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Rabies Day Special: Bridging the Gap between Science and Safety

Popular Article

Current Rabies Status and Upcoming Methods for Eradicating the Disease Worldwide

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Introduction:

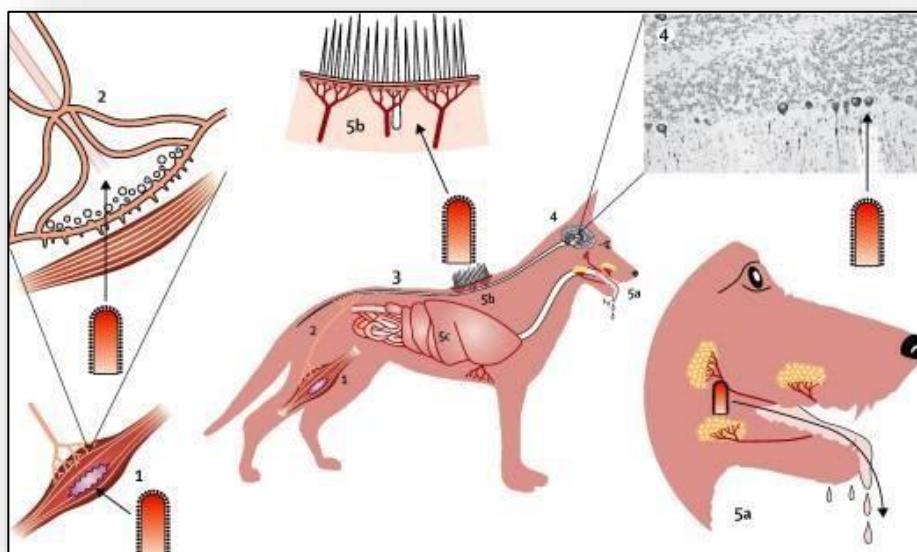
Rabies continues to be a major and much-feared hazard to public health in the 21st century. The disease, which is brought on by neurotropic viruses of the genus *Lyssavirus*, manifests as a progressive and always deadly encephalomyelitis under treatment. As per Fooks and Jackson (2020), the rabies virus (RABV) is a member of the family Rhabdoviridae, which comprises viruses in the shape of bullets, the genus *Lyssavirus*, and the order Mononegavirales, which comprises viruses with non-segmented, negative-stranded RNA genomes. Based on preliminary statistics, it appears that rabies causes almost 60,000 deaths worldwide each year, more than any other zoonotic disease combined. The most common way for rabies to spread among animals is by animal bites, although it can also be contracted through licks, scratches, or the infecting of mucosa or open wounds with saliva. Nearly all human instances of rabies are transmitted by dogs, who serve as the primary vector for the disease. Therefore, the first line of defense against human rabies is to control rabies in dogs, particularly in stray or free-roaming dogs (Meslin and Briggs, 2013). The World Organization for Animal Health (WOAH), formerly known as the OIE, the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) partnered with the Global Alliance for Rabies Control (GARC) under the United Against Rabies Forum (Tidman *et al.*, 2022) to launch Zero by 30, the Global Strategic Plan to End Human Deaths from Dog-mediated Rabies by 2030.

The One-Health Strategy:

- The idea of One Health, which holds that human, animal and environmental health are intricately related, dates to at least ancient Greece. The phrase was first used in 2004 at the Wildlife Conservation Society's "One World, One Health" conference in New York City. The organization then released the "Manhattan Principles," a set of 12 recommendations (Bresalier *et al.*, 2021).

- The current priorities are to give programs the organizational, financial and political stability they require to reach their goals and to strengthen and expand One Health's operationalization. For this next phase, the 4Cs—communication, coordination, collaboration, and capacity building—are essential (OHHLEP et al., 2022).
- The One Health Joint Plan of Action (2022–2026): Health of Humans, Animals, Plants and the Environment was introduced by the Quadripartite in late 2022.

Pathophysiology of Rabies Virus (Singh and Ruzek, 2013)



1. The virus enters the host's muscular tissue through a bite wound.
2. Via the neuromuscular junction, enters the peripheral nervous system (PNS).
3. Proceeds from the brain and spinal cord to the PNS.
4. A virus enters the brain and multiplies greatly, causing neuronal dysfunction (slide displays virus in cerebellar Purkinje cells at a 40x magnification).
5. (a) The virus reproduces in the glands that produce saliva, which is then expelled.
5. (b) Penetrates Purkinje cells and skin's peripheral nerves.
5. (c) Spreads the brain to infect the host's various tissues and organs.

