



## RABIES, HUMAN & ANIMAL

1. **Agent:** Rabies virus.
  2. **Identification:**
    - a. **Symptoms:** An acute encephalomyelitis of mammals, especially carnivores, characterized by central nervous system involvement leading to paralysis and death.
    - b. **Differential Diagnosis:** Other causes of encephalitis, tetanus, tick paralysis, ascending myelitis, lead encephalopathy, anti-NMDA (N-methyl D-aspartate) receptor encephalitis, and various forms of acute meningitis.
    - c. **Diagnosis:** Suggested by a history of exposure to wild mammal with known risk of rabies infection. Several tests are necessary to diagnose rabies ante-mortem (before death) in humans; no single test is sufficient. Tests are performed on samples of saliva, serum, spinal fluid, and skin biopsies of hair follicles at the nape of the neck. Saliva can be tested by virus isolation or reverse transcription followed by polymerase chain reaction (RT-PCR). Serum and spinal fluid are tested for antibodies to rabies virus. Skin biopsy specimens are examined for rabies antigen in the cutaneous nerves at the base of hair follicles.
  3. **Incubation:** In humans, from 10 days to greater than 1 year; in the majority of cases, 14 to 56 days. Period tends to shorten as severity of exposure increases. In animal, generally 15 to 50 days, but variable and in rare cases even several months or longer.
  4. **Reservoir:** Wild and domestic animals of the *Canidae* family, including dog, coyote, fox, wolf; also bobcat, skunk, raccoon, mongoose, ferret, and other biting carnivores; bats.
  5. **Source:** Introduction of virus-laden saliva into bite wound or (rarely) by saliva entering scratch, other break in skin, or mucous membranes.
  6. **Transmission:** Normally by bite or lick. Transmission from person to person remotely possible. Transmission can occur by ingestion of infected material or by inhalation of contaminated air (e.g., in caves where bats roost). Transplant of corneas and other organs and tissues from unsuspected rabies cases.
  7. **Communicability:** In dogs and cats for 3-5 days before onset of clinical signs and during course of disease. Wild animals such as skunks, bats, and foxes may have virus present in saliva for long periods before onset of clinical symptoms.
  8. **Specific Treatment:** None. See **Recommendations for Use and Storage of Immunobiologics and Other Prophylactic Agents (B-71)** and **Control of Communicable Diseases Manual** for specific instructions.
  9. **Immunity:** None known. Uniformly fatal.
- ### REPORTING PROCEDURES
1. **Reportable.** *California Code of Regulations*, Title 17, Sections 2500, 2604, and 2606 Los Angeles County Ordinance 10.72.010.
    - a. Immediately telephone report of human case or suspect to Morbidity Unit.
    - b. Call ACDC. After working hours, contact Administrative Officer of the Day through County Operator.
    - c. Immediately report wild or foreign animal bites to Veterinary Public Health.
  2. **Report Form:**

**HUMAN RABIES CASE REPORT (CDPH 8526).**

**RABIES EXPOSURE QUESTIONNAIRE FOR HEALTHCARE WORKER (acd-rabiesexpHCW)** (to be completed by ACDC)
  3. **Epidemiologic Data:**



- a. Date person bitten; severity and location of bite; first signs of abnormal animal behavior.
- b. Location and identification of biting animal and owner.
- c. History of circumstances of bite, e.g., was animal provoked, was an attempt made to hold or pick up an injured animal. Feeding or playing with wildlife.
- d. Vaccination status of biting animal.
- e. Recent travel history of case and biting animal.
- f. Occupational association with domestic and wild animals.
- g. Vaccination status of case and other exposed contacts.
- h. Recent surgery, particularly organ or tissue transplantation.

**CONTROL OF CASE, CONTACTS & CARRIERS**

**FOR POST-EXPOSURE PROPHYLAXIS**

Public Health Nursing Home Visit Protocol:  
Home visit as necessary – a face to face interview is conducted as necessary.

Refer to “[Public Health Nursing Home Visit AS NECESSARY \(HVAN\) Algorithm](#)” (B-73 Part IV [Public Health Nursing Home Visit Protocol](#)).

