



सत्यमेव जयते
Ministry of Health & Family Welfare
Government of India

A Comprehensive Learning Guide

Rabies



**NATIONAL CENTRE FOR DISEASE CONTROL
DIRECTORATE GENERAL OF HEALTH SERVICES,**
Ministry of Health & Family Welfare, Government of India



Disclaimer: Any use, reference, or citation of this document must include proper attribution to the Centre for One Health, National Centre for Disease Control, Directorate General of Health Services, Ministry of Health & Family Welfare, Government of India.



सत्यमेव जयते

Ministry of Health & Family Welfare
Government of India

Rabies

A Comprehensive Learning Guide

Centre for One Health

National Centre for Disease Control
Directorate General of Health Services
Ministry of Health & Family Welfare,
Government of India

प्रो.(डॉ.) अतुल गोयल

Prof. (Dr.) Atul Goel

MD (Med.)

स्वास्थ्य सेवा महानिदेशक

DIRECTOR GENERAL OF HEALTH SERVICES



भारत सरकार
स्वास्थ्य एवं परिवार कल्याण मंत्रालय
स्वास्थ्य सेवा महानिदेशालय

Government of India
Ministry of Health & Family Welfare
Directorate General of Health Services



Message

Zoonotic diseases pose a significant and ongoing threat to biodiversity, human and public health and economic stability. Given India's diverse ecosystem, high population density and increasing human-animal action, the country remains particularly susceptible to zoonotic outbreaks. Past occurrences of plague, Nipah virus, avian influenza, leptospirosis, and Kyasanur Forest Disease emphasizes a critical need for robust surveillance, early detection, and a coordinated, intersectoral response.

Recognizing the importance of addressing zoonotic diseases as a public health priority, the Centre for One Health, under the National Centre for Disease Control (NCDC), is committed for strengthening surveillance, prevention, and response mechanisms through an integrated One Health approach. As part of this effort, the Centre for One Health has developed comprehensive learning guides on Priority Zoonotic Diseases. These modules provide scientifically validated, evidence-based guidance on the epidemiology, diagnosis, treatment, and prevention of key zoonotic diseases.

Strengthening disease surveillance, ensuring early diagnosis, and implementing timely interventions through a coordinated and multi-sectoral approach are critical to mitigating the risks associated with zoonotic diseases.

I am pleased to release these learning guides as a significant step in our ongoing efforts to combat zoonotic diseases. I urge all healthcare professionals, veterinary experts, and community leaders to actively utilize these resources to enhance their clinical index of suspicion for zoonosis and eventually contribute towards strengthening our health care system for responding timely and more efficiently to future outbreaks.

(Atul Goel)



सत्यमेव जयते

भारत सरकार

राष्ट्रीय रोग नियंत्रण केन्द्र

(स्वास्थ्य सेवा महानिदेशालय)

स्वास्थ्य एवं परिवार कल्याण मंत्रालय, भारत सरकार

22 - शाम नाथ मार्ग, दिल्ली 110054

Government of India

NATIONAL CENTRE FOR DISEASE CONTROL

[Formerly Known as National Institute of Communicable Diseases (NICD)]

Directorate General of Health Services

Ministry of Health & Family Welfare, Government of India

22 - Sham Nath Marg, Delhi-110054



प्रो. (डॉ.) रंजन दास
Prof. (Dr.) Ranjan Das
MD (CM)

निदेशक
Director



Direct: 00-91-1123913148, 23922132

Fax : 00-91-1123922677

Email : dirnicd@nic.in

Website : www.ncdc.mohfw.gov.in

www.idsp.mohfw.gov.in



MESSAGE

It is my pleasure to know that the Centre for One Health at NCDC has prepared **Comprehensive Learning Guides** on 10 priority zoonotic diseases, which is now being shared with all concerned.

These resources become relevant in considering; India has encountered multiple zoonotic disease outbreaks in recent years, highlighting their persistent and evolving threat to public health. The re-emergence of **Nipah virus** in Kerala, **Kyasanur Forest Disease (KFD)** in Karnataka, and **avian influenza** across several states underscores the complex interconnections between human, animal, and environmental health. The rising cases of **leptospirosis** and **scrub typhus**, driven by climatic changes and ecological disruptions, further illustrate the unpredictable nature of zoonotic spillovers. With the additional challenges posed by **emerging coronaviruses** and **antimicrobial resistance (AMR)**, there is an urgent need for a **cohesive, evidence-based approach** to mitigate these risks effectively.

