

Rhabdoviridae , Lyssavirus (Rabies)

Important Properties of Rhabdoviruses

These are bullet-shaped enveloped viruses with a helical nucleocapsid and a single-stranded, linear, RNA. The term *rhabdo* refers to the bullet shape. Rabies virus is the only important human pathogen.

The viruses are classified in the family **Rhabdoviridae**. Rabies viruses belong to the genus *Lyssavirus*.

Rabies virus is a rhabdovirus with morphologic and biochemical properties in common with vesicular stomatitis virus of cattle and several animal, plant, and insect viruses. The particles are surrounded by a membranous envelope with protruding spikes. The peplomers (spikes) are composed of trimers of the viral glycoprotein. Inside the envelope is a ribonucleocapsid.

Virion: Bullet-shaped.

Genome: Single-stranded RNA, linear.

Envelope: Present

replication: Cytoplasm; virions bud from plasma membrane

Outstanding characteristics:

Wide array of viruses with broad host range

Group includes the deadly rabies virus.

Pathogenesis and Pathology:

Rabies virus multiplies in muscle or connective tissue at the site of inoculation and then enters peripheral nerves at neuromuscular junctions and spreads up the nerves to the central nervous system. However, it is also possible for rabies virus to enter the nervous system directly without local replication. It multiplies in the central nervous system and

progressive encephalitis develops. The virus then spreads through peripheral nerves to the salivary glands and other tissues. The organ with the highest titers of virus is the submaxillary salivary gland. Other organs where rabies virus has been found include pancreas, kidney, heart, retina, and cornea. Rabies virus has not been isolated from the blood of infected persons.

Susceptibility to infection and the incubation period may depend on the host's age, genetic background, and immune status, the viral strain involved, the amount of inoculum, the severity of lacerations, and the distance the virus has to travel from its point of entry to the central nervous system. There is a higher attack rate and shorter incubation period in persons bitten on the face or head; the lowest mortality occurs in those bitten on the legs.

Rabies virus produces a specific eosinophilic cytoplasmic inclusion, the Negri body (are cytoplasmic inclusions in neurons that are composed of rabies virus proteins and RNA) , in infected nerve cells. Negri bodies are filled with viral nucleocapsids. The presence of such inclusions is pathognomonic of rabies but is not observed in at least 20% of cases. Therefore, the absence of Negri bodies does not rule out rabies as a diagnosis. The importance of Negri bodies in rabies diagnosis has been lessened by the development of the more sensitive fluorescent antibody and reverse transcription-polymerase chain reaction diagnostic tests.

Clinical findings

Rabies is a disease spread to humans by bites of rabid animals is an acute infection of the central nervous system that is almost always fatal. The virus is usually transmitted to humans from the bite of a rabid animal or by contact with saliva from rabid animals. Although the number of

human cases is small, rabies is a major public health problem because it is widespread among animal reservoirs.

The incubation period in humans is typically 1–3 months but may be as short as 1 week or more than a year. It is usually shorter in children than in adults.

The clinical spectrum can be divided into three phases:

1. **Short prodromal phase:** The prodrome, lasting 2–10 days, may show any of the following nonspecific symptoms: malaise, anorexia, headache, photophobia, nausea and vomiting, sore throat, and fever. Usually there is an abnormal sensation around the wound site.
2. **An acute neurologic phase:** During the acute neurologic phase, which lasts 2–7 days, patients show signs of nervous system dysfunction such as nervousness, apprehension, hallucinations, and bizarre behavior. General sympathetic overactivity is observed, including lacrimation, pupillary dilatation, and increased salivation and perspiration. A large fraction of patients will exhibit hydrophobia (fear of water) or aerophobia (fear when feeling a breeze). The act of swallowing precipitates a painful spasm of the throat muscles. This phase is followed by convulsive seizures or coma and death.
3. **Coma.**

The major cause of death is cardiorespiratory arrest. Paralytic rabies occurs in about 30% of patients, most frequently in those infected with bat rabies virus. The disease course is slower, with some patients surviving 30 days. Recovery and survival are extremely rare.

Laboratory Diagnosis

There are no tests to diagnose rabies infections in humans before the onset of clinical symptoms.

1. rabies Antigens or Nucleic Acids.
2. Serology.
3. Viral isolation.
4. Animal Observation.

Pathophysiology of rabies Prevention by Vaccine

The virus must be amplified in muscle near the site of inoculation until the concentration of virus is sufficient to accomplish infection of the central nervous system. If immunogenic vaccine or specific antibody can be administered promptly, virus replication can be depressed and virus can be prevented from invading the central nervous system. The action of passively administered antibody is to neutralize some of the inoculated virus and lower the concentration of virus in the body, providing additional time for a vaccine to stimulate active antibody production to prevent entry into the central nervous system.

Types of Vaccines

All vaccines for human use contain only inactivated rabies virus. Two vaccines are available in the United States, although a number of others are in use in other countries. Both rabies vaccines available in the United States are equally safe and efficacious.

1. Human diploid cell vaccine (HDCV).
2. Purified chick embryo cell vaccine (PCEC).
3. rabies vaccine, adsorbed (rVA).

4. Nerve tissue vaccine.
5. Duck embryo vaccine.
6. Live attenuated viruses.

Treatment and Control

There is no successful treatment for clinical rabies. Interferons, ribavirin, and other drugs have shown no beneficial effects. Symptomatic treatment may prolong life, but the outcome is almost always fatal.

Preexposure vaccination is desirable for all persons who are at high risk of contact with rabid animals, such as veterinarians, animal care personnel, certain laboratory workers, and spelunkers. Persons traveling to developing countries where rabies control programs for domestic animals are not optimal should be offered preexposure prophylaxis if they plan to stay for more than 30 days. However, preexposure prophylaxis does not eliminate the need for prompt postexposure prophylaxis if an exposure to rabies occurs.

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