Clinical Signs:

- Rabies usually takes 2-3 months to incubate, although one week or up to a year, depending on the location and viral load of the virus. Incubation times are often shorter in dogs.
- Fever, discomfort and strange or inexplicable tingling, prickling or burning sensations at the location of the wound.
- Gradual and lethal inflammation of the brain and spinal cord as it spreads throughout the central nervous system.
- Hyperactivity, irritable behaviour, hallucinations, poor coordination, hydrophobia and aerophobia are all symptoms of **furious rabies**.
- Muscles at the site of the wound eventually lose their ability to move. The underreporting of rabies is partly due to the misdiagnosis of the **paralytic form** of the disease.

Diagnosis:

- It can be challenging to diagnose rabies virus infection premortem.
- Hydrophobia is extremely suggestive, although no clinical sign is pathognomonic for rabies.
- The fluorescence antibody test (FAT) is used to detect virus antigen in both human and animal materials through brain smears or touch impressions.
- Direct rapid immunohistochemical test (dRIT).

- PCR techniques have been used to confirm the origin of viral isolates and molecular-based approaches for the diagnosis of rabies.
- RT-PCR-based procedures and innovative molecular methods created for the diagnostic amplification of lyssavirus genome fragments.

Management:

- Combinations of treatments, immunotherapies, ketamine and the rabies vaccine have all been used in clinical management of the disease.
- A trial-and-error strategy is unlikely to result in the development of a viable rabies therapy in the future, particularly given the large number of neuroprotective medication studies that have failed to demonstrate the efficacy of any one drug.

Prevention and management of human rabies

1. Raising awareness about the rabies virus helps people take the necessary medical attention.
2. Rabies immunoglobulin (RIG) and post-exposure prophylaxis (PEP).
3. Mass canine vaccination campaigns **Vaccination of human beings**

Pre-exposure prophylaxis (PrEP)

- Animal neural tissues were used to make rudimentary rabies vaccinations.
- Pre-exposure vaccine, a three-dose regimen of intramuscular or intradermal injections is administered on days 0, 7, 21 or 28, with day 0 serving as the first dose.

Post-exposure prophylaxis (PEP)

- Treat the wound thoroughly with soap and water for at least 15 minutes, rabies vaccination and inject monoclonal antibodies into the wound.
- Currently, four distinct post-exposure prophylactic vaccination regimens—three administered intramuscularly and one intradermally. Rabies immune globulin (RIG).
- TriGAS, a new prototype vaccination that carries three copies of the glycoprotein gene.

Prevention and Control of Rabies Virus:

- Vaccination coverage approaches 70%, surgical sterilization or capture and killing.
- Gonazon®, is a contraceptive pill that blocks gonadotrophin production. Its active ingredient is azagly-nafarelin (Goericke-Pesch et al., 2010).
- The complete eradication of *canine rabies worldwide* and the avoidance of nearly all future human rabies deaths if they are utilized *One Health methods*.

Future Challenges:

- Childhood vaccination schedule should be a top priority. The current kids Expanded Programme on Immunization (EPI) schedule (Taylor et al., 2013).
- The goal of eliminating human rabies, the *strategic approach for programs* aiming at canine rabies elimination

should centre on a multidisciplinary core of disparate groups, including representatives from the public and private sectors.

- The *One Health strategy*, which is a joint multidisciplinary endeavour, aims to prevent rabies by immunizing dogs on a large scale and managing dog populations in a humane manner.
- The United Nations Food and Agriculture Organization has put up a Progressive Control Pathway aimed at eradicating rabies.
- The OIE suggested a route that veterinary services must follow to control rabies in dogs in a way that will increase veterinary service compliance over time. Its three main elements are strategy, vision and performance.

Conclusion:

In light of this, the Food and Agriculture Organization, the World Health Organization, and the Organization for International Peace have put forth a plan to eradicate human-to-dog rabies transmission in rabies-endemic nations; they suggest that this be a feasible objective by 2030.

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