



동물교상으로 응급실을 방문한 소아환자의 광견병 노출 후 예방의 적절성

유제준 · 고정인 · 여운형 · 박태진 · 정성구 · 권재현¹

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Appropriateness of rabies post-exposure prophylaxis in pediatric patients visiting the emergency department due to animal bite

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Purpose: To study the appropriateness of rabies post-exposure prophylaxis (rPEP) for children with animal bite who visited the emergency department (ED).

Methods: The study enrolled children younger than 18 years with animal bite who visited the National Medical Center ED between January 2014 and October 2017. The children's electronic medical records were retrospectively reviewed. Data for analysis included age, sex, body parts bitten by animals, species of animals, regions where animal bites occurred, history of recent antibiotics therapy and tetanus vaccination, and justification by the 2017 Guidelines for Rabies Control in Korea and implementation of rPEP. In children who underwent unjustified rPEP or did not undergo justified one, we recorded their guardians' opinion for or against rPEP.

Results: Of the 63 enrolled children, rPEP was justified for 38 children by the Korean guidelines. Of the 38 children, 35 actually underwent rPEP. Among the remaining 3 children, 2 did not undergo the prophylaxis as per the guardians' requests. Among the 25 children whose rPEP was not justified, 8 underwent the prophylaxis. Of these 8 children, 7 did based on the guardians' requests.

Conclusion: In this study, inappropriate rPEP was usually affected by the guardians' requests, regardless of the criteria for such prophylaxis. Thus, their requests for or against rPEP should be discussed with emergency physicians who are aware of the relevant criteria to prevent occurrence of rabies or unnecessary use of medical resources.

Key words: Emergency Medicine; Pediatrics; Post-Exposure Prophylaxis; Rabies; Rabies Vaccine

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Introduction

The outbreak of rabies due to animal bite is an important global public health issue. Preventable by proper pre-exposure prophylaxis, rabies can be transmitted from saliva of animals to humans.

According to the World Health Organization report, approximately 59,000 people in over 150 countries die from rabies each year¹⁾. Furthermore, 95% of the deaths occur in Asian and African countries¹⁾. Animal bite, a mode of transmission of rabies to humans, is commonly encountered in emergency departments (EDs), accounting for approximately 1% of all ED admissions^{2,3)}.

The Korea Animal Health Integrated System is used to monitor rabies outbreaks and carry out surveillance of patients with animal bite to prevent occurrence of rabies. Although rabies outbreaks have not been reported since 2004⁴⁾, the number of patients visiting EDs with animal bite has been increasing annually²⁾. In addition to injuries, serious complications such as sepsis due to secondary bacterial infection, tetanus, and encephalopathy caused by the onset of rabies may occur. Thus, extreme caution should be taken when treating patients bitten by animals in the ED⁵⁾. Despite this increasing trend of animal bite, the rabies post-exposure prophylaxis (rPEP), a rabies-prevention strategy using vaccine and immunoglobulin performed after injury from animals suspected of having rabies, is limitedly implemented in Korea.

This study aimed to investigate the current practice and appropriateness of rPEP in children with animal bite at an ED in Korea.

Methods

We reviewed the electronic medical records of children (< 18 years) who visited at the National Medical Center ED between January 2014 and October 2017, and were discharged with diagnosis related to animal bite. The study excluded patients who were aged 18 years or older, who repeatedly visited the ED for rabies vaccination, who were not actually bitten by an animal according to the chart or who were bitten by an unknown species. This study was approved by the Institutional Review Board (IRB no. H-1711-084-005), and the require-

ment for informed consent was waived due to the retrospective nature of the study.

Data for analysis included age, sex, body parts bitten by animals, species of animals, accident area, history of recent antibiotic therapy, history of tetanus vaccination, and justification by the 2017 Guidelines for Rabies Control in Korea⁶⁾ and implementation of rPEP. In cases of non-adherence to the guidelines, we recorded the guardians' opinion for or against rPEP.

