



# City Health Information

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The New York City Department of Health and Mental Hygiene

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REVISED

## RABIES IN NEW YORK CITY AND HUMAN RABIES PREVENTION

- When a patient presents with an animal bite, assess the need for rabies postexposure prophylaxis (PEP), and ensure that PEP is given properly when needed.
- Be aware that PEP is indicated only in particular circumstances, depending on whether a true exposure has occurred, the type of animal, and its availability for observation or testing. Raccoons and bats are the primary vectors of rabies in NYC.
- Report every animal bite to the NYC Health Department.

The rabies virus can infect all warm-blooded mammals, leading to acute, rapidly progressive encephalitis that results in death. When an animal is infected, the rabies virus moves along the peripheral nerves to the central nervous system (CNS) and brain, and then to the salivary glands. Initial signs appear after an incubation period of several weeks to months. These include a change in the animal's behavior; some animals may become aggressive and others may become reserved and withdrawn. Soon after, nonspecific symptoms such as lethargy, fever, and anorexia appear, followed by neurologic signs such as changes in gait, difficulty

swallowing, and paralysis and death within days. In almost all cases of human rabies, the virus is transmitted through the bite of a rabid animal.<sup>1</sup>

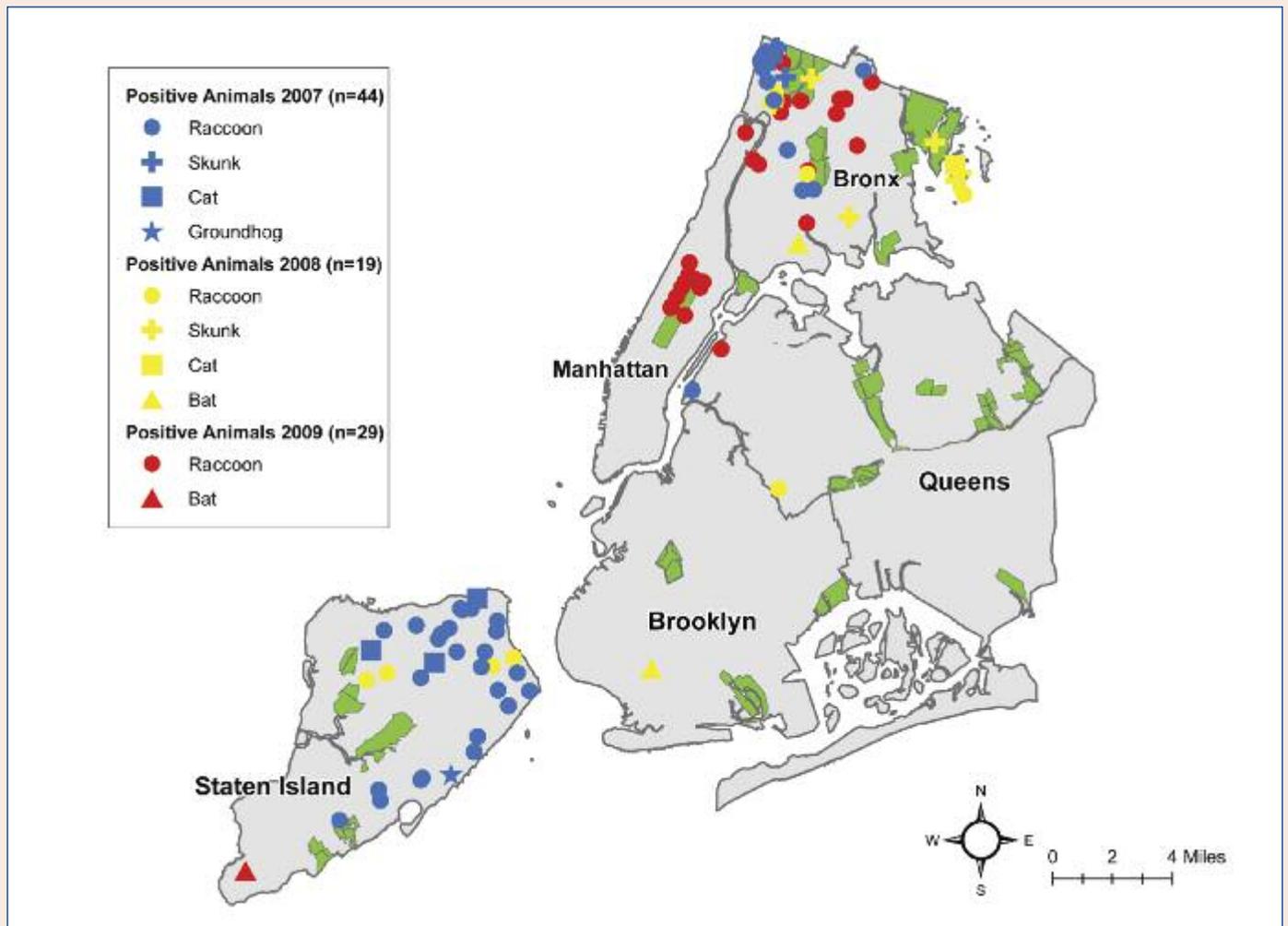
Fortunately, in the United States (US), rabies in humans is extremely uncommon, and postexposure prophylaxis (PEP) is not automatically indicated when a person is bitten by an animal. It is important for the clinician to consider up-to-date epidemiologic data on rabies in NYC (**Resources**) when treating patients for bite wounds. From 2003 to 2006, there were 24,343 Emergency Department (ED) visits for animal bites reported in the 5 boroughs, largely due to dogs (73%), cats (13%), and rodents (7%). During that time, 2,464 animals were tested for rabies and 92 tested positive. Most (79%) of those were raccoons, predominantly from the Bronx and Staten Island. None were dogs.

