Key Points

- Rabies is an acute, 100% fatal, viral infection of the brain, acquired through penetrating bites, licks, or scratches from rabid dogs, bats, and other mammals.
- Overall risk is rare for travelers, but risk becomes significant after a potential bite exposure.
- Symptoms are initially mild and include tingling at the site of the bite, fever, and extreme fear of water; illness uniformly and rapidly leads to death.
- Consequences of infection are paralysis, coma, and death once the rabies virus reaches the brain from the site of the bite or wound. The virus will reach the brain more quickly from bites to the face.
- Prevention includes avoiding any contact with dogs and other biting mammals (including bats) in countries with a high risk of rabies.
- Rabies vaccine for prevention prior to any exposure or potential bite is given in 3 doses: 1 each on days 0, 7, and 28. In those already vaccinated, 2 doses of vaccine spaced by 3 days must be given after every subsequent, potentially rabid bite or lick. In those who have never been vaccinated and who have sustained a bite or lick, 4 doses of vaccine on days 0, 3, 7, and 14 must be given; rabies immune globulin is also given on the first day.
- Vaccine side effects are most commonly injection-site reactions.
- Duration of vaccine protection is limited to the time interval until any subsequent rabies exposure, at which time postexposure vaccination will be required. Regular boosters are recommended only for veterinary and wildlife workers.

Introduction

Rabies is an acute, progressive, and uniformly fatal viral infection of the central nervous system that is vaccine preventable. Almost all rabies deaths are due to dog or bat bites. Tens of millions of human exposures and tens of thousands of deaths may occur each year due to rabies.

Risk Areas

Rabies is found on all continents except Antarctica. Canine rabies is most prevalent in Africa and Asia, has limited distribution in parts of Central and South America, and is absent from Western Europe, Japan, Australia and many small island countries. Rabies does not exist in land animals in all countries, but bats are present in every country in the world; bat rabies occurs worldwide, except in New Zealand. In the U.S., bats that feed on insects (notably silver-haired bats) are the most common cause of human rabies cases. In Central and South America, rabies transmitted by vampire bats causes significant death in cattle and occasional outbreaks in humans. Rabies virus of this type can also be found in raccoons, skunks, cats, and foxes in the U.S. and mongooses and jackals in southern Africa, Central America, and the Caribbean islands.

Transmission

Rabies is transmitted to humans via saliva through penetrating bites of rabid animals, which may not exhibit features of disease (especially carnivores and bats). Rabies virus is introduced through intact skin (e.g., by a bite or scratch) or licked onto preexisting nonintact skin or mucous tissue, where it then travels through the nerves to the brain. All mammals are susceptible, but dogs and other canines...
(foxes, wolves, jackals, and coyotes) are the most important vectors because they bite readily and may have daily contact with humans. Monkeys are a potential but uncertain source; nevertheless, monkey bites must be treated as a potential rabies risk. Bat rabies is transmitted by bat bites or scratches (which may not be noticed) or, more rarely, by inhalation of aerosolized bat saliva in caves where numerous bats congregate. Human-to-human transmission has never been reported.

**Risk Factors**

Rabies is a rare but high impact disease in travelers and can be prevented through vaccination. Very few cases of potential exposure progress to rabies among travelers, as shown by the low number of imported cases reported in Europe, U.S., and Japan.

A bite, a scratch, or a lick from a dog or other mammal in a rabies-endemic country or a bite or scratch from a bat anywhere in the world presents a risk of rabies to an unvaccinated traveler.

Risk of developing rabies increases with severity (number and depth) of bites and proximity to the head. Timely immunization is protective when given before and/or after exposure to neutralize the rabies virus before it reaches the brain. Bites to the face carry an especially high risk and require more urgent initiation of treatment following exposure.

**Symptoms**

Symptoms most commonly develop 20 to 60 days after exposure, depending on the severity and site of the bite, although symptoms could occur 5 days to several years after exposure.

Tingling at the site of the bite is usually followed by fever, headache, muscle aches, anxiety, depression, irritability, and sometimes respiratory or gastrointestinal symptoms, which progress to the classical features of either furious or paralytic rabies.

**Consequences of Infection**

Patients with furious rabies, which is common after dog bites, are terrified of water (hydrophobia) and develop severe spasms of the breathing muscles, which may lead to suffocation, generalized convulsions, coma, and death (in approximately 5 days). Patients with paralytic rabies, which is common after bat bites, become lethargic, dribble saliva, and develop an ascending loss of muscle tone and paralysis, coma, and death (in approximately 13 days).