According to the above-mentioned guidelines, rPEP should be implemented: if the biting animal shows symptoms suspicious of rabies or dies, cannot be observed, or shows abnormal symptoms or dies during the 10-day observation⁶⁾. The rabies vaccine is injected intramuscularly for 28 days with a 5-dose vaccination schedule (days 0, 3, 7, 14, and 28), and 1 human rabies immunoglobulin is preferentially infiltrated on wounds (or injected on the gluteal muscles) on day 0.

All statistical data were analyzed using SPSS ver. 25.0 (IBM Corp., Armonk, NY), and results with $P < 0.05$ were considered significant. Categorical variables were analyzed using Fisher's exact test, whereas continuous variables were analyzed using the Wilcoxon rank-sum test. The values obtained were rounded off to the second decimal point.

Results

A total of 883 patients had animal bite as a discharge diagnosis between January 2014 and October 2017. Sixty three of them were enrolled in the study (Fig. 1). The study population's baseline characteristics are listed in Table 1. The most common bitten body part was the upper extremity (36.5%), followed by the lower extremity (30.1%), multiple parts (15.9%), and the injuries were most commonly caused by dogs (74.6%). A total of 58 patients (92.1%) were administered antibiotics, and 10 (15.9%) received tetanus vaccination. Most animal bites occurred in Korea (73.0%) (Fig. 2). Within Korea and among other countries, Seoul (46%) and Southeast Asia (17.5%) respectively were the regions where the bite most

frequently occurred.

Of the 38 children whose rPEP was justified by the guidelines, the prophylaxis was implemented in the 35 children (Table 2). Of the 3 children who did not undergo the justified rPEP, 2 did not do so by the guardians' requests. Among the 8 patients

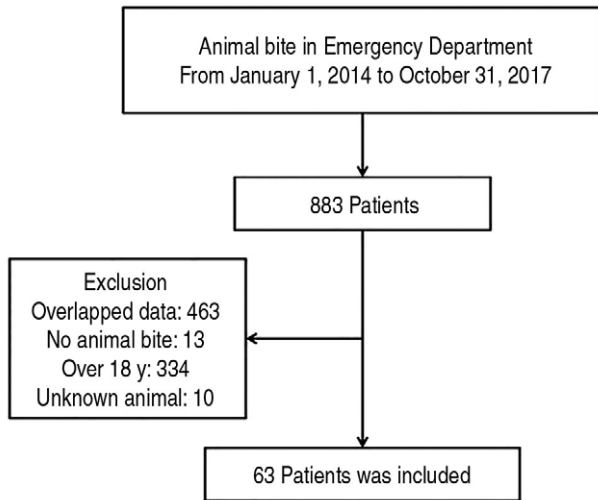


Fig. 1. Flow chart of the study population.

Table 1. Baseline characteristics of the children with animal bite (N = 63)

Characteristic	Value
Age, y	8.0 ± 4.4
Boys	40 (63.5)
Temp, °C	36.7 ± 0.4
Body parts	
Upper extremities	23 (36.5)
Lower extremities	19 (30.1)
Multiple (≥ 2 parts)	10 (15.9)
Head and neck	8 (12.7)
Trunk	2 (3.2)
Unknown	1 (1.6)
Animal species	
Dog	47 (74.6)
Monkey	11 (17.5)
Cat	2 (3.2)
Others*	3 (4.7)
Recent antibiotic therapy	58 (92.1)
Tetanus vaccination	10 (15.9)
rPEP justified by the guidelines [§]	38 (60.3)

Values are expressed as number (%) or mean ± standard deviation.

* Rats, hamsters, and weasels (one each).

rPEP: rabies post-exposure prophylaxis.

who underwent rPEP unjustified by the guidelines, 7 did by the guardians' requests. The remaining 17 children did not undergo rPEP and the prophylaxis was not justified.

