



Chapter 131 – Rabies

Episode Overview:

- 1) What are the top 5 rabies-virus carrying animals in Canada? In the world?
- 2) Describe the pathogenesis of the rabies virus disease (see fig. 123.6)
- 3) List 5 stages of rabies. What are the clinical presentations of rabies?
- 4) How is rabies diagnosed?
- 5) What factors are involved in a rabies risk assessment. Which types of animal contact require PEP?
- 6) Describe important aspects of rabies post-exposure immunoprophylaxis for the following exposures:
 - a) Non-immunized
 - b) Immunized

Wisecracks

- 1) List 4 reservoirs of rabies
- 2) What is the dose of HRIG?

Key Points:

- Post-exposure prophylaxis (PEP) for rabies should be administered to individuals exposed to the secretions of high-risk animals - raccoons, **bats**, skunks, foxes, coyotes, dogs along the Mexican border, and wild carnivores in rabies-endemic areas
- PEP given strictly according to WHO or CDC guidelines is extremely effective in preventing rabies. PEP includes wound care, passive immunization with RIG, and active immunization with rabies vaccine
- Discussion with public health officials is recommended to guide decisions regarding when PEP should be considered. The CDC clinician information line is 877-554-4625 or 800-CDC-INFO. In British Columbia, call BCCDC @ 604-707-2400

Rosen's in Perspective

- Where is the highest annual death rate from rabies in the world?

According to the [BC Centres for Disease Control](#), rabies is:

“Clinical illness is characterized by acute encephalomyelitis (headache, fever, hydrophobia, delirium, convulsions, paralysis) progressing to coma and death.”

Susceptibility depends on a few things. According to [UptoDate](#):

“Host susceptibility to infection — A patient's susceptibility to rabies infection is related to several factors. As an example, a bite with prominent salivary contamination on exposed



skin of the face and head is more likely to result in a productive infection than a bite through clothing where saliva may be absorbed.

Other factors that may increase host susceptibility to infection include:

- The virus variant
- The size of the viral inoculum
- The degree of innervation at the site of the bite
- Host immunity and genetics

All mammals are believed susceptible to rabies virus infection, although species differ in relative susceptibility. For example, foxes, coyotes, wolves, and jackals are quite susceptible whereas opossums are relatively resistant .”

1) What are the top 5 rabies-virus carrying animals in Canada? In the world?

Canada:

1. Bat
2. Raccoon
3. Skunk
4. Bovine
5. Red Fox / Arctic Fox

Rabies Cases

Rabies Cases	BC	AB	SK	MB	ON	QC	NR	NS	PE	NL	NU	NT	YT
Arctic Fox											4	1	
Bat	18	10	14	1	29	5	2						
Bovine			1	3	1								
Caprine			1	1									
Cat			2	1	1								
Dog			1	1									
Equine			1										
Llama					1								
Ovine			1										
Red Fox					1	1					1	2	
Raccoon					171		1						
Skunk			22	9	84								
Total	18	10	43	16	288	6	3	0	0	0	5	3	0

Data above from Canadian Food Inspection Agency [here](#)

World:

Daaaaaags: Most common vector worldwide. Dogbites to humans account for most of the approx 55, 000 cases / year (Most in Asia and Africa: estimates range from 30,000 and 70,000 deaths per year)



Question 2) Describe the pathogenesis of the rabies virus disease

See Fig. 123.6

Zoonotic Badness caused by neurotropic viruses in the Rhabdoviridae Family, genus Lyssavirus.

These bullet shaped Lyssavirus virion likes to infect neuronal tissues, starting in the PNS and migrating to the CNS at approximately 50 to 100 mm per day.

Transmission via:

- Exposure to saliva via animal bite
- Rare aerosolized particles in bat caves
- Accidental lab exposures
- Transplantation of tissue/organs from infected donor

IMPORTANT TO NOTE: “No transmission of rabies has been documented from infected patients to health care personnel or household contacts or by fomites or environmental surfaces “ -UptoDate

3) List 5 stages of rabies. What are the clinical presentations of rabies?

1. Virus enters muscle tissue of host through bite wound
2. Virus enters the peripheral nervous system via the NMJ
3. Virus travels from PNS to the spinal cord and brain
4. Virus enters the brain and undergoes extensive replication, leading to neuronal dysfunction
5. Replicates in salivary glands, enters peripheral nerves of skin & Purkinje cells, spreads from brain to infect many tissues and host organs

4) How is rabies diagnosed?

Gold standard: PCR of Skin >>> Saliva>> Urine/Serum/CSF

Antibody titres: serum antibodies to rabies virus “May not be present until several days after the onset of clinical signs and may appear even later in the CSF. If no vaccine or rabies immune globulin has been given, the presence of antibody to rabies virus in serum {or in the CSF} is diagnostic of infection.” -UptoDate

The following samples and tests should be obtained:

- Saliva – All saliva specimens should be collected and placed in a small sterile container and sealed securely. Laboratory tests to be performed include reverse transcriptase polymerase chain reaction (RT-PCR) for the detection of virus RNA and viral culture for the isolation of infectious virus.