**Need for Medical Assistance**

A traveler who has been bitten, scratched, or licked by a mammal in a rabies-endemic country or by a bat anywhere in the world should urgently seek medical advice on receiving a postexposure series of vaccinations. Bites to the face require urgent medical attention. Any potentially rabid exposure, even from months earlier, warrants immediate initiation of appropriate medical evaluation. National, state, or local health authorities should be consulted by the traveler or medical provider for recent information on rabies risk according to the particular exposure.

**Prevention**

**Nonvaccine**

**Preexposure**
Preventive measures include the following:

- Avoid contact with all dogs and other biting mammals in countries with canine rabies.
- Avoid provoking domestic animals.
- Avoid contact with all wild mammals, especially those that are behaving abnormally, in countries with rabies in wild mammals (e.g., skunks, raccoons, mongooses).
- Avoid touching or feeding monkeys, especially those in temples and national parks because they often show little fear of humans.
- Avoid any caves that are possibly bat-infested.
- Be especially vigilant with children because they are at high risk for exposure and may not report bites, scratches, or other incidents that might occur.

**Postexposure**

The following measures are recommended:

- **Immediately** cleanse all wounds thoroughly with copious amounts of soap and water (under a running tap if possible) for a minimum of 15 minutes.
- Use a virucidal agent (such as povidone-iodine) if available to irrigate the wounds and destroy the virus.
- Deep wounds are usually not closed or sutured.
- Treatment should be sought urgently.

**Vaccine and/or Vaccine and Rabies Immune Globulin**

**Preexposure**

Rabies vaccine can be given before travel for travelers going to any country with rabies (especially canine rabies) to simplify the postexposure vaccine schedule and eliminate the need for rabies immune globulin (RIG), which is often very difficult to obtain abroad.

Preexposure exposure (PrEP) rabies vaccination is recommended for:

- Long-stay travelers in high-risk destinations
- Shorter-stay travelers in high-risk destinations if more than 24 hours from a reliable source of modern cell-culture rabies vaccine and rabies immune globulin (RIG)
- Travelers with extensive outdoor exposure (occupational or adventure) in high-risk destinations where immediate access to appropriate medical care may be limited, regardless of length of stay
- Risk-averse travelers going to high-risk destinations, especially those engaging in high-risk activities

**Postexposure**

Postexposure prophylaxis (PEP), with or without RIG (depending on PrEP status; see below), is recommended for:

- Bite exposures that include any penetration of the skin by the teeth of a potentially rabid animal
  - PEP does not need to be initiated if a biting dog, cat, or ferret is healthy and available for 10 days’ observation. If PEP has been initiated and the animal remains healthy, PEP can be discontinued.
  - Skunks, raccoons, foxes, coyotes, and most carnivores in countries with known wildlife rabies should be considered rabid unless proven negative by testing.
Bites caused by livestock, small and large rodents (rats, mice, hamsters, gerbils, guinea pigs, woodchucks, beavers), and lagomorphs (rabbits, hares) almost never require initiation of PEP.

- Nonbite exposures, including scratches or contamination of open wounds, abrasions, or mucous membranes with saliva or other potentially infectious material
- Bat exposures from anywhere in the world (all bats should be considered potentially rabid):
  - PEP is recommended for all bat-bite exposures.
  - PEP is recommended if it is not reasonably certain that exposure did not occur, even if evidence of exposure is not visible.
  - PEP is not indicated for bat exposures if it is reasonably certain that exposure did not occur or if the bat is available for testing and is negative for rabies virus.

### Side Effects

Mild local reactions can include pain, redness, swelling, or itching at the injection site. Fever, headache, dizziness, abdominal pain, and gastrointestinal symptoms may also occur. Neurological complications have been reported, albeit rarely.

Persons with underlying medical conditions or who have concerns about the vaccines should speak to their health care provider before vaccine administration.

### Timing

Preexposure vaccination consists of 3 doses, 1 each on days 0, 7, and 28 (the third dose may be given as early as day 21 if time is limited). If the 3-dose preexposure series cannot be completed before travel, do not start the series.

Duration of vaccine protection is limited to the time interval until any subsequent rabies exposure, at which time postexposure vaccination will be required. Regular boosters are recommended only for veterinary and wildlife workers.

Postexposure vaccination, with or without RIG (depending on preexposure vaccination status; see below), is recommended for:

- Persons who have received the complete preexposure vaccine series or a prior postexposure series are given rabies vaccine only: 2 doses, 1 each on days 0 and 3.
- Persons who have not received the complete preexposure vaccine series need both rabies vaccine and RIG: 4 doses of vaccine, 1 each on days 0, 3, 7, and 14-28; RIG is injected on day 0 into and around the bite or exposure site to ensure as much contact with areas of saliva contamination as possible.