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Rabies Day Special: Bridging the Gap between Science and Safety

Popular Article

Rabies: Understanding and Control Strategies

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Introduction:

Rabies is an acute, progressive viral encephalomyelitis that primarily affects carnivores and bats, but any mammal can be infected. It is a preventable yet deadly viral infection, usually transmitted through bites, scratches, or saliva of infected animals, particularly domestic dogs, which are the main source of human exposure (WHO, 2013).

Rabies virus belongs to Rhabdoviridae family and characterized by its bullet shape and single-stranded, negative-sense RNA structure. Its envelope and ribonucleocapsid core increase its virulence, leading to severe symptoms like hydrophobia and aerophobia. These symptoms arise from nervous system infection, typically seen in the furious form of rabies, which accounts for 80% of human cases. The other 20% are paralytic cases. Initial symptoms such as fever, headache, and fatigue quickly progress to encephalomyelitis and delirium. Rabies disproportionately affects poor and rural populations, with most deaths occurring in children under 15 years in Asia and Africa. However, the incidence of rabies has significantly decreased, especially in developed countries, thanks to the development of rabies vaccine by Louis Pasteur in 1885 and subsequent public health measures such as widespread animal vaccination and post-exposure prophylaxis (Koury and Warrington, 2023).

Current Strategies for Rabies Control in India:

Effective control of rabies in dogs is crucial for reducing human rabies cases in the long term, achievable through mass dog vaccination and population control measures. Aligning with the global goal to eliminate human deaths from dog-mediated rabies by 2030 (Zero by 30), India introduced its National Action Plan for the Elimination of Dog-mediated Rabies (NAPRE) in 2021. This plan mandates human rabies to be a notifiable disease across all states, establishing effective reporting and surveillance systems. Enhanced diagnostic services and vaccine availability will follow, addressing gaps in rabies control policies.

Vaccination remains the cornerstone for preventing rabies in exposed individuals. Post-exposure prophylaxis (PEP) includes thorough wound cleaning and administration of rabies immunoglobulin and vaccines.

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There are various types of rabies vaccines with differing safety profiles and immunogenicity, driving ongoing research for improvement. Live-attenuated vaccines pose risks like inducing rabies due to mutations, while inactivated vaccines have lower immunogenicity and require multiple doses, making them costlier. This has led to the development of adjuvanted vaccines (Astray et al., 2017). Current research focuses on next-generation vaccines, such as genetically modified and viral vector-based vaccines, though challenges related to safety and effective distribution persist. Preventative measures also include animal vaccination and public awareness campaigns. In 2018, the Global Strategic Plan aimed to eradicate human deaths due to rabid dogs by 2030, emphasizing animal vaccination (Natesan et al., 2023).

Primary objective of PEP is to neutralize the rabies virus at the bite site, preventing its entry into the nervous system. PEP should begin as soon as possible after exposure, accompanied by proper wound care and rabies immunoglobulin (RIG) infiltration when necessary. Pre-exposure prophylaxis (PrEP) aims to stimulate the immune system to produce rabies virus-neutralizing antibodies (RVNA) before potential exposure, requiring only a few vaccine boosters in case of subsequent exposures to trigger a rapid immune response and prevent infection.

Human Rabies Vaccination: PrEP and PEP

Pre-exposure prophylaxis (PrEP) is administered to individuals at high risk of exposure to rabid animals such as veterinarians, laboratory staff, animal handlers and people living or traveling to high-risk areas. The PrEP schedule consists of three intramuscular (1 ml) or intradermal (0.1 ml) injections of cell culture or embryonated egg-adapted vaccine on days 0, 7, and 21 or 28. Post-exposure prophylaxis (PEP) given after a suspected rabid animal bite to prevent disease development, involving human rabies immune globulin and a rabies vaccine on the day of exposure, followed by a series of injections on days 0, 3, 7, 14, and 28 (Singh *et al.*, 2017).

In rabies endemic areas, any animal bite or contact from a suspected rabid animal necessitates prompt PEP, including wound treatment and immunization based on injury location. Goa, India, successfully eliminated human rabies through PEP access, awareness campaigns, and enhanced surveillance (Gibson *et al.*, 2022).

Conclusion:

Rabies control in India poses a significant public health challenge. Effective prevention and control hinge on developing cost-effective vaccination technology for humans and animals, implementing state-level rabies control programs in collaboration with national and international health agencies, and raising public awareness. The One Health concept plays a crucial role in preventing and controlling rabies in India.

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