



Epidemiological Characteristics of Post-exposure Prophylaxis of Rabies in Varna Region for the Period 2014-2018

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Received: 15 Feb 2020 ♦ **Accepted:** 9 Apr 2020 ♦ **Published:** 31 Dec 2020

Citation: Kolarova-Dimitrova M. Epidemiological characteristics of post-exposure prophylaxis of rabies in Varna region for the period 2014-2018. *Folia Med (Plovdiv)* 2020;62(4):777-84. doi: 10.3897/folmed.62.e51162.

Abstract

Introduction: Rabies is a viral zoonosis still posing a significant threat to public health worldwide, especially in developing countries. The disease can be controlled by animal vaccination and appropriate post-exposure prophylaxis in humans administered in the earliest possible time.

Aim: To study and analyze animal-related injuries and post-exposure prophylaxis for rabies.

Materials and methods: Between 2014 and 2018, a retrospective epidemiological study was conducted in Varna region, which included 1462 persons who suffered injuries from animals. The study was based on the official data in the annual analysis of the Regional Health Inspectorate (RHI) in Varna. The information was summarized, analyzed, and graphically illustrated. The results were statistically analysed using SPSS v. 20 employing variational and comparative (χ^2) analyses. The statistical significance level was set at $p < 0.05$.

Results: Of 1462 registered post-injury care seekers, 642 (42.7%) had to be given post-exposure prophylaxis on an emergency basis. The latter were mainly city residents (91.8%). Immunization against rabies was given in the first two days after exposure in 477 (76.4%) subjects. The average number of doses per immunized person was 3.63. The injuries were mainly from stray dogs (58.14%), followed by domestic (37.41%) and wild (4.45%) animals. According to the anatomical site of injury, limb injuries predominated in 88.65% (lower limbs 45% and upper limbs 43.64%). Most of the injuries were light (71.54%), followed by moderate (18.91%) and severe injuries (9.61%).

Conclusions: Rabies prevention can be much more facilitated by the combined efforts of doctors, veterinarians, animal welfare organizations and, last but not least, responsible population behavior. Post-exposure prophylaxis is an integral part of successfully curbing rabies programs but effective disease control can be achieved only through health education and vaccination of animals.

Keywords

dogs, epidemiology, PEP, rabies, targeted immunizations, vaccination

INTRODUCTION

Rabies is an acute, progressive viral infection which is virtually 100% fatal once the first clinical symptoms appear. The disease is mainly observed in wild animals, but because

of the large number of stray dogs, the virus often passes into their population. Key interventions to control the disease are vaccination of high-risk people, human observation, post-exposure prophylaxis (PEP) in animal bites and vaccination and/or control of canine populations, and

other animals in order to break the cycle of transmission in dogs and to humans. Despite the proven effectiveness of these interventions, rabies is estimated to cause 59000 human deaths annually in over 150 countries, with 95% of cases occurring in Africa and Asia.² In these regions, animal control is usually ineffective and PEP is not available to the most vulnerable populations due to the high cost of the vaccine and specific immunoglobulin, as well as limited availability, especially outside large urban areas. Rabies disproportionately affects children and is ranked the seventh most important infectious disease worldwide due to over 3.7 million disability-adjusted life years loss and US\$8.6 billion in economic losses.^{3,4} Theoretically, preventing rabies death by eliminating animal disease carries a much lower cost than it does to rely on indefinitely PEP for the treatment of exposed persons.

In Europe, human rabies is a very rare vaccine-preventable zoonosis without autochthonous cases for decades.² As a result of the European programs for eradication of rabies via oral vaccination of wild animals in the European countries (including Bulgaria) since 2009, a remarkable success has been reported in *restricting rabies virus spread* among animal population. Nevertheless, 167 cases were reported in animals (both wild and domestic) in Bulgaria between 2006 and 2018.⁵ On the other hand, the presence of sporadic cases of rabies in animals in neighbouring Romania in 2018 was the reason for strict adherence to WHO recommendations for evaluation of the risk and administering PEP in humans.⁶

AIM

To study and analyze animal-related injuries and PEP for rabies.

