pISSN:2349-5707 Volume:13,Issue 4, April -2026 eISSN:2349-5715

UNDERSTANDING RABIES: HOW A BITE LEADS TO BRAIN INFECTION

Rashad Mahmood
Professor of Physiology, Asia International University
Asia International University, Bukhara, Uzbekistan
Email: Rashadphysiology@gmail.com

Abstract: Objective: To describe the main aspects of rabies virus infection, including its spread, effects on the body, methods of diagnosis, and prevention strategies. Study Design: This paper is a review of existing scientific reports and global health guidelines on rabies. Results: The rabies virus enters humans most often through the bite of an infected dog [1]. Dogs are responsible for over 99% of human rabies cases worldwide [2]. After the bite, the virus grows in nearby muscle tissue and then moves along nerve pathways to the brain and spinal cord [3]. Once inside the brain, it triggers severe swelling, which eventually leads to death due to breathing failure [4]. Early warning signs include fever and headache, followed by confusion, terror of water, excess saliva, fits, and loss of muscle control [5]. No effective treatment exists once these signs appear [6]. However, thorough wound cleaning with soap and water for 15 minutes, followed by rabies vaccine and immunoglobulin, can stop the disease nearly 100% of the time if given before symptoms start [7]. Conclusion: Rabies is almost always deadly after symptoms show up, but it is entirely avoidable. Widespread dog vaccination, public awareness, and rapid post-bite care are the cornerstones of rabies elimination [1].

Keywords: Rabies, dog bite, nervous system, prevention, vaccine

Introduction

Rabies has been known to humans for thousands of years. Ancient writings from Egypt, Greece, and India mention this disease [8]. In 1885, Louis Pasteur created the first successful rabies vaccine **[9]**. Even with this discovery, rabies still causes tens of thousands of human deaths each year, mainly in Asia and Africa **[1]**. Many cases are not recorded because of weak laboratory services **[2]**. Dogs are the primary source of human infection **[3]**. Once a person develops signs such as fear of water, mental confusion, and muscle paralysis, death is almost unavoidable **[4]**. Fortunately, rabies can be fully prevented through proper wound cleaning and timely vaccination after exposure **[7]**. This article gives a simple and clear overview of rabies for students and health workers.

Results

How the Virus Spreads (Transmission)

The rabies virus lives in the saliva of sick animals. It passes to humans through bites, scratches, or when infected saliva touches broken skin or moist areas like the mouth or eyes **[2]**. Very rarely, people have caught rabies by breathing the virus in bat caves or research labs **[10]**. What Happens Inside the Body (Replication and Pathogenesis)

pISSN:2349-5707 Volume:13,Issue 4, April -2026 eISSN:2349-5715

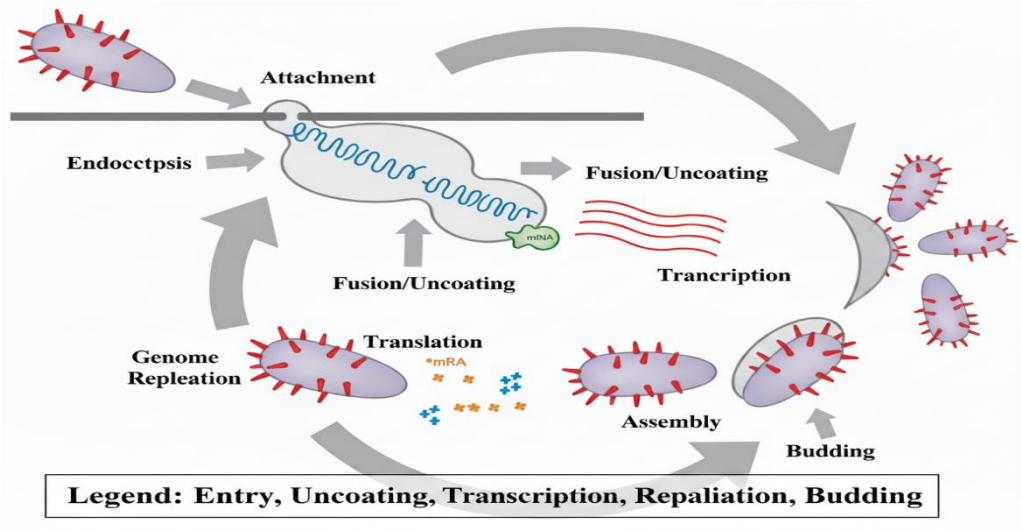

Figure-1: Replication Cycle of Rabies Virus19

After entering the body, the virus first multiplies in the muscle around the bite wound. Next, it attaches to nearby nerve endings and races toward the brain and spinal cord **[3]**. The virus moves quickly because it hijacks the nerve cells' internal transport system [11]. Upon reaching the brain, the virus causes widespread swelling and destruction of nerve cells **[12]**. Death typically occurs when the brain can no longer control breathing **[4]**.

