PREVENTION

Rabies in humans can be prevented either by eliminating exposures to rabid animals or by providing exposed persons with prompt local treatment of wounds combined with appropriate passive and active immunization. This can be done by: 1) reducing encounters between humans and potentially rabid animals; 2) immunizing domestic animals; 3) providing pre-exposure immunization to people at high risk for being exposed to rabies; and 4) giving post-exposure preventive therapy to people who -- despite these other efforts -- may have been exposed to the virus.

Appropriate management of those who may have been exposed to rabies infection depends on the evaluation of the risk of infection (type of exposure, location of wound, rabies vaccination status of biting animal, etc.) and the efficacy and risk of prophylactic treatment. All available methods of systemic prophylactic treatment are complicated by instances of adverse reactions. These are rarely severe. Decisions on management must be made immediately; the longer treatment is postponed, the less likely it is to be effective. The urgency for treatment must be tempered by recognition that human rabies is an extremely rare event.

Although the purpose of animal code enforcement is focused upon rabies prevention, reporting animal bites is directly aimed at prevention of this disease. Anyone having knowledge of an animal biting or scratching so as to break the skin is required by California State Law to report the incident to the local health authority. Children should be cautioned to never play with wild animals, especially bats in Los Angeles County.

Local governments should initiate and maintain effective programs to ensure vaccination of all dogs, cats, and ferrets and to remove strays and unwanted animals. Local health departments and animal-control officials can enforce the removal of strays more effectively if owned animals are confined or kept on a leash. Strays should be impounded for at least 3 days to give owners sufficient time to reclaim animals and to determine if human exposure has occurred. Such procedures in the United States have reduced laboratory confirmed rabies cases in dogs from 6,949 in 1947 to 89 in 2001. Since more rabies cases are reported annually involving cats than dogs, vaccination of cats should be required. The control of rabies among wildlife reservoirs is difficult. Vaccination of free-ranging wildlife or selective population reduction may be useful in some situations, but the success of such procedures depends on the circumstances surrounding each rabies outbreak.

RABIES VACCINATION OF ANIMALS

1. Rabies Vaccination of Dogs and Cats: All owners or harborers shall have their dog(s) currently vaccinated against rabies by a California licensed

veterinarian. All owners or harborers shall ensure that the dog(s) is wearing the vaccination tag at all times. Dogs can be vaccinated for rabies starting at four months of age and revaccinated according to California law. It is recommended that cats also be vaccinated.

2. Livestock: It is neither economically feasible nor justified from a public health standpoint to vaccinate all livestock against rabies. However, consideration should be given to the vaccination of livestock, especially animals that are particularly valuable and/or may have frequent contact with humans beings.

3. Wildlife: No parenteral rabies vaccine is licensed for use in wild animals. Because of the risk of rabies in wild animals (especially raccoons, skunks, coyotes, foxes, and bats), Veterinary Public Health strongly recommends the enactment of state laws prohibiting the importation, distribution, relocation, or keeping of wild animals or hybrids as pets.

4. **Maintained in exhibits and in zoological parks:** Captive animals not completely excluded from all contact with rabies vectors can become infected. Moreover, wild animals may be incubating rabies when initially captured; therefore, wild-caught animals susceptible to rabies should be quarantined for a minimum of 180 days before exhibition. Employees who work with animals at such facilities should receive pre-exposure rabies immunization. The use of pre- or post-exposure rabies immunizations of employees who work with animals at such facilities may reduce the need for euthanasia of captive animals.

MANAGEMENT OF ANIMALS THAT BITE PEOPLE

1. **A healthy dog, cat**, that bites a person should be confined and observed for 10 days; it is recommended that rabies vaccine not be administered during the observation period. Such animals should be evaluated by a public health veterinarian at the first sign of illness during confinement. Any illness in the animal should be reported immediately to the local health department. If signs suggestive of rabies develop, the animal should be euthanized, its head removed, and the head shipped under refrigeration (not frozen) for examination of the brain by a qualified laboratory designated by the local or state health department.

2. **Any stray or unwanted dog, cat**, may be quarantined at the local animal shelter. Other biting animals which might have exposed a person to rabies should be reported immediately to the local health department. Prior vaccination of an animal may not preclude the necessity for euthanasia and testing if the period of virus shedding is unknown for that species. Management of animals other than dogs, cats, and ferrets depends on the species, the circumstances of the bite, the epidemiology of rabies in the area, and the biting animal's history, current health status, and potential for exposure to rabies.

3. **Any unowned, unvaccinated dogs, cats,** exposed to a rabid animal should be euthanized immediately. If the owner is unwilling to have this done, the animal should be vaccinated and then placed in strict isolation for 6 months. Animals with expired vaccinations need to be evaluated on a case-by-case basis. Dogs, cats, and ferrets that are currently vaccinated should be revaccinated immediately, quarantined for 30 days, and then kept under the owner's control for an additional two months.