MATERIALS AND METHODS

In the period 2014-2018, a retrospective epidemiological study was conducted in Varna region including

1462 persons sustaining injuries from animals. Their socio-demographic indicators (sex, location, occupation) were collected and analyzed, and the PEP recorded in individual rabies immunization cards in each patient. Specific anti-rabies immunoglobulin was not administered as part of PEP during the study period. In addition, data for the animal and the type of injury were analyzed. Injuries are classified as mild, moderate, and severe according to World Health Organization (WHO) guidelines for post-exposure treatment based on the severity of the wound.¹ The study is based on official data taken from the annual analysis of the Regional Health Inspectorate in Varna. The information was summarized, analyzed, and graphically illustrated. The results were statistically analysed using SPSS v. 20 employing variational and comparative (χ^2) analyses. The statistical significance level was set at $p < 0.05$.

RESULTS

For the study period (2014–2018) in Varna region, there were 1462 documented animal incidents, of which 42.7% (624 persons) were immunized. In both groups (incident victims and immunized), men, urban population and workers predominated (**Table 1**).

Occupational risk exposures have not been reported among veterinary professionals, livestock farmers, hunters, forestry workers, and agricultural workers.

The proportion of men suffering an accident was higher than that of women (55.3% vs. 46.62%) ($p > 0.05$).

By years, there is a tendency for the total number of registered persons with injuries from domestic and wild animals to decrease - by 1.5 times in 2018 compared to the base value in 2014 (**Fig. 1**).

The highest number of reported incidents was the result of bitings by stray dogs - 850 (58.14%), followed by pets - 547 (37.41%) ($p > 0.05$). Incidentally reported over the years were wildlife incidents - 65 (4.45%) (**Fig. 2**).

Throughout the reviewed five year period as per anatomical location limb injuries predominate in total of

Table 1. Distribution of people who had animal incidents between 2014 and 2018

Indicator		People who had incidents with animals n (%)	Immunized persons after animal incidents n (%)	Ratio between general group and immunized persons
Sex	Men	809 (55.3)	344 (55.1)	2.4:1
	Women	653 (44.7)	280 (44.9)	2.3:1
Place of residence	City	1 254 (85.8)	573 (91.8)	2.2:1
	Village	208 (14.2)	51 (8.2)	4.1:1
Age groups	Students	312 (21.3)	130 (20.8)	2.4:1
	Employed	817 (55.9)	386 (61.9)	2.1:1
	Retired	333 (22.8)	108 (17.3)	3.1:1
Total		1462	624	2.3:1

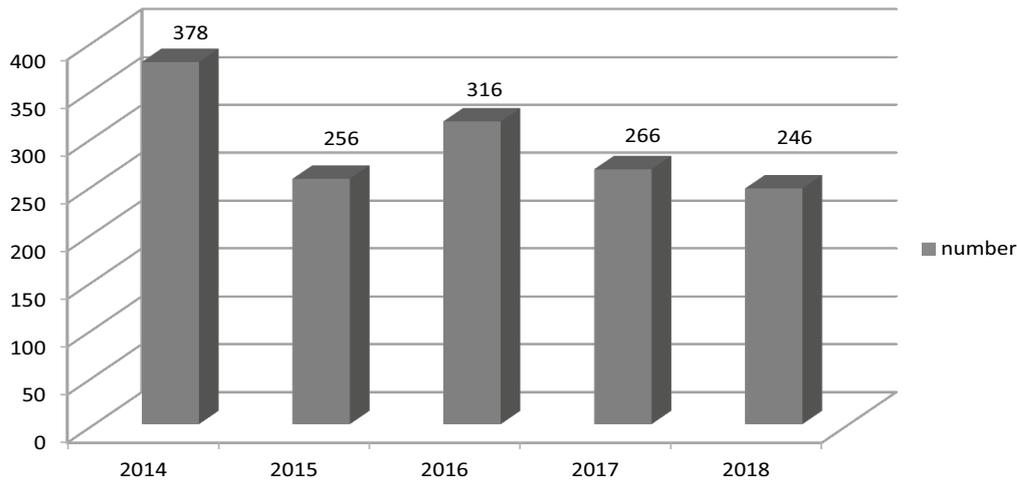


Figure 1. Distribution by years of individuals with registered animal incidents in Varna region for the period 2014-2018.