Signs in Animals

Infected animals often behave oddly. A normally quiet animal may become angry. An animal that sleeps during the day may become active in daylight. Wild animals may lose their natural fear of people. As the illness gets worse, animals may have fits, drool heavily, become paralyzed, and eventually die **[13]**.

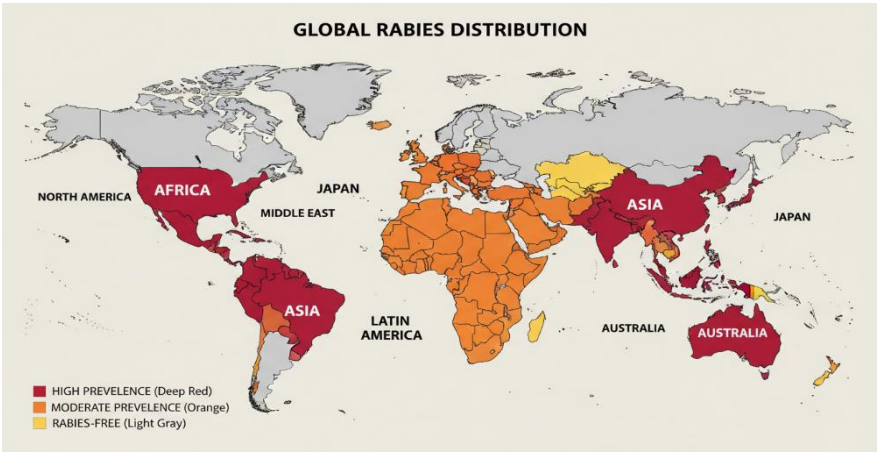

Fig-2: Geographical distribution of rabies virus[17]

Signs in Humans: Early signs look like a common cold or flu: fever, headache, and a tingling or painful feeling at the bite site **[14]**. Later signs include restlessness, confusion, extreme fear of water (hydrophobia), too much saliva, trouble swallowing, fits, and paralysis **[15].** The patient then falls into a coma and dies within 1–2 weeks **[4].**

This map shows the estimated number of human rabies deaths per year across different regions of the world. The highest numbers are seen in Asia and Africa, where dog vaccination programs are limited and access to post-exposure treatment is poor **[1].**

pISSN:2349-5707 Volume:13,Issue 4, April -2026 eISSN:2349-5715

Diagnosis

Doctors suspect rabies by asking about animal bites and looking for typical symptoms. Lab tests on saliva, spinal fluid, or skin samples can confirm the diagnosis **[16].** The direct fluorescent antibody (DFA) test is the most reliable method **[17]**. PCR testing can find the virus earlier in living patients **[18].**

Treatment

No cure exists once symptoms appear. Medical care only aims to reduce suffering. This includes giving sedatives for pain and anxiety, and using a breathing machine to support the lungs [4]. A handful of patients have survived rabies, but nearly all had lasting brain damage **[19]**.

Incubation period	Complications	Treatment	Outcome	Reference No.
21 days	Quadriparesis, cerebellum dysfunction, cardiac arrhythmia, altered consciousness	Suckling-mouse brain rabies vaccine should be administered 10 days after exposure	Recovery with two relapses following booster doses; gradual resolution over 1 year	38
19 days	Encephalitis, convulsions, deep coma, quadriplegia	Vero cell-derived vaccine without rabies immunoglobulin, given the next day	Minor improvement; response to pain, persistent blindness and deafness; death after 34 months	39
20 days	cardiac arrhythmia, encephalitis, coma, paralysis	Duck-embryo vaccine without rabies immunoglobulin, given the next day	Intensive care provided; complete recovery achieved in six months	40
16 days	Hallucinations, focal seizures, coma, hydrophobia	No wound cleaning and chick embryo rabies vaccine without immunoglobulin, same day	Three months in coma; slow improvement with spasticity, tremors, and involuntary movements at 18 months	41
21 days	Encephalitis, impaired consciousness, spastic hemiparesis	Pre-exposure duck-embryo cell vaccine only	Gradual improvement; long-term sequelae including personality	42

pISSN:2349-5707 Volume:13,Issue 4, April -2026 eISSN:2349-5715

			disorder and dementia	

Table-1: Documented cases of human recovery from RABV infection

Prevention

Proper prevention works almost 100% of the time **[7].** Before a bite (pre-exposure): Vaccinate pet dogs and cats **[20]**. Stay away from unknown, sick, or wild animals **[2]**. People traveling to high-risk regions should receive pre-exposure shots **[4].**