In recognition of this pressing need, the **National Centre for Disease Control (NCDC)** has intensified its efforts to fortify **zoonotic disease surveillance, outbreak preparedness, and intersectoral coordination**. As part of this initiative, the **Centre for One Health, NCDC**, has meticulously curated **Comprehensive Learning Guides** on priority zoonotic diseases. These guides, underpinned by the latest scientific insights and global best practices, serve as indispensable resources for **healthcare professionals, veterinarians, and epidemiologists**, equipping them with the knowledge to anticipate, detect, and mitigate zoonotic threats with precision.

To effectively curtail the impact of zoonotic diseases, a **harmonized One Health approach** is paramount—one that transcends disciplinary boundaries and fosters synergies across the human, animal, and environmental health sectors. I urge all stakeholders to **leverage these scholarly resources, enhance disease intelligence networks, and champion research-driven interventions**. By embracing a proactive and interdisciplinary ethos, we can **bolster pandemic preparedness, fortify national health security, and avert future spillover events**.

I sincerely **appreciate** my colleagues at the Centre for One Health, NCDC for their dedication to strengthening zoonotic disease control. Their efforts in enhancing surveillance, preparedness, and public health response are crucial in preventing and managing emerging health threats.

I am glad to see their commitment translating into evidence-based interventions and capacity-building initiatives that enhance zoonotic disease surveillance, outbreak preparedness, and overall health system resilience.

Through continuous innovation, collaboration, and unwavering dedication, we can fortify our health systems and safeguard our nation against zoonotic threats.

Wishing you all happy learning and skill enhancement wherever possible.

रंजन दास 19/3/25
Prof. (Dr.) Ranjan Das



Antibiotic resistance Containment Stewardship: Our Role, Our Responsibility
Judicious Use of Antibiotic: Key to Contain Antibiotic Resistance





भारत सरकार

राष्ट्रीय रोग नियंत्रण केन्द्र
(स्वास्थ्य सेवा महाविदेशातय)

स्वास्थ्य एवं परिवार कल्याण मंत्रालय, भारत सरकार
22, शम नाथ मार्ग, दिल्ली - 110054

Government of India

NATIONAL CENTRE FOR DISEASE CONTROL

[Formerly Known as National Institute of Communicable Diseases (NICD)]

Directorate General of Health Services

Ministry of Health & Family Welfare, Government of India
22, Sham Nath Marg, Delhi-110054



Direct: 00-91-11-23913148

23922132 Fax: 23922677

Email : dnmcd@nic.in, sujeet647@gmail.com

Website : www.ncdc.gov.in

www.ldsp.nic.in



Message

Zoonotic diseases of public health importance continue to pose significant challenges to public health. These diseases, often driven by intricate human-animal-environment interactions, present substantial health risks, particularly to vulnerable populations, and demand a coordinated and robust response from the health sector.

In recognition of the pivotal role healthcare providers play in addressing these challenges, the **Centre for One Health** has developed a **Comprehensive Learning Guide for Priority Zoonotic Diseases**. This guide is designed to build capacity across the health sector, equipping professionals with the essential knowledge and skills needed to identify, manage, and prevent these diseases effectively. By enhancing surveillance systems, fostering rapid and accurate diagnostics, and implementing targeted prevention and control measures, healthcare providers can play a transformative role in mitigating the impact of zoonotic diseases.

The guide emphasizes the importance of building a resilient health workforce capable of responding to outbreaks, engaging communities, and collaborating across disciplines. Through these efforts, we aim to reduce the burden of zoonotic diseases, improve health outcomes, and contribute to the creation of a safer and healthier future.

I encourage all healthcare professionals to utilize this guide as a resource for improving their understanding and response to zoonotic diseases. Together, let us strengthen our health systems and work towards a future free from the threats posed by zoonotic diseases.

Dr. Simmi Tiwari
Joint Director and Head
Centre for One Health



Antibiotic Resistance Containment Stewardship: Our Role, Our Responsibility
Judicious Use of Antibiotic: Key to Contain Antibiotic Resistance



Acknowledgement

The **Comprehensive Learning Guide** for Rabies has been developed to address the significant public health challenges posed by zoonotic diseases, which have serious health, economic, and social implications, particularly for vulnerable populations. The priority zoonotic diseases necessitate robust surveillance, timely diagnosis, and effective prevention and control measures. This guide aims to strengthen the capacity of healthcare professionals by equipping them with the requisite knowledge and skills to mitigate these public health threats and improve health outcomes.

We acknowledge with deep appreciation the valuable contributions of the **subject matter experts** from leading medical institutions and research organizations, whose guidance and technical expertise has been critical in shaping this **Comprehensive Learning Guide**.