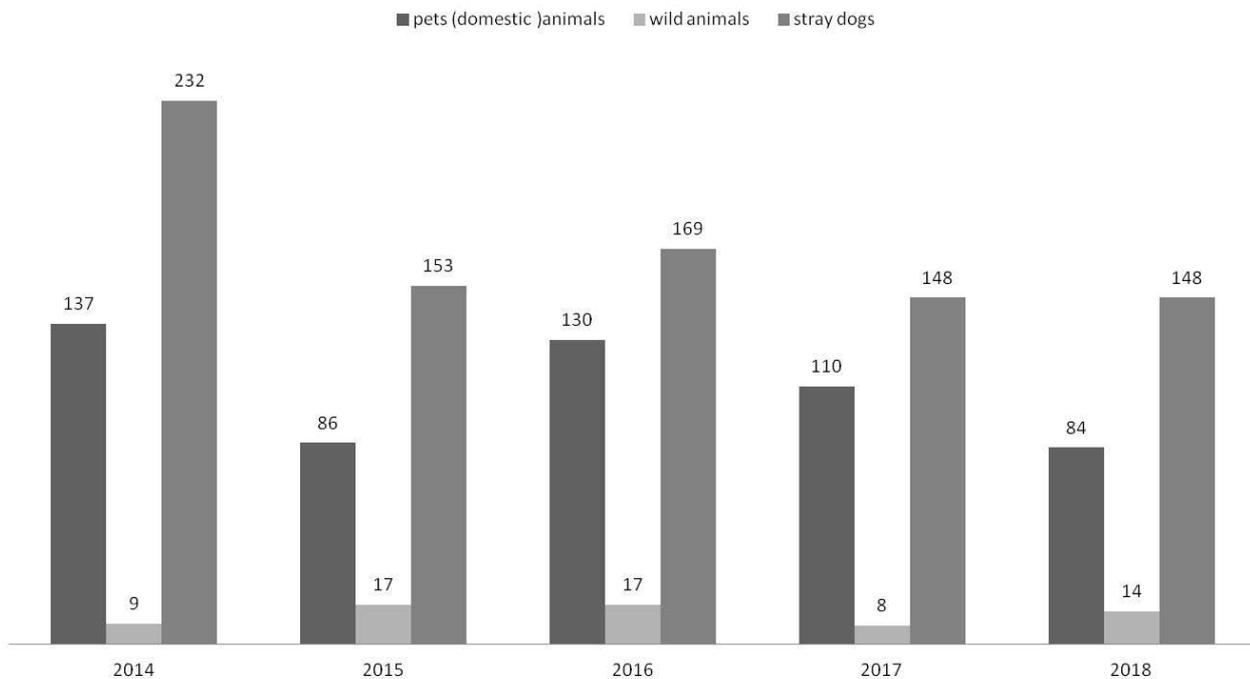


Figure 2. Distribution by year of incidents in Varna region for the period 2014-2018 as per type of animal.

88.65%, respectively of the lower limb 658 (45.01%) and upper 638 (43.64%) ($p>0.05$). In the third place come injuries covering the head and face - 100 (6.84%), followed by those of the upper part of the body - 42 (2.87%) (**Fig. 3**).

The data indicate a tendency for the relative proportion of rabies vaccines to increase from 34.13% in 2014 to 55.28% in 2018 ($\chi^2=10.74$; $p=0.002$) (**Fig. 4**).

In the distribution of the immunized by sex, men predominated (55.13% vs. 44.87%) ($p>0.05$).

Of the 624 immunized persons, 71.54% had only minor injuries, 18.91% had medium severe injuries, and 9.61% suffered severe injuries (**Fig. 5**).

Most of the victims who started post-exposure prophylaxis 477 (76.4%) were immunized within the first two days after the incident (**Fig. 6**). No immunizations were performed in the last three years more than 10 days after incidents with animals.

The total number of vaccine doses used in the immunization of the injured was 2262, with a relative proportion of those with three doses of 47.30%, followed by those with 5 doses of 35.90% ($p<0.05$) (**Fig. 7**). The average number of doses per person immunized over the period was 3.63. One dose (7.80% of the immunized) was not expected to develop immunity.

