

# When Rodents Attack: A Review of Rabies and Post-Exposure Prophylaxis

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In this case report of a 65-year-old woman who presented to the ED for evaluation of an animal bite, the authors review the literature about the treatment of rabies with post-exposure prophylaxis.

### Case

A 65-year-old woman presented to the ED with a chief complaint of an animal bite, in Southwest Ohio. The patient reported picking up what she thought to be an injured bird, which in fact turned out to be a chipmunk. When she handled the creature, it jumped up and bit her on the right arm, latching on through the sleeve of her sweater. Her husband struck the chipmunk with a shovel, thus terminating the threat. The patient was brought to the ED by her husband for evaluation, along with the lifeless animal which had been placed in a plastic bag. On examination, the patient had a small superficial abrasion to her right forearm with shallow skin puncture. This was treated with local wound care, including copious irrigation with normal saline and chlorhexidine. Given that she sustained an animal bite wound, she was treated empirically with amoxicillin/clavulanic acid (Augmentin) orally. Her tetanus vaccine was up to date. The critically important question regarding management of the patient was whether she should be treated with post-exposure prophylaxis for rabies after being bitten by the rodent.

### Discussion

According to the Centers for Disease Control and Prevention (CDC) website regarding the indications for rabies post-exposure prophylaxis, it was found that small rodents, including chipmunks, have not been known to transmit rabies to humans. While these small animals are rarely infected with rabies, there have been reports of squirrels infected with rabies in the United States.<sup>1,2</sup> Therefore, it is recommended that in all cases of rodent bites, the state or local health department should be contacted prior to making a decision regarding post-exposure prophylaxis.<sup>1</sup> The state health department was contacted and

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agreed that post-exposure prophylaxis was not indicated; however, they requested the animal be sent to them for testing, which was arranged. An in-depth literature review found a case report in India of a 7-year-old boy who contracted rabies after being bitten by a squirrel. Per this research, small rodents are rarely infected with rabies, with woodchucks being indicated as local vectors. This particular patient received a tetanus vaccine and wound care initially after the squirrel bite, but presented 2 months later with difficulty with oral feeding, fever, and cough. He succumbed to his illness just 4 hours after admission, and rabies was confirmed through a corneal impression smear.<sup>3</sup> Birhane et al<sup>4</sup> reported three human deaths in the United States from rabies during 2015. The deaths included one due to a rabid dog bite while abroad, one due to contact with a bat, and one from a mongoose bite. None of these patients had been treated with post-exposure prophylaxis.<sup>4</sup>

Rabies is an RNA virus in the genus *Lyssavirus*. Once contracted, the rabies virus initially binds to the nicotinic acetylcholine receptor in muscle, replicates, and ascends along the nerves until it reaches the central nervous system (CNS), then propagates outward via the peripheral nerves. Replication in the CNS occurs in the Negri bodies, which are highly specific for rabies. There are two forms of rabies, a paralytic form and an encephalitic form, with the encephalitic form occurring far more commonly. The encephalitic form presents with hallucinations, and disorientation intermixed with lucid intervals. The paralytic form presents with weakness in the affected limb(s), progressing to quadriplegia and facial weakness, eventually leading to organ failure. The classic hydrophobia that is thought of in connection with rabies is present in only 50% of cases.<sup>5</sup>

Transmission occurs from an infected host via bite most commonly, but can occur through exposure to mucous membranes, aerosol transmission, or exposure in a laboratory setting. The rabies virus can be “shed in the saliva concomitantly with, before or after the development of clinical signs.”<sup>6</sup> Lyssaviruses, such as the rabies virus, do not persist in the environment. Once outside the host, the virus is rapidly inactivated, therefore, fomites do not play a role in transmission.<sup>6</sup> Rabies hosts vary significantly, and the virus has been found in almost all mammalian orders and on all continents except for Antarctica. The primary reservoir for rabies is the bat, followed by dogs; however, cats, foxes, coyotes, jackals, wolves, mongoose, and raccoons are all vectors of rabies. Animals infected with rabies typically show signs of CNS disturbance. According to Rupprecht,<sup>2</sup> “the most reliable signs, regardless of species, are acute behavioral changes and unexplained progressive paralysis.” Notably, wild animals infected with rabies “may lose their fear of people, and nocturnal species may be seen wandering about during the daytime.”<sup>2</sup> According to Rupprecht et al,<sup>6</sup> “Rodents and lagomorphs, although used heavily as laboratory models, are not important in the epidemiology of the disease [rabies], except in the public-health resources devoted to consultation or prophylaxis after routine contact with these ubiquitous small mammals.”