### EPIDEMIOLOGY OF RABIES

#### Animals

Different variants of the rabies virus exist and are maintained in their respective vectors, following geographically distinct patterns. In the US, those vectors include raccoons, skunks, bats, and foxes. The raccoon variant is present along the Atlantic Coast and the bat variant throughout the US except Hawaii. Most rabid animals in the US are raccoons, skunks, bats, and foxes.<sup>2</sup>



**FIGURE 1. LABORATORY-CONFIRMED RABID ANIMALS IN NYC, 2007-2009****TABLE 1. LABORATORY-CONFIRMED RABID ANIMALS IN NYC, 1992-2009**

Animal Species	Bronx	Queens	Manhattan	Staten Island	Brooklyn	Total Positive	Total Tested
Raccoon	163	9	20	121	0	313	5614
Skunk	40	0	0	2	0	42	246
Bat	8	4	7	5	5	29	800
Dog	0	0	0	0	0	0	1757
Cat	2	0	1*	7	1	11	2677
Other†	1	0	0	3	0	4	1865
Total	214	13	28	138	6	399	12959

\*A cat from Columbia County that was tested in NYC.

†Other includes 1 coyote (1999, Bronx), 2 opossums (1994 and 1992, Staten Island), 1 groundhog (2007, Staten Island).

In NYC, rabies most often occurs in raccoons (**Figure 1, Table 1**). Occasionally, rabid raccoons transmit the virus to other animals, usually skunks. In NYC, rabid raccoons were first reported in 1992 in the Bronx and Staten Island, and are still most prevalent in those areas; since 2009 they have become more common in Manhattan. There have also been isolated reports of rabid raccoons in

Queens (and Brooklyn in 2010). A much smaller number of rabid bats have been found in all 5 boroughs. Dogs and cats are also susceptible to rabies, but vaccination and animal control have significantly reduced the numbers of rabid dogs and cats. No rabid dogs have been reported in NYC since 1954. Since 1992, only 11 rabid cats have been identified in NYC; of these, 7 were strays found in

Staten Island in 2006 and 2007. Long Island was free of raccoon rabies until 2004, when the virus was identified in Nassau County; it has since spread to Suffolk County.