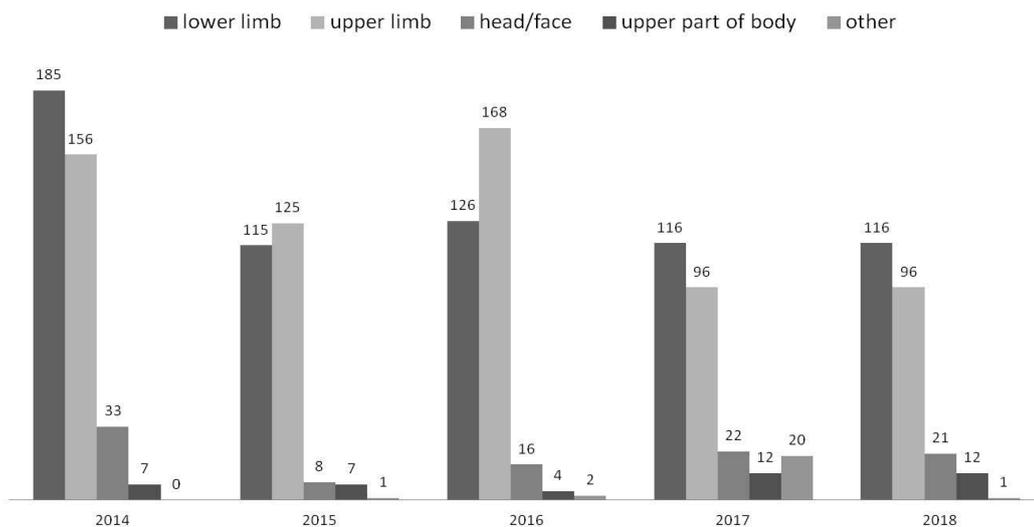


Figure 3. Distribution by year of incidents according to the species of animals.

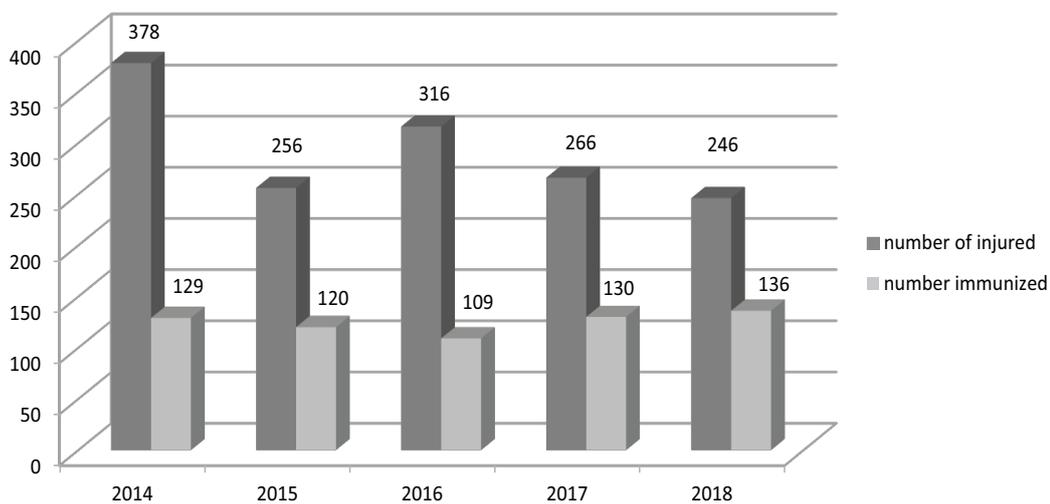


Figure 4. Distribution of the number of injuries and the number of people immunized by year in comparative terms.