Discussion

In this study, we found an inconsistent adherence to the Korean guidelines for rPEP that is usually affected by the guardians' requests. Therefore, emergency physicians may need to be more knowledgeable about the indications for rPEP to deal

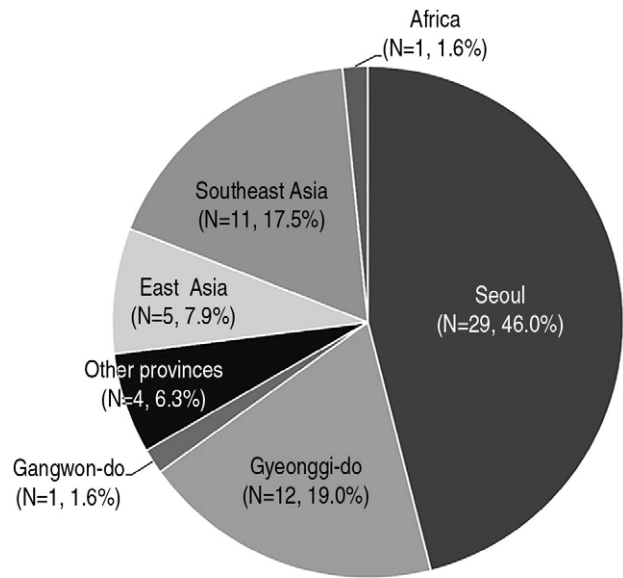


Fig. 2. Regions where animal bites occurred (N = 63).

Table 2. Implementation of rPEP according to justification of the Korean criteria

	Justified (N = 38)	Unjustified (N = 25)
Implemented	35 (92.1)	8 (32)*
Not implemented	3 (7.9) [†]	17 (68)

Values are expressed as number (%).

* Seven out of the 8 children underwent unjustified rPEP as per the guardians' requests. We could not find the reason for the rPEP in the other 1 child.

[†] Two out of the 3 children did not undergo the justified rPEP, as per the guardians' requests. We could not find the reason against the rPEP in the other 1 child.

rPEP: rabies post-exposure prophylaxis.

with the guardians' requests for or against rPEP and optimize performance of rPEP in children with animal bite.

The management of animal bite can be divided into the following steps: prevention, wound care, and infection control. First, the guardians should take proper precautions to prevent their children from animal bites, and when traveling to highly prevalent regions, they should adopt rabies pre-exposure prophylaxis whenever possible⁷. Second, in cases of animal bite, the wounds should be washed immediately with soap and running water for approximately 15 minutes, and any foreign substance near the wound should be removed. Finally, if rPEP is justified, a decision should be made whether the vaccine should be administered intramuscularly or intradermally when injected in the left and right deltoid muscles and anterolateral thigh⁷. The bacteria involved may differ depending on biting animals³. Thus, the bacteria expected from each species of animal should be identified, so that the appropriate empirical antibiotic therapy and tetanus vaccination can be performed.

According to the recent report on animal bites in Korea, they occur more frequently in men than women⁴. However, the incidence of dog bites reported between 2011 and 2016 was higher among women than among men (54.6%), and dog bites occurred most frequently among children aged 5–9 years^{2,8}. In this study, the proportion of boys bitten by an animal was higher than that of girls. This was consistent with the results of other studies^{9–12}.

In this study, the incidence of animal bite was high in Seoul and Gyeonggi-do. Because the study center is located in Seoul, residents in Seoul and Gyeonggi-do might have easy access to it. Areas outside Korea where the animal bite occurred included Southeast Asia (64.7%), East Asia, and Africa. According to a report by the WHO, 99% of rabies are transmitted via dogs⁷. Caution is needed especially in Asia and Africa since dog-mediated

rabies outbreaks and rabies-related deaths are common, with the average 35,172 and 21,476 deaths reported in Asia and Africa each year, respectively⁷.

There are some limitations in this study. First, the findings of this study may not be representative of Korea due to the single center study design. Further multi-center studies are required to ensure wide applicability of the results. Second, because of the retrospective design, there were insufficient data on children with animal bites. Third, for the same reason, it is unclear whether inappropriate rPEP had affected the outcomes of the children.

In conclusion, rPEP for children may not be adherent to the Korean guidelines. Emergency physicians' knowledge about the indications for and methods of rPEP can be helpful in discussing plans for rPEP with children's guardians, and ultimately preventing occurrence of rabies or unnecessary prophylaxis.

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Conflicts of interest

No potential conflicts of interest relevant to this article were reported.

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