Post-exposure prophylaxis is indicated when someone has been in a room with a bat, even if direct contact with the animal is uncertain. Examples of this would include “a sleeping person [who] awakens to find a bat in the room or an adult witnesses a bat in the room with a previously unattended child, mentally disabled person, or intoxicated person.”<sup>7</sup> Following a bite requiring post-exposure prophylaxis treatment, it is pertinent to note if the patient has had a previous immunization. Regardless of immunization status, all bite areas must be thoroughly cleansed and irrigated. The CDC recommends using a virucidal agent, such as a povidine-iodine solution, in the cleansing process. If an individual has been previously immunized to rabies, then the rabies immunoglobulin (RIG) should not be administered; rather, the patient should be given the rabies vaccine,

such as the human diploid cell culture rabies vaccine (HDCV) or the purified chick embryo cell vaccine (PCECV). The dose is 1 mL intramuscularly on day 0 and day 3. If a patient has not had either pre-exposure or prior post-exposure vaccinations, then RIG is also indicated. The full dose of RIG should be given at the site of the bite; however, if this is not feasible due to the location of the wound, then any remainder should be given at a site distant from the vaccine. The rabies vaccine (HDCV or PCECV) should be administered intramuscularly on days 0, 3, 7, and 14. A fifth dose may be considered on day 28 for immunocompromised patients. In adults, the vaccine should be given in the deltoid region, whereas in children it can also be given in the anterolateral aspect of the thigh. It should never be administered in the gluteal region because it may result in lower antibody titers.<sup>8</sup> It is extremely important to administer the RIG in unvaccinated persons. A case report was reviewed from India in which a 45-year-old woman presented with fever, headache, dizziness, and hearing loss 1 month after being bitten by a mongoose on her right leg. She was given 4 doses of a rabies vaccine on days 0, 3, 7, and 28 but was not given RIG. Rabies virus neutralizing antibody titers in the cerebral spinal fluid were initially 2,048 IU/mL and increased after 2 weeks to greater than 16,384 IU/mL confirming the diagnosis of rabies encephalitis. The patient died 1 month after admission.<sup>9</sup> The incubation period for rabies is 1 to 3 months in general, but a range from days to years has been reported.<sup>6</sup> Post-exposure prophylaxis should typically be initiated as soon as possible after a bite; however, it may be delayed up to 10 days after exposure if the animal has been captured and can be monitored for signs of rabies or euthanized and tested. It is recommended that anyone who presents for evaluation after possible exposure, regardless of timeline, should be treated as if the contact had just occurred.<sup>10</sup>

### Case Conclusion

In this case of the chipmunk bite, in accordance with the state health department, rabies prophylaxis was not indicated. It was recommended that the chipmunk be sent off for a necropsy (noting to leave the chipmunk intact and not to behead it). Following shared decision making with the patient and her husband, the chipmunk was sent off for testing with the results to be sent to the patient. She was discharged from the ED with Augmentin, but without rabies post-exposure prophylaxis. According to review of outpatient medical records, the patient was doing well at primary care appointments after the injury.

### References

1. Centers for Disease Control and Prevention. Rabies: Other Wild Animals. <https://www.cdc.gov/rabies/exposure/animals/other.html>. Published April 29, 2016. Accessed July 20, 2017.
2. Rupprecht CERE. Overview of Rabies – Nervous System. Merck Veterinary Manual. <https://www.merckvetmanual.com/nervous-system/rabies/overview-of-rabies>. Accessed June 15, 2018.
3. Kumari PL, Mohanan KR, Kailas L, Chacko KP. A case of rabies after squirrel bite. *Indian J Pediatr*. 2014;81(2):198. doi:10.1007/s12098-013-0990-2.
4. Birhane MG, Cleaton JM, Monroe BP, et al. Rabies surveillance in the United States during 2015. *J Am Vet Med Assoc*. 2017;250(10):1117-1130. doi:10.2460/javma.250.10.1117.
5. Tintinalli JE, Stapczynski JS, Ma OJ, Yealy DM, Meckler GD, Cline DM. *Tintinalli's Emergency Medicine: A Comprehensive Study Guide*. 8th ed. New York, NY: McGraw-Hill; 2016.
6. Rupprecht CE, Hanlon CA, Hemachudha T. Rabies re-examined. *Lancet Infect Dis*. 2002;2(6):327-343.
7. Centers for Disease Control and Prevention. Rabies: Bats. <https://www.cdc.gov/rabies/exposure/animals/bats.html>. Published July 5, 2017. Accessed June 15, 2018.
8. Centers for Disease Control and Prevention. Rabies: Rabies Vaccine. [https://www.cdc.gov/rabies/medical\\_care/vaccine.html](https://www.cdc.gov/rabies/medical_care/vaccine.html). Published September 24, 2014. Accessed July 20, 2017.
9. Mani RS, Moorkoth AP, Balasubramanian P, Devi KL, Madhusudana SN. Rabies following mongoose bite. *Indian J Med Microbiol*. 2016;34(2):256-257. doi:10.4103/0255-0857.176848.
10. Petersen B. Rabies: What's an Exposure? Know When to Vaccinate. Medscape. <https://www.medscape.com/view-article/877636>. Published April 03, 2017. Accessed September 3, 2018.