Rodents and members of the rabbit family are not considered to be vectors of rabies. The one exception is the groundhog, which has tested positive for rabies in NYC. Rabies infection of other domestic rodents or rabbits should be considered in unusual circumstances, such as when the animal has a bite wound and has been housed in an outdoor hutch, or when a rabies vector species (e.g., raccoon) has been observed in the vicinity.

## Humans

In the US, an average of 1 to 2 cases of human rabies are reported each year, primarily due to exposure to rabid bats.<sup>3</sup> Rabies has also been reported in travelers who become infected while overseas. Rarely, organ transplantation has resulted in transmission of rabies.<sup>4,5</sup> Providers should ask about animal exposure and travel history for any patient with rapidly progressive encephalopathy.

There has not been a reported case of human rabies in NYC since the 1940s. Since 1992, 9 NYC residents have been bitten by animals known to be rabid (5 raccoons, 3 cats, 1 bat); all received rabies PEP and none developed rabies.

In the past 50 years, there have been 3 human cases of rabies in New York State; these occurred in a laboratory worker exposed while working with the virus,<sup>6</sup> a traveler bitten by a rabid puppy while in Ghana,<sup>7</sup> and an 11-year-old girl infected with the bat variant.<sup>8</sup>

## Clinical Picture

The incubation period for human rabies is 31-90 days, although there have been rare reports of incubations of a year or more. Factors such as the extent of innervation of the bite site and its proximity to the CNS, severity of the bite, amount of inoculum, and immune status of the victim may affect incubation time.<sup>9</sup>

The first symptoms are often nonspecific (malaise, chills, fever, fatigue, respiratory problems, gastrointestinal distress) and may be attributed to common viral or bacterial infections. As the illness progresses, neurologic or psychiatric symptoms emerge. The one specific symptom reported by many patients is pain or paresthesias starting at the site of the bite and radiating out along the extremity or area of the healed bite wound. Eventually, CNS complications dominate the clinical picture. Findings may include fever, paresthesias, stiff neck, muscle twitching,

convulsions, hyperventilation, hydrophobia, and hypersalivation. The patient may exhibit hyperactivity, anxiety, agitation, hallucinations, thrashing, running, biting, or other bizarre behavior, as well as paralysis (20% of cases), and will ultimately become comatose and die.<sup>9,\*</sup>

## Diagnostic Testing

Rabies in humans can be diagnosed by fluorescent antibody test on biopsy (neck skin) or corneal impressions, by virus isolation from saliva, virus neutralization assay on serum or cerebrospinal fluid (for evidence of rabies antibody), or reverse transcription polymerase chain reaction (RT-PCR) for viral RNA and genomic nucleotide sequence analysis on saliva. Human rabies testing is available at the Wadsworth Rabies Laboratory in Slingerlands, NY; special arrangements for transportation of critical specimens can be made through the NYC Health Department.<sup>10</sup> The testing process requires extensive resources and should only be pursued when rabies is highly suspected based on clinical presentation, progression of illness, and history of animal exposure. All suspected cases of human rabies should be reported immediately, and the diagnosis should be pursued in consultation with the NYC Health Department Bureau of Communicable Disease (BCD).

## DETERMINING EXPOSURE

Exposure to rabies is characterized as either a bite or non-bite exposure; each carries a different degree of risk.<sup>11</sup>

- **Bite (higher-risk)** – Any penetration of skin by an animal's teeth. Bites to the face and hand and multiple bites carry the highest risk of rabies infection.
- **Non-bite (lower-risk)** – Scratches or abrasions received from an animal, or the contamination of open cuts, mucous membranes, or wounds with an animal's saliva (or brain and other neural tissue). Non-bite transmission of rabies is extremely rare.