4. **Any animal bitten or scratched by either a wild, carnivorous mammal or a bat** that is not available for testing should be regarded as having been exposed to rabies. Indigenous rabid bats have been reported from every state except Hawaii and have caused rabies in at least 29 humans in the United States.

5. **All species of livestock are susceptible to rabies; cattle and horses are among the most frequently infected**. Livestock exposed to a rabid animal and currently vaccinated with a vaccine approved by USDA for that species should be revaccinated immediately and observed for 45 days. Unvaccinated livestock should be slaughtered immediately. If the owner is unwilling to have this done, the animal should be kept under very close observation for 6 months.

If the animal is slaughtered within 7 days of being bitten, its tissues may be eaten without risk of infection, provided liberal portions of the exposed area are discarded. Federal meat inspectors must reject for slaughter any animal known to have been exposed to rabies within 8 months.

Neither tissues nor milk from a rabid animal should be used for human or animal consumption. However, because pasteurization temperatures will inactivate rabies virus, drinking pasteurized milk or eating cooked meat does not constitute a rabies exposure.

It is rare to have more than one rabid animal in a herd, or herbivore to herbivore transmission; therefore, it may not be necessary to restrict the rest of the herd if a single animal has been exposed to or infected by rabies.

PRE-EXPOSURE VACCINATION OF PEOPLE

Pre-exposure vaccination should be offered to persons among high-risk groups, such as veterinarians, animal handlers, certain laboratory workers, and persons spending time (e.g., 1 month) in foreign countries where canine rabies is endemic. Other persons whose activities bring them into frequent contact with rabies virus or potentially rabid dogs, cats, skunks, raccoons, bats, or other species at risk of having rabies should also be considered for pre-exposure prophylaxis.

Pre-exposure prophylaxis is given for several reasons. First, it may provide protection to persons with inapparent exposures to rabies. Second, it may protect

persons whose post-exposure therapy might be delayed. Finally, although pre-exposure vaccination does not eliminate the need for additional therapy after a rabies exposure, it simplifies therapy by eliminating the need for human rabies immuno globulin (HRIG) and decreasing the number of doses of vaccine needed - a point of particular importance for persons at high risk of being exposed to rabies in areas where immunizing products may not be available or where they may carry a high risk of adverse reactions.

Intramuscular (IM) Primary Vaccination: Three 1.0-ml injections of human diploid cell vaccine (HDCV) or rabies vaccine adsorbed (RVA) should be given intramuscularly (deltoid area), one each on days 0, 7, and 21 or 28.

Intradermal (ID) Primary Vaccination: A regimen of three 0.1-ml doses of HDCV, one each on days 0, 7, and 21 or 28, is also used for pre-exposure vaccination. The ID dose/route has been recommended previously by the Advisory Committee on Immunization Practices (ACIP) as an alternative to the 1.0-ml IM dose/route for rabies pre-exposure prophylaxis with HDCV.

Booster Doses of Vaccine

Persons who work with live rabies virus in research laboratories or vaccine production facilities (continuous risk category) are at the highest risk of inapparent exposures. Such persons should have a serum sample tested for rabies antibody every 6 months.

Booster doses (IM or ID) of vaccine should be given to maintain a serum titer corresponding to at least complete neutralization at a 1:5 serum dilution by the Rapid Fluorescent Focus Inhibition Test (RFFIT). The frequent risk category includes other laboratory workers, such as those doing rabies diagnostic testing, spelunkers, veterinarians and staff, animal-control and wildlife officers in areas where animal rabies is epizootic, and international travelers living or visiting (for >30 days) in areas where canine rabies is endemic. Persons among this group should have a serum sample tested for rabies antibody every 2 years and, if the titer is less than complete neutralization at a 1:5 serum dilution by the RFFIT, should have a booster dose of vaccine.

Alternatively, a booster can be administered in lieu of a titer determination. Veterinarians and animal control and wildlife officers working in areas of low rabies enzooticity (infrequent exposure group) do not require routine pre-exposure booster doses of HDCV or RVA after completion of primary pre-exposure vaccination.

POST-EXPOSURE PROPHYLAXIS (PEP) OF PEOPLE

There are three components to PEP: 1) local treatment of wounds; 2) provision of passive immunity with purified specific immunoglobulin; and 3) the induction of

active immunity with rabies vaccine. All three components are critical to the effective prevention of rabies.