The Centre for One Health, NCDC, expresses its sincere gratitude to Ms. Punya Salila Srivastava, Secretary, Health and Family Welfare, Government of India; Ms. L.S. Changsan, Additional Secretary, Ministry of Health and Family Welfare, Government of India; Prof. (Dr.) Atul Goel, Director General of Health Services (DGHS), Government of India; Ms. Latha Ganapathy, Joint Secretary, Department of Health & Family Welfare, Government of India for their leadership, guidance, and support.

Lastly, we acknowledge the USAID-funded RISE project team, implemented by Jhpiego, for their technical support in drafting and finalizing this guide. Their collaboration has been pivotal in ensuring the quality and relevance of this resource.

Dr. Simmi Tiwari
Joint Director and Head
Centre for One Health
National Centre for Disease Control
Directorate General of Health Services
Ministry of Health & Family Welfare
Government of India

Preface

Rabies is one of the oldest but neglected zoonotic diseases of global importance. All mammalian species, including humans are susceptible to infection. Rabies is usually caused by Rabies virus. *Lyssavirus*, the causative agent of the disease, has a predilection for neural tissue and, as such, spreads via peripheral nerves to the central nervous system causing fatal encephalitis. The virus transmits from animals to humans through bites or scratches, results in human case fatality rate of virtually 100% in un-vaccinated or untreated patients. Only a few species such as bats are important as reservoirs for the virus. Humans do not play a significant role in the transmission cycle of Rabies and, as such, are considered secondary hosts.

A high presence in wildlife species can create multiple opportunities for cross-species transmission, mostly affecting domestic animals and humans. The Rabies virus is particularly present in the saliva and brain of infected animals.

Rabies can also spread between humans through a transfer of organ/tissue from unwitting rabid organ donor, for example cornea transplant. Without a living host, the Rabies virus is fragile and cannot survive for a prolonged period of time in the environment when exposed to UV radiation, heat, desiccation, solvents, detergents, or a pH outside the 3-11 range. However, the virus can survive for extended periods of time at low temperatures, and has been documented to have endured years of storage in -20°C to -80°C.

This scientific module aims to equip learners with the knowledge and tools necessary to educate and train individuals involved in various aspects of Rabies management. It provides a comprehensive overview of the disease, covering its epidemiology, clinical presentation, laboratory diagnosis, treatment options, and preventive measures.

The module is structured in a user-friendly manner, allowing learners to effectively communicate complex scientific concepts to their audience. It contains detailed explanations to enhance understanding and engagement. The content is supported by the latest scientific research and public health guidelines, ensuring the information presented is accurate and up to date.

It is our sincere hope that this module will serve as a valuable resource for learners and educators, enabling them to grasp essential knowledge and skills. By equipping professionals and individuals at risk with the necessary information, we can enhance our collective ability to detect, prevent, and respond to Rabies outbreaks, thereby safeguarding public health.

We would like to express our gratitude to all the experts, researchers, and contributors who have provided their invaluable insights and expertise in developing this scientific module. Their dedication and commitment to public health have been instrumental in creating a comprehensive resource that will contribute to the effective management of Rabies.

We hope you find this module informative, engaging, and ultimately, empowering. Together, let us work towards building a safer and healthier future by combating Rabies through knowledge and preparedness.

Abbreviations

ABC	Animal Birth Control
ARV	Anti Rabies Vaccine
ASHA	Accredited Social Health Activist
CFR	Case Fatality Rate
CVR	Catch Vaccinate Release
DAHD	Department of Animal Husbandry and Dairying
DALYs	Disability Adjusted Life Years
ELISA	Enzyme Linked Immunosorbent Assay
FAT	Fluorescent Antibody Test
GIS	Geographic Information System
IDSP	Integrated Disease Surveillance Project
IHIP	Integrated Health Information Platform
IM	Intramuscular
IV	Intravenous
LAMA	Left Against Medical Advice
NAPRE	National Action Plan for Rabies Elimination
NCDC	National Centre for Disease Control
NRCP	National Rabies Control Program
NPMU	National Program Management Unit
OPD	Outpatient Department
PCR	Polymerase Chain Reaction
PEP	Post Exposure Prophylaxis
PHC	Primary Health Centre
RIG	Rabies Immunoglobulin
RNP	Ribonucleoprotein
RT-PCR	Reverse Transcription Polymerase Chain Reaction
SOP	Standard Operating Procedure
WHO	World Health Organization