Investigate the day of report.

Consult with Acute Communicable Disease Control regarding investigation.

**HUMAN CASE:**

- 1. **Precaution:** Contact precautions, especially for saliva and respiratory secretions, for duration of illness
- 2. Search for persons and other animals bitten or exposed to saliva.

**CONTACTS:** Anyone in contact with saliva.

The same guidelines are used for treatment of persons significantly exposed by animal bite as those exposed to human case’s saliva.

**CARRIERS:** Not applicable.

**PREVENTION/EDUCATION**

- 1. Vaccinate dogs and cats; recommend pre-exposure prophylactic vaccination for animal control officers, veterinarians, zoo keepers, etc.
- 2. Report all animal bites to local animal control agency.
- 3. Animals manifesting strange behavior should be reported to animal control authorities.
- 4. Do not pick up or handle sick or strangely acting animals, especially bats.
- 5. Avoid exposure to carnivorous wildlife. Do not keep wild animals as pets.
- 6. Warn medical personnel of hazards of saliva and importance of universal infection control precautions.
- 7. Be sure owner of biting dog understands quarantine instructions.

**DIAGNOSTIC PROCEDURES**

Consult with ACDC and Virology Section of Public Health Laboratory.

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**PREVENTION OF RABIES AFTER ANIMAL BITES**

**RABIES PROPHYLAXIS FOR HIGH RISK ANIMAL EXPOSURES**

**INITIAL RISK ASSESSMENT**

- A. Assessment of exposure
  - a. Bite exposure

A bite exposure to rabies virus occurs when saliva or other potentially infectious material (e.g., neural tissues) is introduced into intact skin through a cut into the skin. Bite exposure is considered



- a significantly higher risk exposure than a non-bite exposure.
- b. Non-bite exposure
- 1) Non-bite exposure occurs when saliva or other potentially infectious material comes in contact with mucous membrane without bite. These are in general much lower risk than bite exposure and rarely cause rabies.
  - 2) High risk non-bite exposures have been documented among surgical recipients of corneas, solid organs and vascular tissue transplanted from a patient who died of rabies.
  - 3) Aerosolization of rabies virus has also been documented to lead to human rabies in the laboratory setting and in caves containing in the Southwestern US and persons exposed to large amount of aerosolized rabies virus.
  - 4) Exposure to blood, urine, or feces does not constitute exposure.
  - 5) Contact of saliva to intact skin does not constitute exposure.
- c. Bat exposures: The most common rabies virus variant responsible for human rabies in the US is bat-related.
- 1) Bats involved in a human exposure should be tested for rabies if available.
  - 2) Assess exposure—determine if bite, scratch or mucous membrane exposure occurred.
- d. Human to human exposures: Infection via organ and tissue transplantation has been documented for corneas, solid organs, and vascular tissue.
- 1) Although no human to human transmission within the US has been documented, medical staff should wear gowns, goggles, masks, gloves, particularly during intubation and suctioning for suspected human rabies cases.
2. Review rabies surveillance data from area where bite exposure from potential rabid animal occurred.
- a. Bats – Rabid bats have been documented in 49 states; only Hawaii is free of bat rabies.
    - 1) All bat exposures are considered high risk exposure.
    - 2) Exposure to bat saliva can occur through minor bites.
  - b. Western terrestrial carnivores – Raccoons, skunks, and foxes have been documented to be infected with rabies. Clinical signs of rabies in the wildlife are not reliable. All such exposures should be considered as potentially rabid.
  - c. Other wild animals – Small rodents such as squirrels, chipmunks, rats, mice, hamsters, guinea pigs, gerbils, rabbits and hares are considered to be very low risk for rabies.
  - d. Domestic dogs, cats, and ferrets – With near universal registration, licensing, and vaccination for rabies, the risk of acquiring rabies from indigenous US dogs is nearly non-existent. A healthy domestic dog, cat or ferret that bites a person should be confined and observed for 10 days.
    - 1) In developing countries, dog bites continue to place humans at risk for exposure to rabies from both domesticated and feral dogs.
3. Circumstances of biting Incident and vaccination status of exposing animal
- a. Unprovoked vs. provoked – An unprovoked attack by an animal is more likely to be associated with rabies than a provoked attack.
  - b. Vaccination status – Up-to-date rabies vaccinated animal is unlikely to be infected with rabies.
- B. TREATMENT OF WOUNDS AFTER POTENTIALLY RABID EXPOSURE