1) Local treatment of wounds: Immediate and extensive washing of all bite wounds, scratches, or other sites of potential exposure for 10 minutes with soap and water is arguably the most important measure for preventing rabies following an exposure to a rabid animal. Experiments done in animals suggest that thorough and vigorous cleansing to the depth of the wound with a 20% soap solution can reduce the risk of developing rabies by up to 90%[13]. Tetanus booster vaccine (Td) should be given if indicated.

2) Immunoglobulin Administration: Purified human anti-rabies immunoglobulin (**HRIG**) provides rapid protection against rabies for one to two weeks after exposure -- while the more lasting vaccine-induced immune response is developing. HRIG should be given to any previously unvaccinated person regardless of their age, type of exposure, or time since exposure. HRIG can be given through the seventh day following administration of the first dose of vaccine but should not be given after this time because it could interfere with the antibody response to the vaccine. HRIG is *not* given for preexposure prophylaxis. *Nor should HRIG be given as part of PEP in a person who has previously been vaccinated with HDCV, RVA, or PCECV or who has a documented rabies antibody titer to any vaccine.*

The recommended dose of HRIG is 20 IU/kg body weight (0.06 ml/lb body wt). *As much of the dose as is anatomically feasible* should be infiltrated in the area around the wound(s). The remaining volume is administered intramuscularly at a site distant from vaccine inoculation, such as the gluteal area.[14]

3) Vaccine Administration: Primary post-exposure immunization with HDCV, RVA , and PCECV is given intramuscularly (IM) in a regimen of five 1-ml doses. The first dose is given as soon after exposure as possible (day 0). The remaining four doses are given on days 3, 7, 14 and 28 following the first dose.

For adults and older children, the vaccine should be injected into the deltoid muscle. For small children and infants, the muscles of the antero-lateral thigh can be used. *Vaccine should never be given in the gluteal area or in the same anatomical site as HRIG.* If an individual misses any vaccine doses during the first two weeks of the regimen, providers should consult the vaccine manufacturer. The schedule should be adjusted to ensure that four doses of vaccine are received during the first 14 days. The fifth dose can be given on day 28. *Persons who have already received pre-exposure prophylaxis still require two booster doses of vaccine on day 0 and day 3.*

ASSESSING THE NEED FOR POST-EXPOSURE ANTI-RABIES TREATMENT:

The need for post-exposure treatment should be based on careful consideration

of four basic areas: TYPE OF EXPOSURE, ANIMAL BEHAVIOR, ANIMAL SPECIES, and LABORATORY TEST RESULTS.

Type of Exposure: Rabies can only be transmitted when the saliva or neural tissue of an infected animal is introduced into an open cut or wound (less than 24 hours old) in a person's skin or contacts the mucous membranes in such areas as the eyes, nose, or mouth. Categories of exposure are:

1) **Bite** - Any penetration of the skin by an animal's teeth. Bites in general are high-risk exposures. Bites to the head and neck carry the highest risk.

2) **Non-bite** - Scratches or abrasions received from an animal, or the contamination of open cuts or wounds with an animal's saliva or neural tissue.

3) **Non-exposure** - Animal contact by itself, such as being in the vicinity of, petting, or handling an animal; or coming into contact with the blood, urine, or feces of an animal does not constitute exposure and, therefore, does NOT require post-exposure rabies treatment.

Animal Behavior: Consideration should be given to whether the animal appeared to be behaving normally or whether there were signs of rabies such as unusual aggression, impaired locomotion, varying degrees of paralysis (frequently beginning in the hind legs or throat), excessive salivation (foaming at the mouth), avoidance of water or food, extreme depression, or bizarre behavior such as no fear of humans by a wild animal or daylight activity by a normally nocturnal species. Consideration should also be given to whether the attack was provoked or unprovoked.

1) **Provoked Attack** - An attack is considered to be "provoked" if an animal (dog/cat) is placed in a situation such that an expected reaction would be to bite or attack. This includes, but is not limited to, invasion of an animal's territory; attempting to pet or handle an unfamiliar animal; startling an animal; running or bicycling past an animal; assisting an injured or sick animal; trying to capture an animal; or removing food, water, or other objects in the animal's possession.

2) **Unprovoked Attack** - An "unprovoked" attack or bite occurs when a domestic animal strikes for no apparent reason. The behavior should be unusual for the particular animal. A confirmation of chronic aggressive behavior in a domestic animal can often be made by interviewing the animal's owner. This will assist in determining whether the attack was indeed "unprovoked."

Animal Species: The risk of rabies is very much dependent upon the species of biting animal.

High Risk Animals - Bats and carnivorous wild animals (skunks, raccoons, foxes, coyotes, and bobcats) are the animals most commonly infected with rabies

in California. Exposures from these animals are considered to carry a high risk of rabies. Rabid bats are detected routinely in Los Angeles County.