conducted in countries where laws on stray animals are much stricter, it is reported that non-fatal rabies risky contacts are usually caused by animals known to children, and in a small part of them, the child and the animal live in the same house (12-15). On the other hand, in a study conducted in Ankara and Hatay in our country, it has been reported that most of the cases applied to the emergency service after risky

contact with stray animals (16,17). In our study, injury was more common with stray dogs. We think there are two main reasons for this finding. The first is that a significant part of the contacts analyzed in our study took place in rural areas. The second is that there is a very high number of stray animals in the streets of residential areas in our country. Stray animals are generally fed on the street without being owned by people.

Dogs and cats constitute the majority of risky contacts (16-18). The location of the lesion differs depending on the nature of the biting animal, whether it is owned or not, the presence of a parent, and the age of the child. There are studies reporting the upper extremity, the lower extremity as the most affected area, or the face-head-neck region in studies where it has been reported that the contacts have been mostly made by wolfhounds or Doberman dogs (12-14,16,17,19). It has been reported in studies that the prevalence and severity of the lesions are generally not very high (12,14,16,17). In our study, similar to the literature, the most frequent contact was dog and then cat. Risky contact with another animal was not present in the records. In terms of frequency, lesion sites were first in the upper extremities, followed by the lower extremities. Facial and head injuries constituted a very small percentage. The majority of the lesions were evaluated as category 2. We think that the age of the subjects included in the study, the breed of the animal, and the position of the child during contact affect these parameters.

The most basic preventive measure before contact is vaccination of animals (8). Vaccination and sterilization of stray animals is the duty of municipalities. At the same time, it is recommended that those who want to keep animals should preferably adopt stray animals, and pet owners are required to have their animals vaccinated regularly. Studies have reported that the vaccination status of animals is not known, or it is not done or incompletely done in a significant portion of rabies risky contact cases who apply to the hospital (12,17,19,20). The incubation period of rabies infection is very variable. Post-exposure prophylaxis should be applied by categorizing the contact regardless of the time elapsed after the risky contact (8). In our study, most of the risky contacts were with stray animals and their vaccination status was not clear. In all of the owned animals, the owners had incomplete vaccinations. Therefore, rabies prophylaxis was started within the first 24 hours in all 840 cases evaluated as category 2 and 3. It was determined that human-derived rabies immunoglobulin was administered to category 3 cases. Rabies did not develop in any case. No adverse events related to rabies vaccine or immunoglobulin were reported.

Rabies Prophylaxis Guidelines published by the Infectious Diseases Society of America and the Ministry of Health in our country, include antibiotic prophylaxis for lacerations with

primary closure and wounds requiring surgical repair, wounds in the hand, face or genital area, wounds close to a bone or joints and/or wounds in lymphatic deterioration areas, and in immunosuppressed individuals. It is recommended for wounds associated with host wounds, deep puncture wounds or lacerations (especially due to cat bites), crush injury. Because of its spectrum, amoxicillin-clavulanic acid, the preferred antibiotic agent for the prevention of infection due to animal bite wounds, has been suggested as the first choice (8,21,22). In the literature, the rate of starting antibiotic prophylaxis is between 8.3 and 62.8% (12,17,19). In our study, it was observed that antibiotic prophylaxis was started in 94% of the cases, and this rate is very high compared to the literature. Although it is not clear from the records, it is estimated that some of these prophylaxis are unnecessary. This result reveals the necessity of updating the knowledge of physicians working in the emergency department and emphasizing the principles of rational antibiotic use.

The main limitation of our study is that it reflects a single center experience. In addition, since it is a retrospective study, clinical information such as the breed of the animal subject to the contact, the wound care performed before the hospital after the exposure, the scar status and cosmetic complications of this post-contact lesion in the long term could not be obtained.

As a result, rabies-risk contacts were caused by stray animals and unvaccinated pets. In the vast majority of contacts, the children were not accompanied by their parents. Especially in rural areas, young children who were left alone made up the largest group. Pets were not vaccinated. In order to reduce the frequency and risk of this contact, young children should not be left alone in the open area, children should be taught the basic principles of communication with animals from a young age, and their animals should be fully vaccinated.

Ethics Committee Approval: Ethics committee approval for the study was obtained from SBU Gazi Yaşargil Training and Research Hospital Clinical Research Ethics Committee (Decision no: 755, Date: 07.05.2021).

Informed Consent: Patient consent was obtained.

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