**Non-exposure:** Petting or handling an animal; contact with blood, urine, or feces; and contact with saliva on intact skin do *not* constitute rabies exposures.

**Possible exposure to a bat:** Most bats found in NYC are not infected with rabies, but bats cause most cases of human rabies in the US. A bat bite causes minimal trauma, so that victims may not even be aware that a bite occurred. Because people have developed rabies after unrecognized bat exposures, reasonable possibility of exposure is treated as an exposure (see box on page 4).<sup>11</sup>

\*One case of survival after intensive treatment of rabies infection has been documented (Willoughby RE, et al. *N Engl J Med.* 2005;35(24):2508-2514).

## ASSESSING POSSIBLE EXPOSURE TO A BAT

Exposure Unlikely	Exposure Reasonable Possibility
<ul style="list-style-type: none"> <li>Bat droppings (guano) found in sleeping quarters.</li> </ul>	<ul style="list-style-type: none"> <li>Bat found in same room with someone who might be unaware that exposure has occurred (e.g., sleeping, mentally disabled, or intoxicated person; unattended infant or child).</li> </ul>
<ul style="list-style-type: none"> <li>Teenager or adult touches a bat, but is certain the bat did not bite or scratch.</li> </ul>	<ul style="list-style-type: none"> <li>Young child touches a live bat (may be unaware or unable to communicate exposure).</li> </ul>
<ul style="list-style-type: none"> <li>Bat swoops by a teenager or adult who does not feel it touch, or contact is not with bare skin (e.g., touches area covered by clothing).</li> </ul>	<ul style="list-style-type: none"> <li>Bat flies into someone, touching bare skin and person is unable to determine what type of contact occurred.</li> </ul>
<ul style="list-style-type: none"> <li>Person has contact with a completely dried-up carcass of a bat.</li> </ul>	<ul style="list-style-type: none"> <li>Someone with bare feet steps on a live bat.</li> </ul>
<ul style="list-style-type: none"> <li>Bats are heard or seen in walls or attic.</li> </ul>	<ul style="list-style-type: none"> <li>Person puts hand in firewood or brush, feels pain, then sees a live bat.</li> </ul>

## HOW TO MANAGE POSSIBLE EXPOSURE TO RABIES

The need for rabies PEP is determined by assessing the exposure, the particular circumstances surrounding the bite, the type of animal, and its availability for rabies evaluation (**Table 2**). If the history suggests that an exposure has occurred and the animal cannot be observed or tested, PEP may be indicated (**Figure 2**). BCD is available for consultation (business hours: 212-788-9830; other times: 212-POISONS, 212-764-7667).

## WHEN AND HOW TO ADMINISTER PEP

PEP consists of both rabies vaccine and human rabies immune globulin (HRIG), with certain exceptions (**Table 3**).