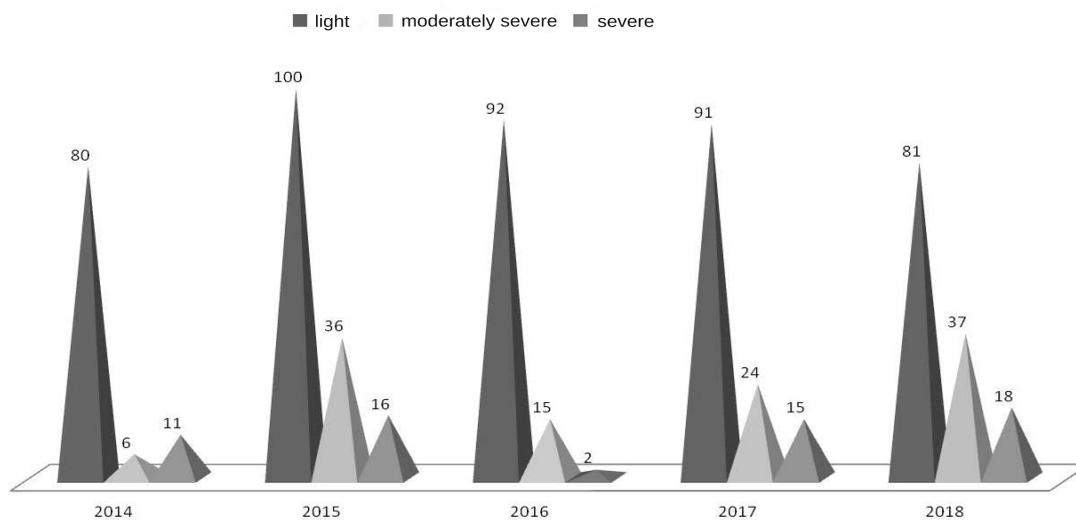


Figure 5. Distribution by year of the immunized according to the severity of the injury.

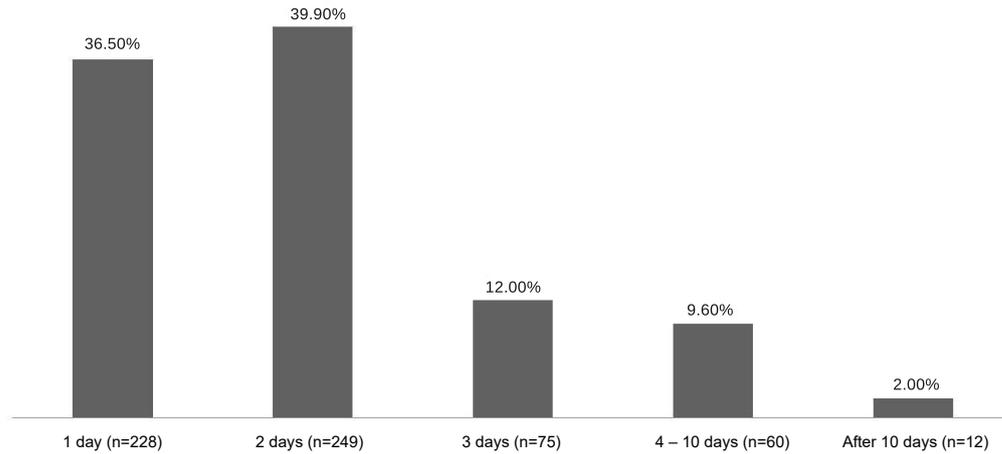


Figure 6. Initiation of PEP with vaccine (in days after the time of incident with an animal).

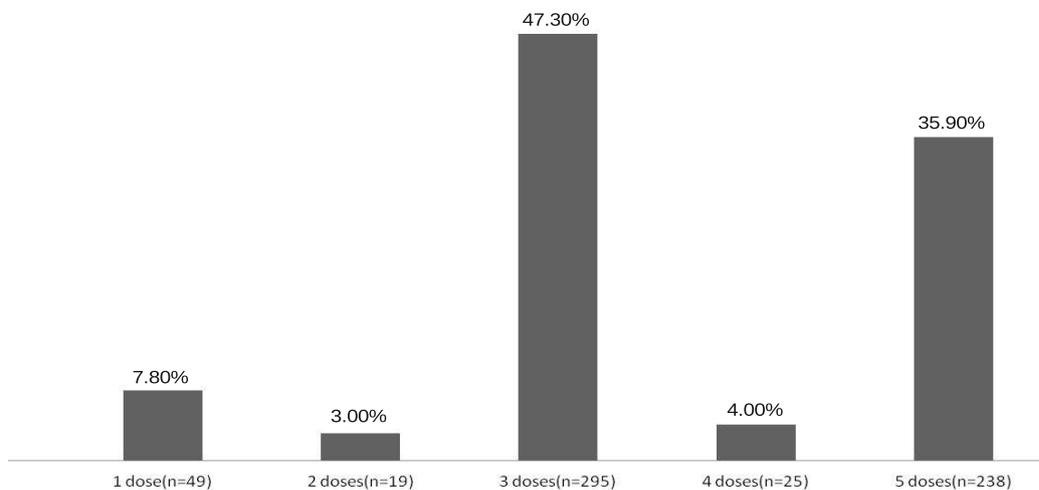


Figure 7. Distribution of rabies immunized persons by number doses given.