Table of Contents

Contents	Page no.
Acknowledgement	09
Preface	11
Abbreviations	12
Introduction to Learning Guide for Rabies	17
Course Description	19
Course Design	19
Evaluation Approach	19
• <i>Pre-Training Quiz</i>	19
• <i>Post-Training Quiz</i>	19
Course Syllabus	20
Course Goals	20
• <i>Participant's Learning Objectives</i>	20
• <i>Participant Selection Criteria</i>	20
• <i>Using the Resource Guide</i>	21
• <i>Composition of participants</i>	21
Course Schedule	21
Course Outline	22
Agenda	23
Session 1: Introduction to Rabies	24
Introduction to Rabies	24
• <i>Definition and Importance</i>	25
• <i>Historical Background</i>	25
• <i>Microbiology of Rabies Virus</i>	25
• <i>Pathogenesis</i>	26
Session 2: Epidemiology of Rabies	29
Epidemiology of Rabies	30
• <i>Global Burden and Incidence</i>	30
• <i>Distribution of Risk-Levels for Humans Contracting Rabies</i>	30
• <i>Burden in India</i>	32
• <i>Infectious Agent</i>	34
• <i>Host Range in India</i>	34
• <i>Transmission</i>	34
Session 3: Rabies in Humans	39
Rabies in Humans	40
• <i>Incubation Period</i>	40
• <i>Case Fatality Rate (CFR)</i>	40
• <i>Clinical Presentation</i>	40
• <i>Case Definition of Rabies</i>	42
• <i>Differential Diagnosis</i>	43

• <i>Prognosis</i>	45
Session 4: Rabies in Animals	49
Rabies in Animals	50
• <i>Symptoms in Animals</i>	50
• <i>Standard case definitions for Animal Rabies</i>	52
Vaccination in animals	53
Handling and Consumption of Animal Products	53
Session 5: Laboratory Diagnosis	56
Laboratory Diagnosis of Rabies	57
• <i>Specimen Consultation, Collection, Packing, and Transportation</i>	57
• <i>Laboratory Tests</i>	60
• <i>Algorithms for Laboratory Diagnosis of Rabies</i>	62
• <i>List of Laboratories for Diagnosis of Rabies</i>	63
Session 6: Management of Rabies	69
Management of Patients with Rabies	70
• <i>Palliative Care in Rabies</i>	70
Session 7: Prevention of Rabies	73
Post-Exposure Prophylaxis	74
• <i>Exposure Assessment</i>	74
• <i>Wound Management</i>	75
• <i>Route of Administration of Rabies Vaccine</i>	75
• <i>Passive Immunization with Rabies Immunoglobulin (RIG)</i>	77
• <i>Management of Rabies PEP During Re-Exposure for Previously Immunized Individuals</i>	80
• <i>PEP in Immunocompromised Patients</i>	80
• <i>Animal Considerations in PEP</i>	81
• <i>Contraindications and Precautions in PEP</i>	81
• <i>Adverse Reactions to Rabies Biologics</i>	81
• <i>Special Situations</i>	82
Pre-Exposure Prophylaxis	82
• <i>Schedule & Dosage</i>	82
Session 8: Risk Communication & Community Engagement	90
Risk Communication and Community Engagement	91
• <i>Key Components of Risk Communication</i>	91
• <i>Stakeholders in Risk Communication</i>	91
• <i>Communication Channels</i>	91
• <i>Information, Education, and Communication (IEC) Activities</i>	91
• <i>Addressing Rabies Myths</i>	92
• <i>Preventing Dog Bites</i>	92
Session 9: Surveillance	95
Surveillance of Rabies	96
• <i>Components of the Surveillance System</i>	96
• <i>Surveillance of Human Health Component under NAPRE</i>	97
• <i>Surveillance of Animal Health Component under NAPRE</i>	98
Session 10: One Health - Rabies	101
One Health - Rabies	102

• <i>The Concept of One Health</i>	102
• <i>Rationale for One Health in Rabies Control</i>	102
• <i>Key Stakeholders in One Health for Rabies Control</i>	102
• <i>Rabies Control in Animal Reservoirs</i>	103
• <i>Environmental Factors Influencing Rabies</i>	104
• <i>Awareness, Education, and Community Engagement</i>	104
• <i>Training for Health and Veterinary Professionals</i>	104
• <i>Integrated Bite Case Management (IBCM) for Human Rabies</i>	105
Annexures	107
• <i>Annexure – 1: Indications and Dosages of Medications for Symptom Management</i>	107
• <i>Annexure – 2: Additional slides for Laboratory Personnel</i>	109
References	116
Note to Facilitators	117
Pre-test/ Post-test	120
Answer Key	126

Introduction to learning guide for Rabies

Historically, zoonotic diseases have had a significant impact on human evolution, particularly on cultures and societies that domesticated and raised animals for food and clothing. Zoonoses pose a frequent and feared risk to humanity, transcending natural boundaries and occurring worldwide. Their profound effect on the global economy and health is well recognized, ranging from the international movement of animals and the importation of diseases to bans on animal product imports and restrictions on other international trade practices. Thus, zoonoses are no longer confined to national borders, and global surveillance is necessary for effective control.