### Rabies Vaccines

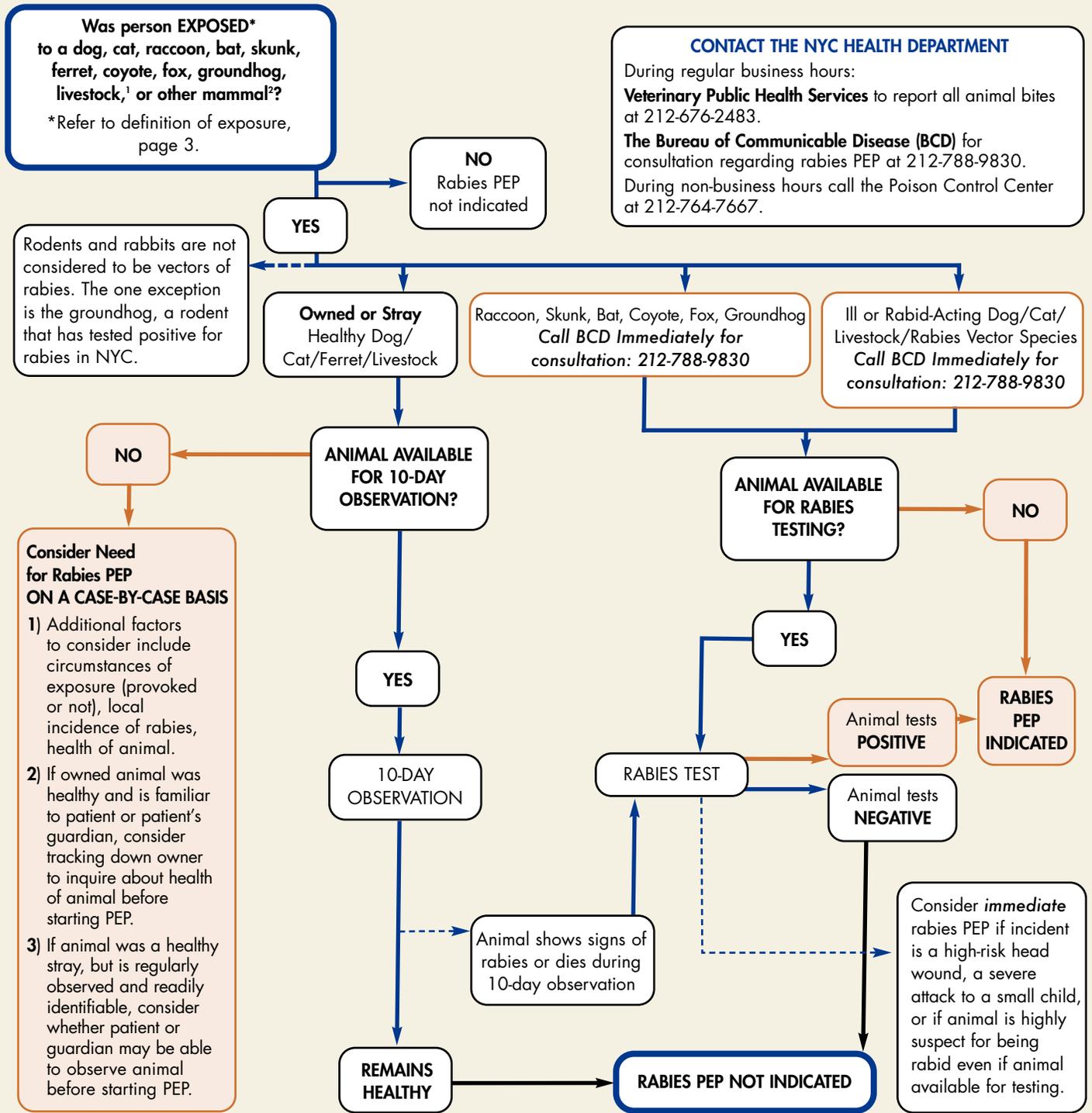
Two inactivated rabies vaccines are available in the US: Imovax<sup>®</sup>, a human diploid cell vaccine (HDCV), and RabAvert<sup>®</sup>, a purified chick embryo cell vaccine (PCEC). HDVC and PCEC are given in a 1-mL dose for both pre- and postexposure vaccination. A detectable antibody response occurs in 7-10 days, and immunity lasts at least 2 years. For adults, the vaccination should always be administered intramuscularly (IM) in the deltoid area. For children, the anterolateral aspect of the thigh is also acceptable. The gluteal area should never be used because administration in this area results in lower neutralizing antibody titers. The two licensed rabies vaccines are considered equally safe and effective. Reports in the literature indicate that interchanging vaccines is acceptable.<sup>11,12</sup>

## TABLE 2. MANAGING POTENTIAL RABIES EXPOSURES

- **Wound Care** – Evaluate and thoroughly irrigate and clean the wound. Assess need for tetanus immunization.
- **Exposure** – Determine whether there was a potential rabies exposure (see page 3).
- **History** – Get a good history including animal species, circumstances (provoked or not), owned vs. stray, location of animal, was animal ill or acting abnormally, vaccination status of animal.
- **Animal** – What type of animal? If an animal is capable of transmitting rabies, determine whether the animal is available for observation or testing.
- **Rabies PEP** – Give PEP if indicated (**Figure 2**).
- **Consult** – If needed, call BCD for consultation: 212-788-9830; non-business hours call 212-POISONS (212-764-7667).
- **Report** – Report the bite to the VPHS Animal Bite Unit at 212-676-2483.