DISCUSSION

Information on the spread of rabies by animals in Bulgaria dates from 1896, and systematic registration of human cases, morbidity, and lethality has been done since 1928.⁷ Rabies is considered eradicated in Bulgaria, as there have been only 6 cases in humans since 1954, with the last one in 1994. This success is the result of integrated efforts and interventions such as induction of compulsory rabies vaccination for domestic dogs in 1949, control of the population of stray animals (dogs, in particular), control of epizootic processes in wild animals, assessment of injuries in humans with carrying out a PEP, which has been applied since 1894 and others. A particularly successful intervention was the launching in 2009 of the national program for oral vaccination of foxes against rabies in the territory of 18 administrative districts, with which the last registered case of rabies in animals in Bulgaria was in 2014 in Kyustendil.⁸ On the other hand, the presence of sporadic cases of rabies among

animals in neighbouring Romania in 2018, as the historical fact that fox rabies infiltrated Bulgaria through Constanta (Romania) in 1974 and the territorial proximity of the Varna region were the reasons we performed this study.

Notwithstanding what we have reported, a trend to reduce the total number of domestic and wild animal injuries by 1.5 times in 2018 compared to 2014, we accept this result as unsatisfactory. The obvious problem is injuries caused by stray dogs and pets, 850 (58.14%) and 547 (37.41%), respectively. The results of our study also confirm the findings of other authors that the majority of animal incidents are due to dog injuries, in our case talking about stray dogs.⁹⁻¹² So are the summaries country data for 2013-2014.¹³

According to many researchers, dog bites are a major public health problem. It has been found that 99% of rabies cases in humans are results of dog injuries.¹⁴ In this respect, one of the main strategies for rabies prevention is to provide high vaccination coverage in the dog population.^{4,15}

The number of injuries from stray dogs, which often move in packs, can be considered as an indirect indicator

of controlling their population in the area. Insufficient cooperation between the regional health inspectorates, veterinary specialists and the municipality in the fight against stray dogs is a fact. There are also problems with environmental organizations.

On the territory of Varna municipality, there is a shelter for stray dogs in the village of Kamenar. Its operation is associated with the provision of significant financial resources to perform removing parasites, castration, immunization against rabies and, if necessary, euthanizing dogs. The aggressive behavior of stray dogs and the frequent injuries they cause determine the uncertainty and widespread use of PEP, which explains the fact that almost half of the people with injuries in our study (42.7%) received curative anti-rabies vaccination. PEP against rabies follows the national and WHO guidelines. PEP should be administered to people after they are bitten, scratched or contaminated with saliva from an animal suspected of being infected with rabies or exposed to bats.¹⁶

Comparative analysis with country data for the period 2005-2015 shows that the areas with the highest consumption of targeted rabies immunizations are Sofia (the city) and Pleven districts (over 4000 immunized for the period). According to this indicator, Varna Region, similar to the districts of Shumen, Burgas, Targovishte, Ruse and Sofia, shows a relatively high consumption of vaccine – 1501-2000 immunized persons.¹⁷ Some authors have found that the high cost of PEP for rabies and the potential loss of income due to frequent travel to the hospital is an additional barrier to treatment, especially in low- and middle-income countries.¹⁸⁻²¹ This could explain the fact that only 43.9% of the animal incidents in our sample were immunized, with the majority being in cities (91.8 %).

PEP is administered in specialized offices which are now only three compared to thirteen in 2009. A key element in its implementation is the refinement of the need for application. The number of vaccine applications and duration of the rabies immunization course is determined after assessing the nature of the injury (bite, scratching, ligation), its location, severity and numbers, as well as the risk assessment of the animal causing the injury. Injuries to the head, toes of the upper limbs, multiple and severe injuries, as well as the inability to monitor the animals that caused the injury, necessitate a complete immunization course of five anti-rabies vaccines.

PEP should start as early as possible after injury to the animal, but in no case should it be denied to exposed subjects after the time interval has expired.²² Proper wound healing and concomitant administration of rabies immunoglobulin (RIG) combined with rabies vaccine (ARV) show high efficacy in preventing rabies, even in high risk cases. PEP equals more than 20 million treatments per year and is an effective control measure against rabies for more than 100 years.^{3,23}

Several PEP regimens (using intramuscular or intradermal administration) are currently approved for persons who have not been vaccinated before exposure.²⁵ The spe-

cific steps recommended for PEP depend on the exposure category of a suspected rabies animal, the steps include immediate and complete wound washing followed by rabies vaccination and in some cases administration of rabies immunoglobulin (RIG). Like other studies, men are more often at risk of exposure than women and the proportion of men in cases is significantly higher. This phenomenon may be related to occupational or behavioral factors that make men more likely to contact animals.^{12,19,26}