Controlling zoonoses remains a priority for international agencies, addressing the specific health and economic challenges of each region. They equally impact animal, human, and environmental sectors, causing substantial damage to the nation's economy. To protect all the sectors, it is essential to rapidly identify, diagnose, and manage these diseases. The One Health approach plays a crucial role in this endeavor, as we have learned valuable lessons from the COVID-19 pandemic regarding the need for strong surveillance and diagnostic preparedness to handle future pandemic situations.

To provide comprehensive training, the Centre for One Health, NCDC has developed learning guide. This guide serves as both trainers' guides and self-directed learning resources. The training focuses on zoonoses and zoonotic diseases of public health importance in India (ZPHI) and emphasizes the One Health approach to responding to zoonotic diseases. By the end of the training, participants should have a solid understanding of the core principles of Rabies, its outbreak potential, health emergencies, risk communication, diagnostic procedures, laboratory safety, surveillance, data reporting, and their applications.

The guide is based on national and international guidelines and serve as a comprehensive training resource for individuals involved in zoonotic disease diagnosis and surveillance activities. The curriculum is designed to enable facilitators and learners to undergo step-by-step learning within a specified time frame, ensuring a thorough understanding of each module. The guide caters to various audiences, including medical professionals including doctors, veterinarians, paramedical staff and laboratory personnel who are expected to acquire knowledge and competencies beyond their regular field of work.

The guide consists of a Facilitators' Guide (FG). The FG provides instructional processes and supports educators in facilitating and assessing learning. Each module follows a standardized structure, including a session outline, detailed session plans, slide decks, and a wide range of references and resources for further reading. These resources offer comprehensive information on the respective topics.

The learning guide aims to provide a comprehensive education for medical professionals including doctors, veterinarians, paramedical staff and laboratory personnel. It helps them understand, identify, and differentiate between zoonotic diseases and equips them with the necessary knowledge and orientation for diagnostics procedures and surveillance systems.

COURSE DESCRIPTION

Course Design

This Comprehensive Rabies guide is tailored for medical professionals including doctors, veterinarians, paramedical staff and laboratory personnel. The course is designed to enhance their understanding and expertise in dealing with Rabies cases, spanning various aspects of prevention, diagnosis, and treatment. The training approach emphasizes practical application, aiming to equip participants with hands-on skills and competencies that can be directly applied in their professional roles.

Evaluation Approach

The evaluation approach for the Rabies preparedness and response training guide includes a comprehensive pre-training and post-training quiz questionnaire designed to assess participants' knowledge and learning progression. The questionnaire utilizes multiple-choice questions (MCQs) to gauge participants' understanding of Rabies-related concepts before and after the training. This approach allows for a clear measurement of knowledge enhancement and provides valuable insights into the effectiveness of the training program.

- ***Pre-Training Quiz***

Before the training begins, participants will be administered a pre-training questionnaire. This questionnaire serves as a baseline assessment of participants' existing knowledge and awareness of Rabies. The pre-training quiz will consist of MCQs that cover various aspects of Rabies, including its etiology, modes of transmission, clinical manifestations, prevention measures, and response strategies. The purpose of the pre-training quiz is to establish a starting point and identify areas where participants may require more focused training.

- ***Post-Training Quiz***

Upon completion of the Rabies preparedness and response training guide, participants will be given a post-training quiz questionnaire. This questionnaire will contain a similar set of MCQs as the pre-training quiz, covering the same topics related to Rabies. The aim of the post-training quiz is to evaluate participants' knowledge advancement and to measure the effectiveness of the training in enhancing their understanding of Rabies related concepts and procedures.

COURSE SYLLABUS

Course Goals

- Foster an in-depth comprehension of Rabies and its diverse forms.
- Equip participants with skills for Rabies diagnosis, management, and prevention.
- Emphasize the importance of the One Health approach in addressing zoonotic diseases.
- Develop proficiency in risk communication, laboratory safety, and surveillance strategies.

Participant's Learning Objectives

By the course's conclusion, participants will be able to:

- Describe Rabies disease and its epidemiology
- Describe virus structure and its biology
- Understand case definition and disease progression in human and animal population
- Sample types for diagnosis in humans and animals
- Storage conditions
- Illustrate disease algorithm and laboratory requirements
- Explain various laboratory diagnostics assays
- Surveillance system for Rabies
- Prevention, control and management
- Safety Regulations

Participant Selection Criteria

Participants for this Rabies response and preparedness training should be professionals from various fields involved in emergency response and public health:

- Emergency Responders: Including public health experts, medical personnel, and first responders.
- Laboratory and Biosafety Staff: Those experienced in handling biohazards.
- Government and Decision-Makers: Officials with authority in emergency coordination.
- Community Leaders and Experts: Community influencers, researchers, and mental health specialists.