BCD=Bureau of Communicable Disease; VPHS=Veterinary Public Health Services.

**FIGURE 2. GUIDE TO RABIES POSTEXPOSURE PROPHYLAXIS**



**IMPORTANT POINTS TO REMEMBER**

If animal is available or already undergoing observation or testing, counsel victim or guardian of victim regarding risk and need for PEP.

**NO NEED TO INITIATE RABIES PEP IN THE FOLLOWING CIRCUMSTANCES:**

- 1) Healthy dog, cat, ferret, or livestock undergoing 10-day observation.
  - 2) Rabies vector species that is available for testing and results available within 24-48 hours.
  - 3) Any animal considered to be rabid that is available for testing and results available within 24-48 hours.
- Test results are available within 24 hours of submission to the Public Health Rabies Laboratory during regular business days. In some instances, emergency testing may be indicated and can be done in consultation with the NYC Health Department.

<sup>1</sup> Horses, mules, donkeys, sheep, goats, and swine (pigs).

<sup>2</sup> For exposures to other mammals, consult BCD.

Serious problems from rabies vaccine are very rare. Mild problems include soreness, redness, swelling, or itching at the vaccination site (30%-74%); headache, nausea, abdominal pain, muscle aches, or dizziness (5%-40%). Moderate problems include hives, pain in the joints, fever (about 6% of booster doses), and (very rarely) illness resembling Guillain-Barré Syndrome with complete recovery.<sup>11</sup>

### Human Rabies Immune Globulin (HRIG)

HRIG must be administered to a patient receiving PEP unless the patient has had a complete rabies pre- or postexposure prophylaxis series in the past. HRIG neutralizes the virus at the wound site and reduces the amount of viable virus, which prevents or limits replication in muscle cells and subsequent invasion of nerve endings. Two versions of HRIG are available in the US: Imogram® and HyperRab™. HRIG dosing is weight-dependent. When possible, administer the full amount of HRIG in and around the wound site. For small children or limited injection sites (i.e., fingertip), inject as much HRIG around the site as possible; the remainder can be given IM at a site distant from vaccine administration (e.g., opposite deltoid muscle). Avoid administering in the gluteals if the patient is overweight.<sup>11</sup>

### Who Should Get Preexposure Vaccination

Preexposure vaccination is appropriate for people at high risk for rabies exposure, such as veterinarians, animal handlers, animal control workers, laboratory workers, and people planning travel to areas where rabies is endemic. Vaccine is given in three IM doses in the deltoid area on days 0, 7, and either day 21 or day 28. A booster should be provided according to ACIP guidelines (**Resources**). Preexposure vaccination does not eliminate the need for PEP, but it simplifies therapy (**Table 3**) and may offer protection to persons with unknown exposure or when PEP may be delayed.<sup>11</sup>

### Who Should Get Postexposure Vaccination

Only patients with a known or potential exposure to rabies should receive postexposure vaccination. The administration protocol depends on whether the patient has had prior immunization (**Table 3**). People who have received the vaccination series either pre- or postexposure are considered immunized and should adhere to the protocol for previously vaccinated patients. Rabies vaccination is costly and can be a traumatic experience for the recipient; therefore, it should not be given unless clearly indicated. If there is any doubt about the need for PEP or its proper administration, the clinician should consult BCD. Examples of issues that may arise in administering PEP are given in **Table 4**.<sup>11,12</sup>