Wound cleansing – Thorough cleaning of all wounds with soap and water should be done immediately after bite exposure from any animal regardless of vaccination status. If available, use a virucidal agent such as povidine-iodine to irrigate the wounds. Assessment of the need for a tetanus vaccine booster should also be considered.

### **POST-EXPOSURE PROPHYLAXIS AFTER POTENTIALLY RABID EXPOSURE**

#### Human rabies immune globulin (HRIG)

- Should be administered only once as the initial treatment to previously unvaccinated persons. For the patient who has previously been vaccinated against rabies, see below.
- HRIG provides immediate rabies virus neutralizing antibody coverage until the patient responds to vaccination.
- Can be administered up to and including day 7 after initiation of the vaccine series.
- Recommended dosage of HRIG is 20 IU/kg body weight.
- Ideally the entire dose should be infiltrated around the area of the wound. The remaining amounts are administered at an anatomical site distant from vaccine administration

### **RABIES VACCINE FOR PREVIOUSLY UNVACCINATED PERSONS**

Human Rabies Vaccine – two vaccines are available in the US (see Table 1):

Imovax<sup>R</sup> – Human Diploid Cell Vaccine (HDCV),  
manufactured by Sanofi Pasteur  
and

RabAvert<sup>R</sup> – Purified Chick Embryo Cell Vaccine  
(PCECV), manufactured by Novartis Vaccine  
and Diagnostics

Either brand of vaccine can be administered in conjunction with HRIG at the beginning of post-exposure prophylaxis. For completion of the vaccine series, the two brands are considered interchangeable.

The Advisory Committee on Immunization Practices finalized recommendations on March 19, 2010, supporting a 4 dose rabies vaccine regimen in immunocompetent and previously unvaccinated individuals; see details at

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5902a1.htm>.

### **POST-EXPOSURE PROPHYLAXIS FOR PREVIOUSLY VACCINATED PERSONS**

1. Wound care and assessment for tetanus booster should proceed as previously noted for all bites exposures.
2. For persons who previously received a complete vaccination series (pre- or post-exposure prophylaxis) with a cell-culture vaccine or who previously had a documented adequate rabies virus-neutralizing antibody titer following vaccination with noncell-culture vaccine, the recommendation for a 2-dose PEP vaccination (2 IM doses, 1.0 mL each in the deltoid, one immediately and one 3 days later) series has not changed.
3. Administration of HRIG is unnecessary and should not be administered due to possible interference with an expected anamnestic immune response in previously vaccinated individuals.

### **ROLE OF ACUTE COMMUNICABLE DISEASE CONTROL PROGRAM IN ASSESSMENT OF RISK**

1. ACDC provides evaluation and assessment of the need for rabies post-exposure prophylaxis for medical providers in Los Angeles County during normal working hours and after hours through the Administrative Officer of the Day.
2. ACDC coordinates with Community Health Services for rabies post-exposure prophylaxis administration to uninsured individuals who are deemed by Public Health to require post-exposure prophylaxis.

### **REFERENCES**

1. **Centers for Disease Control and Prevention. Use of a Reduced (4-dose) Vaccine Schedule for Postexposure Prophylaxis to Prevent Human Rabies.** Recommendations of the Advisory Committee on Immunization Practices. March 19, 2010. Vol.59/RR-2. <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5902a1.htm>.
2. Centers for Disease Control and Prevention, Human Rabies Prevention- United States,



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2008. Recommendations of the Advisory Committee on Immunization Practices. May 23, 2008, Vol. 57, No. RR-3. <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5703a1.htm>

3. Heymann, DL, Editor. Control of Communicable Diseases Manual, 19<sup>th</sup> Edition, 2008. Rabies chapter. American Public Health Association.