- Skin biopsy – A section of full thickness skin (ie, five to six mm in diameter) should be taken from the posterior region of the neck at the hairline. The sample should contain a minimum of approximately 10 hair follicles and include the cutaneous nerves at the base of the follicles. The specimen should be placed on a small piece of moist sterile gauze (without immersion in diluent or transport media) and put in a sealed container. Laboratory tests to be performed include RT-PCR and immunofluorescence staining for viral antigen.
- Serum and cerebrospinal fluid – A minimum of 0.5 mL of serum and CSF should be obtained for testing. If the patient has been immunized, a second serum specimen should be obtained a few days later to see if antibody titers are rising [7]. Laboratory tests for rabies antibody include indirect immunofluorescence and virus neutralization assays.

5) What factors are involved in a rabies risk assessment. Which types of animal contact require PEP?

Animal and type of exposure (bite vs. scratch vs. handling)
 Exposure site (highly innervated >>> low innervation)
 Host vaccination status

Here is the full list:

- The epidemiology of animal rabies in the region
- The type of exposure
 - Bites
 - Bat exposures
 - Non-bite animal exposures
 - Human-to-human transmission
 - Risk for health care workers
 - Transplant recipients
- Bite and non-bite exposures
- Whether the exposure was provoked or unprovoked
- The species and vaccination status of the animal

Table 123.3 - Guidelines to determine need for rabies postexposure prophylaxis (PEP)

Animal	Evaluation & Dispo of Animal	PEP Recommendations
Dogs, cats, ferrets	Healthy and available for 10 days observation	No vaccination unless animal develops symptoms
	Rabid or suspected rabid	Vaccinate immediately
	Unknown or escaped	Consult public health officials
Raccoons, skunks, foxes	Regard as rabid unless animal is proven to be seronegative by lab testing	Consider immediate prophylaxis
Livestock, rodents, rabbits, hares, other mammals	Consider individually	Consult public health officials; bites of rodents rarely require PEP



6) Describe important aspects of rabies post-exposure immunoprophylaxis for the following exposures: A) Non-immunized, B) Immunized

See Rosen's Table 123.2 Pre- and Postexposure Vaccination Recommendations

This Table provides:

- Number of vaccine doses / number of clinic visits
- Administration route (intramuscular vs. intradermal)
- Injection schedule (ex. Days 0, 7, 21, 28)

Wisecracks

1) List 4 reservoirs of rabies

BATS>>>Raccoons>>Skunks>> Fox

2) What is the dose of HRIG?

20mg/kg injected into tissue around wound. If full volume cannot be injected around wound, pick other site than vaccine site and inject remaining volume IM

What is the clinical presentation of rabies?

- Incubation: 1-3 months; should be on your ddx for myelitis or encephalitis!

From UPTODATE:

- The **prodrome** consists of nonspecific flu-like symptoms, including malaise, anorexia, irritability, low grade fever, sore throat, headache, nausea, and vomiting. There may also be specific neurologic signs and symptoms at the site of virus entry that are suggestive of rabies infection, including paresthesias, pain and pruritus.
- An **acute neurologic syndrome** of either **encephalitic or paralytic rabies (classical rabies)** follows the prodrome and typically lasts for two to seven days. Manifestations may include hyperactivity, persistent fever, fluctuating consciousness, painful pharyngeal or inspiratory spasms, autonomic stimulation (hypersalivation), hydrophobia and seizures. Paralytic rabies is characterized by quadriparesis and sphincter involvement.
- **Atypical rabies = BAT ASSOCIATED**, which is less common than either classic form, has been most often described in patients with bat-associated rabies. Atypical features include neuropathic pain, choreiform movements of the bitten limb during the prodromal phase, focal brainstem signs, cranial nerve palsies, myoclonus, and seizures. (See '[Clinical rabies](#)' above.)



- *The clinical diagnosis of rabies is straightforward in developing countries when a non-immunized patient presents after a bite by a known rabid animal. In developed countries, many patients have an unrecognized exposure (eg, to a bat) and diagnosis is often delayed.*
 - *In developed countries, some patients may have an unrecognized exposure (eg, to a bat) or were unaware of the risks of an exposure and did not receive postexposure prophylaxis [49]. **In the 52 cases of human rabies reported in the United States between 1990 and 2006, approximately 50 percent were diagnosed postmortem [25].** The clinical diagnosis of rabies is more straightforward in developing countries when a nonimmunized patient presents after a bite by a potentially or known rabid animal.*