**TABLE 3. RABIES POSTEXPOSURE PROPHYLAXIS REGIMENS**

Regimen	Not Previously Vaccinated	Previously Vaccinated (either pre- or postexposure)*
Wound Cleansing	YES <ul style="list-style-type: none"> <li>• Irrigation</li> <li>• Povidone-iodine</li> <li>• Determine need for tetanus</li> </ul>	YES <ul style="list-style-type: none"> <li>• Irrigation</li> <li>• Povidone-iodine</li> <li>• Determine need for tetanus</li> </ul>
Human Rabies Immune Globulin	YES <ul style="list-style-type: none"> <li>• 20 IU/kg</li> </ul>	NO
Rabies Vaccine	YES <ul style="list-style-type: none"> <li>• 1.0 mL IM in deltoid area<sup>†</sup></li> </ul> Days 0, 3, 7, 14 <sup>††</sup>	YES <ul style="list-style-type: none"> <li>• 1.0 mL IM in deltoid area<sup>†</sup></li> </ul> Days 0 and 3

\*Only applies to patients previously vaccinated using cell culture vaccine or any patient with a documented rabies virus neutralizing antibody titer.

<sup>†</sup>In children, anterolateral thigh can also be used. Avoid administration in gluteals.

<sup>††</sup>Immunosuppressed people should receive a fifth dose of vaccine on day 28, followed by a rapid fluorescent focus inhibition test on serum to ensure an acceptable rabies antibody response.

More information on specific regimens is available at [www.nyc.gov/html/doh/downloads/pdf/cd/acip-mmwr-2008.pdf](http://www.nyc.gov/html/doh/downloads/pdf/cd/acip-mmwr-2008.pdf). See also <http://www.cdc.gov/mmwr/pdf/rr/rr5902.pdf> IM=intramuscular.

#### TABLE 4. POSTEXPOSURE PROPHYLAXIS: WHAT TO DO IF...

- A patient is off-schedule: The PEP treatment schedule should be evaluated on a case-by-case basis.<sup>11</sup>
  - DO NOT restart the series unless the patient began the series outside the US and the biologics used are questionable or no information is available. Consult the Bureau of Communicable Disease (BCD) for guidance.
  - HRIG should be given on day 0. Given after day 7, HRIG can interfere with the body's antibody production and may be contraindicated.
    - If the provider fails to administer HRIG on day 0, HRIG can be given up to 7 days after starting the vaccine schedule. If after day 7, contact BCD.
    - If HRIG was administered but NOT at the bite site, contact BCD.
  - Rabies vaccinations should be administered on days 0, 3, 7, and 14. Deviations of a few days are of no great concern and the patient should resume the series, maintaining the recommended spacing between doses.
    - For example, if a patient misses day 3 and presents on day 5, the day 3 dose should be given that day, the day 7 dose on day 9, and the remaining dose on day 16.
  - If there is significant deviation from the schedule, resume series as above. Administer a fourth dose of rabies vaccine on day 14. Antibody titers should be assessed by RFFIT on a serum sample collected 14-28 days after finishing PEP to ensure a 1:5 serum dilution.
- The patient is immunosuppressed at time of PEP: Administer a fifth dose of rabies on day 28. Antibody titers should be assessed by RFFIT on a serum sample collected 14-28 days after finishing PEP to ensure a 1:5 serum dilution.<sup>11</sup>
- The patient is pregnant: Pregnancy is not considered a contraindication to PEP; no fetal abnormalities have been associated with rabies vaccination.<sup>11</sup>
- The patient has begun PEP with a different rabies vaccine: There are reports in the literature that indicate HDCV and PCEC vaccines can be interchanged.<sup>12</sup> If the original vaccine type is not available, continue vaccination with vaccine that is available.

**RFFIT** = rapid fluorescent focus inhibition test.

Most EDs in NYC stock rabies biologics and typically serve as the appropriate health care site to initiate the PEP series. Every effort should be made to ensure that patients receive all doses at the appropriate intervals.