**TABLE 1. Currently available rabies biologics — United States, 2008**

Human rabies vaccine	Product name	Manufacturer	Dose	Route	Indications
Human diploid cell vaccine	Imovax® Rabies*	sanofi Pasteur Phone: 800-822-2463 Website: <a href="http://www.vaccineplace.com/products/">http://www.vaccineplace.com/products/</a>	1 mL	Intramuscular	Pre-exposure or postexposure†
Purified chick embryo cell vaccine	RabAvert®	Novartis Vaccines and Diagnostics Phone: 800-244-7668 Website: <a href="http://www.rabavert.com">http://www.rabavert.com</a>	1 mL	Intramuscular	Pre-exposure or postexposure†
Rabies immune globulin	Imogam® Rabies-HT	sanofi pasteur Phone: 800-822-2463 Website: <a href="http://www.vaccineplace.com/products/">http://www.vaccineplace.com/products/</a>	20 IU/kg	Local§	Postexposure only
	HyperRab™ S/D	Talecris Biotherapeutics Bayer Biological Products Phone: 800-243-4153 Website: <a href="http://www.talecris-pl.info">http://www.talecris-pl.info</a>	20 IU/kg	Local§	Postexposure only

\* Imovax rabies I.D., administered intradermally, is no longer available in the United States.  
 † For postexposure prophylaxis, the vaccine is administered on days 0, 3, 7, 14 and 28 in patients who have not been previously vaccinated and on days 0 and 3 in patients who have been previously vaccinated. For pre-exposure prophylaxis, the vaccine is administered on days 0, 7 and 21 or 28.  
 § As much of the product as is anatomically feasible should be infiltrated into and around the wound. Any remaining product should be administered intramuscularly in the deltoid or quadriceps (at a location other than that used for vaccine inoculation to minimize potential interference).

**Table 2. The Advisory Committee on Immunization Practices Recommendations for the Prevention of Human Rabies (March 19, 2010) (modified Feb. 2, 2012 by ACDC)**

1. A regimen of 4 one-mL doses of rabies vaccine (HDCV) or PCECV should be administered intramuscularly to previous unvaccinated persons with no immunosuppression.
2. The first dose should be administered as soon as possible after exposure and this is considered day 0 of the post-exposure prophylaxis.
3. Additional doses should be administered on days 3, 7, and 14 after the first vaccination.
4. Deviation from recommended post-exposure vaccination schedules once vaccination is initiated by a few days for each individual dose is unimportant. The effect of longer lapses of weeks or more is unknown. Most interruptions in the vaccine schedule do not require re-initiation of the entire series.
5. Post-vaccination serologic testing is not necessary in immunocompetent persons. Immunosuppressed individuals should have serologic testing documenting seroconversion; specimens should be collected from 1 to 2 weeks after completion of rabies vaccination series. See for <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5902a1.htm> further details and contact the Public Health Laboratory to arrange for testing. Low-cost service is available to the private sector from Atlanta Health Associates, Inc., <http://www.atlantahealth.net/> and Kansas State University laboratory, <http://www.vet.k-state.edu/depts/dmp/service/rabies/>.
6. Precautions in Individuals with Immunosuppression: Primary or secondary immunodeficiencies can significantly reduce immune responses to vaccines. All rabies licensed vaccines are inactivated cell culture vaccines and can safely be administered to persons with altered immunocompetence. All persons with immunosuppression should be administered 5 (five) doses of vaccine.
7. See details on rabies vaccine storage and use in the Recommendations for Use and Storage of Immunobiologics and Other Prophylactic Agents (B-71).
8. For additional instructions regarding management of adverse reactions to rabies biologics and other precautions and contraindications to rabies post-exposure prophylaxis, please see <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5703a1.htm> for additional details.
9. Patients who did not receive RIG at the appropriate time and who are not immunocompromised generally will receive only 4 doses of rabies vaccine, regardless of the lack of RIG. If there is concern about the quality of the vaccine administered in another country, with or without RIG, an antibody titer can be obtained as described above in step 5, and an additional dose of vaccine administered if adequate antibodies are not detected.