After a bite (post-exposure):

Wash the wound with soap and running water for 15 minutes **[7]** Put an antiseptic such as povidone-iodine or alcohol on the wound **[2]** Receive rabies vaccine on days 0, 3, 7, and 14 **[4]** Receive rabies immunoglobulin injected into and around the wound **[21]** If these steps are completed before symptoms begin, rabies is fully prevented **[7].**

Discussion

Rabies continues to be a serious health issue in poorer nations **[1].** The main causes are unvaccinated stray dogs and a lack of mass vaccination programs **[2]**. Once the virus reaches the brain and symptoms appear, no medicine can save the patient. This is why prevention is the only sensible approach **[4].** Vaccinating large numbers of dogs is the single best way to break the chain of infection **[20**]. Teaching the public is equally important. Many people living in villages do not realize that washing a bite wound with soap can save a life **[7]**. Some still visit traditional healers instead of going to a hospital **[2]**. Several countries have gotten rid of rabies completely. Japan, Australia, and the United Kingdom are good examples **[1]**. Their success proves that elimination is achievable with strong government backing, good disease tracking, and free or low-cost vaccines [4]. Future work should focus on creating better and faster diagnostic tools **[18],** developing oral vaccines for wildlife **[22]**, making vaccines affordable for poor communities **[20]**, and training more health workers in rabies prevention **[2]**.

Conclusion

Rabies is among the most dangerous diseases known, yet it is also among the easiest to prevent **[1].** Once symptoms appear, survival is nearly impossible **[4]**. However, quick wound cleaning and post-exposure vaccination can save every affected person **[7].** Mass dog vaccination is the most effective measure **[20]**. Public education, political will, and easy access to vaccines are essential to reach the global goal of eliminating rabies by 2030 **[2].**

References:

1. World Health Organization. WHO expert consultation on rabies. Third report. Geneva: WHO; 2018.

2. Centers for Disease Control and Prevention. Rabies prevention guidelines. Atlanta: CDC; 2024.

3. Jackson AC. Rabies: Pathogenesis, prevention, and treatment. In: Jackson AC, editor. Rabies. 3rd ed. Elsevier; 2013. p. 1–30.

4. Hemachudha T, Ugolini G, Wacharapluesadee S, et al. Human rabies: neuropathogenesis, diagnosis, and management. Lancet Neurol. 2013;12(5):498–513.

5. Garg SR. Rabies in man and animals. Springer; 2014.

6. Jackson AC. Rabies. In: Jankovic J, Mazziotta JC, Pomeroy SL, editors. Bradley's Neurology in Clinical Practice. 8th ed. Elsevier; 2022.

pISSN:2349-5707 Volume:13,Issue 4, April -2026 eISSN:2349-5715

7. World Health Organization. Rabies fact sheet. 2025.

8. Tarantola A. Four thousand years of concepts relating to rabies in animals and humans, its prevention and its cure. Trop Med Infect Dis. 2017;2(2):5.

9. Priest RD. Meister and Jupille: Lives and afterlives of Pasteur's first rabies vaccine patients, 1885–1940. Fr Hist Stud. 2023;46(1):125–52.

10. Rudd RJ, Davis AD. Rabies Virus. In: Loeffelholz MJ, Hodinka RL, Young SA, Pinsky BA, editors. Clinical Virology Manual. Washington, DC: ASM Press; 2016. p. 473–91.

11. Ugolini G. Rabies virus as a transneuronal tracer of neuronal connections. Adv Virus Res. 2011; 79:165–202.

12. Dutta K, Ghosh S, Basu A. Infections and inflammation in the brain and spinal cord: A Dangerous Liaison. In: Jana N, Basu A, Tandon P, editors. Inflammation: The common link in brain pathologies. Singapore: Springer; 2016. p. 71–138.

13. Rustad JK, Cho T, Chemali Z, Rost N, Stern TA. The recognition and treatment of rabies: a case report and discussion. Psychosomatics. 2015;56(2):196–201.

14. Mustafa M, Ellzam E, Sharifa A, Rahman M, Sien M, Nang M. Rabies a zoonotic disease, transmission, prevention and treatment. J Dent Med Sci. 2015;14(10):82–7.

15. Hanlon CA, Nadin-Davis SA. Laboratory diagnosis of rabies. In: Jackson AC, editor. Rabies. 3rd ed. Elsevier; 2013. p. 409–59.

16. Prabhu KN, Isloor S, Veeresh BH, et al. Application and comparative evaluation of fluorescent antibody, immunohistochemistry and reverse transcription polymerase chain reaction tests for the detection of rabies virus antigen or nucleic acid in brain samples of animals suspected of rabies in India. Vet Sci. 2018;5(1):24.