Physicians can order biologics directly from the manufacturer. The Health Department does not provide rabies biologics or administer PEP directly.

#### Animal Bite Follow-Up

The NYC Health Code requires that all animal bites be reported. The NYC Office of Veterinary Public Health Services (VPHS) receives those reports and coordinates follow-up with the animal, its owner, and the person bitten to ensure that the animal is managed appropriately and the public is protected from further harm. VPHS arranges animal capture and animal rabies testing if indicated. To report an animal bite or provide information about the biting animal, call the VPHS Animal Bite Unit at 212-676-2483, from 9 a.m. to 5 p.m., Monday to Friday, or the Poison Control Center at 212-POISONS (212-764-7667) all other times.

#### INFORMATION FOR VETERINARIANS

NYC Health Code Section 11.64 requires that animal diseases that are communicable to humans and that are of public health concern be reported to BCD (see box on back). Influenza, which was recently added to the list, is specified as any strain of influenza with the potential to cause a pandemic. Influenza viruses can be found in several types of animals including birds, pigs, equines, canines, and sea mammals.

To make a report during regular business hours, call BCD at 212-788-9830. For urgent matters outside regular business hours, call the Poison Control Center at 212-POISONS (212-764-7667). For more information about animal disease reporting, visit the Health Department Web site at: [www.nyc.gov/html/doh/html/zoo/zoo-reporting.shtml](http://www.nyc.gov/html/doh/html/zoo/zoo-reporting.shtml).

#### SUMMARY

When treating patients with reported animal bites or other potential rabies exposures, advise them that the risk of rabies transmission is low except for certain situations (animal bites from raccoons, bats, skunks, and other rabies vector

species). For dog or cat bites, rabies postexposure prophylaxis is usually not indicated. Whenever possible, the animal should be observed and/or tested. When rabies PEP is indicated, it is essential that patients are followed closely to ensure that they complete preventive therapy. ♦

## REPORTABLE ANIMAL DISEASES

### Report if disease is suspected

- Rabies
- Anthrax
- Brucellosis
- Glanders
- Plague
- Q fever
- Tularemia
- Monkeypox
- Influenza caused by novel viral strain with pandemic potential
- Severe acute respiratory syndrome (SARS)
- Arboviral encephalitis, acute

### Report if disease is diagnosed

- Psittacosis
- Leptospirosis

## RESOURCES

- NYC Health Department Rabies Web site [www.nyc.gov/html/doh/html/cd/cdrab.shtml](http://www.nyc.gov/html/doh/html/cd/cdrab.shtml)
- New York City Health Department Veterinary Public Health Services [www.nyc.gov/html/doh/html/vet/vet1.shtml](http://www.nyc.gov/html/doh/html/vet/vet1.shtml)
- ACIP Guidelines on the Prevention of Rabies in Humans [www.nyc.gov/html/doh/downloads/pdf/cd/acip-mmwr-2008.pdf](http://www.nyc.gov/html/doh/downloads/pdf/cd/acip-mmwr-2008.pdf); <http://www.cdc.gov/mmwr/pdf/rr/rr5902.pdf>
- NASPHV Animal Rabies Compendium [www.nyc.gov/html/doh/downloads/pdf/zoo/zoo-rabies-compendium-2008.pdf](http://www.nyc.gov/html/doh/downloads/pdf/zoo/zoo-rabies-compendium-2008.pdf)
- CDC Rabies Web site [www.cdc.gov/rabies](http://www.cdc.gov/rabies)

## HOW TO CONTACT THE NYC HEALTH DEPARTMENT

- Bureau of Communicable Disease: 212-788-9830.
- Veterinary Public Health Services: 212-676-2483.

During non-business hours call the Poison Control Center at 212-764-7667.

*Resource listings are provided for informational purposes only and do not imply endorsement by the NYC DOHMH.*

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