Using the Resource Guide

All training activities in this course will be conducted in an interactive, participatory manner using the training guide appropriately as suggested in the course outline in the facilitators' guide. To accomplish this, the trainer will have to change roles throughout the course. For example, the trainer is a facilitator when conducting small group discussions and finally, when objectively assessing performance, the trainer serves as an evaluator.

Composition of Participants

The training is intended for 15-20 participants hailing from various state and healthcare fraternities. There can be a single facilitator as an expert of the disease.

COURSE SCHEDULE

Morning Session

Introduce and welcome participants

- Discuss participant expectations and prior knowledge.
- Outline the objectives of the course and learning outcomes.

Review the course schedule and its components

- Provide an overview of the training guide materials.
- Conduct a pre-course knowledge assessment to gauge participants' baseline understanding.
- Distribute course materials, including handouts and resources.

Interactive presentations

- Take Sessions 1-4 and discuss in detail about basics of Rabies, its epidemiology, and its significant features in humans and animals.
- Interactive discussion and Q&A session after the lecture

Afternoon Session

Interactive presentations

- Take Sessions 5-10 and discuss in detail about frequently asked questions, diagnosis of Rabies, its treatment, prevention & control, outbreak management and surveillance.

Debriefing and group discussions on simulation outcomes

- Interactive discussion and Q&A session after the lecture

Review, Assessment, and Closing

- Comprehensive review of key concepts covered during the training.
- Interactive quiz to reinforce learning.

- Final assessment to measure participants' understanding of course material.
- Reflection session: Participants share insights and takeaways from the course.
- Closing remarks, thanking participants for their engagement.

COURSE OUTLINE

The course outline presented here follows a model structure for the training curriculum. It delineates the enabling objectives necessary to achieve the participant learning goals outlined in the course syllabus. The outline offers recommendations for suitable learning activities and essential resources and materials for each enabling objective. Depending on specific participant requirements, the trainer has the option to introduce supplementary practice activities, devise case studies, role-play scenarios, or tailor learning situations accordingly.

The course outline comprises four columns -

- **Duration:** This column specifies the estimated time allocated for each learning activity. This allocation ensures an equitable distribution of time across the diverse training components.
- **Learning Objectives:** This column lays out the enabling objectives and their alignment with corresponding learning activities. The objectives are sequenced to provide guidance on the training structure. The interplay of objectives and activities—ranging from icebreakers and interactive group tasks to practical exercises and breaks—constitutes the overall training progression.
- **Pre-requisite Knowledge/Skill:** This column addresses the foundational knowledge or skills that participants should possess prior to the session. It underscores the importance of existing competencies for effective engagement in the training.
- **Competencies to be Achieved:** The fourth column enumerates the competencies participants are expected to acquire by the conclusion of the session. It underscores the practical outcomes that participants will attain through engagement in the training.

AGENDA

S. No	Topic	Duration
1.	Welcome & Introduction of the training agenda and setting ground rules	15 mins
2.	Ice breaker: Talk about yourself. - Contribution to the management & control of zoonoses - Expectations from the training	30 mins
3.	Training objectives	15 mins
4.	Pre-Test Quiz	20 mins
5.	Session 1: Introduction to Rabies	15 mins
6.	Session 2: Epidemiology of Rabies	20 mins
7.	Session 3: Rabies in Humans	20 mins
8.	Session 4: Rabies in Animals	10 mins
9.	Session 5: Laboratory Diagnosis	20 mins
10.	Session 6: Management of Rabies	10 mins
11.	Session 7: Prevention	30 mins
12.	Session 8: Risk Communication & Community Engagement	15 mins
13.	Session 9: Surveillance	30 mins
14.	Session 10: One Health - Rabies	10 mins
15.	Post - Test Quiz	20 mins
16.	Q/A session, review, and discussion	15 mins
17.	Closing remarks	05 mins

Session-1

Introduction to Rabies

Course No. 001	Session 1: Introduction to Rabies
Duration	15 minutes
Learning Objective	• Explain the disease overview • Describe the causative agent and its characteristics • Explain pathogenesis of rabies disease
Pre-requisite knowledge/skill	• Understanding of rabies epidemiology and virology • Familiarity with general concepts of pathogenesis and host-virus interactions. • Awareness of public health impact of viral diseases.
Competencies to be achieved	• Learners will acquire knowledge about rabies as a zoonotic disease and its impact on human and animal health • Learners will be able to describe the structure, transmission, and pathogenesis of the rabies virus