In our study, the highest relative share was the administration of 3 doses of the vaccine (47.30%), with treatment usually starting on the first or second day after the incident (36.5% and 39.9%, respectively), which is considered optimal. Similar are the country summary data.¹³

A number of authors consider that the current PEP schemes may be reduced in duration and, in some cases, in the number of doses administered while maintaining the immunogenicity and efficacy of PEP. The largest amount of published evidence supports altered one-month identification schemes, up to 3 doses, and / or treatment duration of up to one week. The authors believe that reducing the number of clinic visits and associated costs potentially improves patient compliance with the treatment plan.^{15,27-30}

When used appropriately and timely, rabies PEP is almost 100% effective in preventing the disease.²³

CONCLUSIONS

The data analysis provides information about the organization of PEP against rabies in the third largest administrative region in Bulgaria, located in the north-eastern part of the country. The results of our study shows that despite the awareness about the seriousness of the disease less than half the victims of animal injuries have taken steps to receive PEP.

Rabies prevention can be much more facilitated by the combined efforts of doctors, veterinarians, animal welfare organizations and, last but not least, the responsible population behavior PEP is an integral part of curbing rabies, but effective disease control can only be achieved through health education and vaccination of animals.

Acknowledgements

The authors thank the department anti-epidemic control of Disease Surveillance Directorate at RHI Varna, for the analysis provided and data concerning PEP in Varna.

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Эпидемиологическая характеристика постконтактной профилактики бешенства в регионе города Варна за период 2014-2018 г.

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Дата получения: 15 февраля 2020 ♦ **Дата приемки:** 9 апреля 2020 ♦ **Дата публикации:** 31 декабря 2020

Образец цитирования: Kolarova-Dimitrova M. Epidemiological characteristics of post-exposure prophylaxis of rabies in Varna region for the period 2014-2018. Folia Med (Plovdiv) 2020;62(4):777-84. doi: 10.3897/folmed.62.e51162.

Резюме

Введение: Бешенство – это вирусный зооноз, который по-прежнему представляет серьёзную угрозу для здоровья человека во всём мире, особенно в развивающихся странах. Заболевание можно контролировать путём вакцинации животных и соответствующей постконтактной профилактики людей, которую следует назначать как можно скорее.

Цель: Изучить и проанализировать происшествия, связанные с животными, и профилактику бешенства после контакта.

Материалы и методы: В период 2014-2018 г. проведено ретроспективное эпидемиологическое исследование в регионе города Варны, которое охватило 1462 человек, пострадавших от укусов животных. Исследование было основано на официальных данных ежегодного анализа Региональной инспекции здравоохранения (РИЗ) в Варне. Информация была обобщена, проанализирована и проиллюстрирована графически. Статистический анализ результатов проводился с помощью SPSS v. 20 методом вариационного и сравнительного (χ^2) анализа. Уровень статистической значимости составил $p < 0.05$.

Результаты: Из 1462 зарегистрированных пациентов, нуждающихся в посттравматической помощи, 642 (42.7%) пришлось пройти экстренную постконтактную профилактику. Последние составляли преимущественно городские жители (91.8%). Иммунизация против бешенства была проведена после контакта в первые два дня у 477 (76.4%) субъектов. Среднее количество доз на одного иммунизированного человека составляло 3.63. Укусы были причинены в основном бездомными собаками (58.14%), домашними (37.41%) и дикими (4.45%) животными. По анатомической локализации укусов, в 88.65% преобладали укусы конечностей (нижние конечности 45% и верхние конечности 43.64%). Большинство ран были незначительными (71.54%), за ними следовали раны средней степени (18.91%) и тяжёлые (9.61%).

Заключение: Профилактика бешенства может быть существенно поддержана совместными усилиями врачей, ветеринаров, организаций по защите животных и, что не менее важно, ответственным поведением населения. Постконтактная профилактика является неотъемлемой частью успешных программ борьбы с бешенством, но эффективный контроль над заболеванием может быть достигнут только посредством санитарного просвещения и вакцинации животных.

Ключевые слова

собаки, эпидемиология, ПКП, бешенство, таргетная иммунизация, вакцинация