INTRODUCTION TO RABIES

Definition and Importance

Rabies is a rapidly progressing, acute infectious disease that affects the central nervous system (CNS) in both humans and animals. The disease is caused by the rabies virus, typically transmitted through the bite of an infected animal. Rabies manifests in two forms: encephalitic and paralytic, both of which are invariably fatal once clinical symptoms emerge. However, despite its lethality, rabies is entirely preventable with the use of vaccines, medical treatments, and available technologies. As a zoonotic viral disease, rabies is categorized as a neglected tropical disease and is responsible for tens of thousands of deaths each year, with children under the age of 15 comprising approximately 40% of the victims. Nearly 99% of human rabies cases worldwide result from dog bites and scratches, which underscores the importance of dog vaccination and bite prevention strategies in controlling the disease. In India, dogs are responsible for about 97% of human rabies cases, followed by cats (2%), jackals, mongooses, and others (1%).

Historical Background

This viral disease has a long history, with early records dating back to the 23rd century BC in the Eshnunna Code, which recognized the dangers of rabid dogs. Though it was not until the 19th century that substantial progress was made in understanding and controlling the disease. The most significant breakthrough came in 1885 when Louis Pasteur developed the first rabies vaccine. Pasteur's work involved attenuating the rabies virus in rabbits, then using the weakened virus to vaccinate individuals exposed to rabies. The first successful treatment was administered to a boy, Joseph Meister, who survived after being bitten by a rabid dog. This development marked the beginning of modern rabies prevention, leading to widespread vaccination programs that have since saved countless lives.

Microbiology of Rabies Virus

The rabies virus is a negative-sense, single-stranded, non-segmented RNA virus, with dimensions of approximately 60 nm by 180 nm. Its structure consists of an internal nucleocapsid, which encloses the viral RNA, and an external lipid bilayer membrane. The outer envelope is embedded with transmembrane glycoprotein spikes.

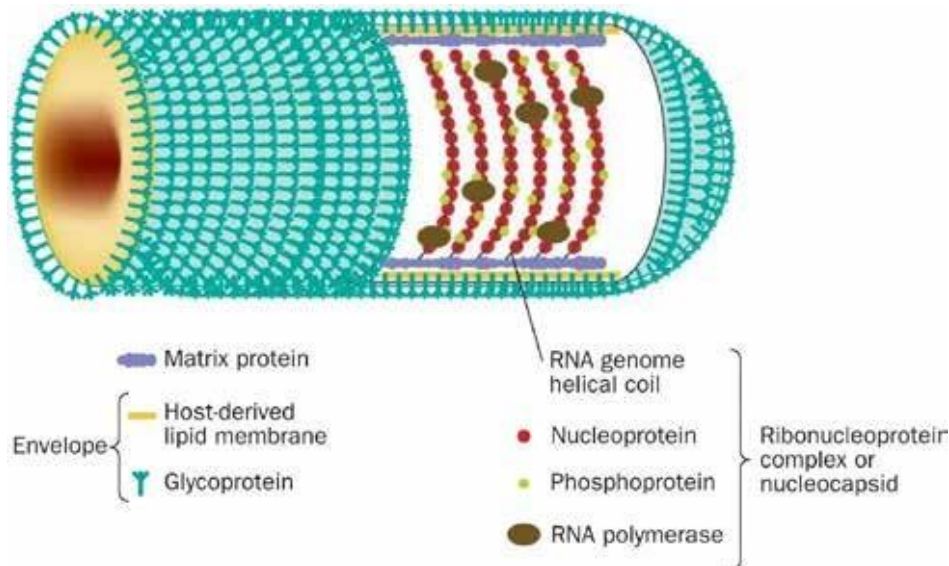


Fig 1: Structure of Rabies virus.

The viral genome encodes five key proteins, which are associated with either the ribonucleoprotein (RNP) complex or the viral envelope. The L (RNA transcriptase), N (nucleoprotein), and NS (transcriptase-associated) proteins form the RNP complex along with the viral RNA. These components accumulate in the cytoplasm of infected neurons, forming Negri bodies, which are the hallmark histopathologic feature of rabies infection. The M (matrix) and G (glycoprotein) proteins are integrated into the lipid envelope, with the G protein forming protrusions on the surface. This glycoprotein is the only viral protein known to stimulate the production of virus-neutralizing antibodies.

Pathogenesis

The incubation period of rabies, the time between exposure and onset of symptoms, typically ranges from 20 to 90 days but can be as short as a few days or extend beyond a year in rare cases. During this period, the rabies virus is believed to remain near the site of inoculation. In muscle tissue, the virus binds to nicotinic acetylcholine receptors at neuromuscular junctions, though the mechanisms of entry into skin and subcutaneous tissues remain unclear.

The virus spreads centripetally along peripheral nerves toward the spinal cord or brainstem via retrograde fast axonal transport at a rate of up to 250 mm per day. It pauses for approximately 12 hours at each synapse. Once the virus reaches the central nervous system (CNS), it rapidly spreads to other areas via neuroanatomical connections, primarily infecting neurons, with astrocyte infection being rare. After establishing CNS infection, the virus spreads centrifugally through sensory and autonomic nerves to peripheral tissues, such as the salivary glands, heart, adrenal glands, and skin. It replicates in the acinar cells of the salivary glands, allowing rabid animals to transmit the virus through saliva. Hematogenous spread of the virus has not been well-documented.

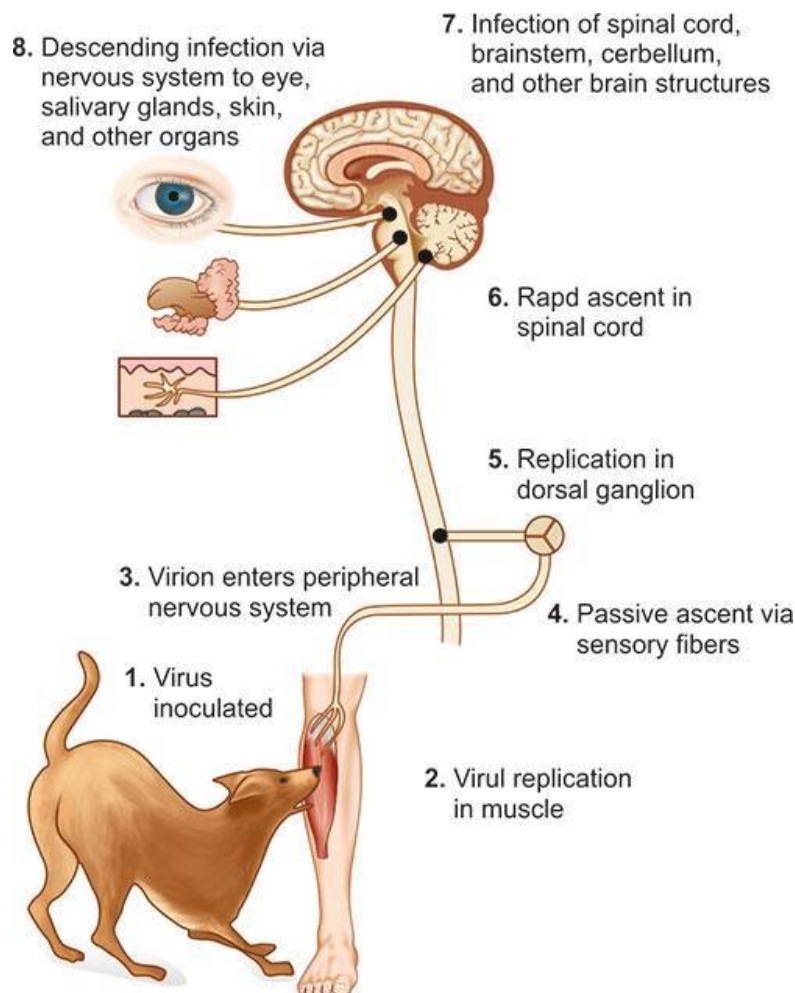


Fig 2: Pathogenetic events following peripheral inoculation of rabies virus by an animal bite.

Pathologically, rabies produces mild inflammation in the CNS, with mononuclear cell infiltration in the leptomeninges, perivascular regions, and parenchyma. Neuronal degeneration is generally minimal, and neuronal death is rare. Despite the clinical severity and fatality, the pathological changes are mild. The hallmark of rabies infection is the presence of Negri bodies—eosinophilic cytoplasmic inclusions in neurons that contain viral proteins and RNA. These inclusions are most commonly found in Purkinje cells of the cerebellum and pyramidal neurons of the hippocampus, though not in all cases.

Points to Remember

- Rabies is a fatal, zoonotic disease affecting the central nervous system, primarily transmitted through the bite of an infected animal.
- The rabies virus is a negative-sense, single-stranded RNA virus with a unique structure, including glycoprotein spikes that trigger immune responses.
- Nearly 99% of human rabies cases are caused by dog bites, highlighting the importance of dog vaccination in preventing the disease.
- Rabies remains entirely preventable through timely vaccination and treatment, despite its high lethality once symptoms appear.

Introduction

Definition and Importance

- Rabies is a rapidly progressing, acute viral infectious disease that affects the central nervous system (CNS) in both humans and animals.
- Transmitted through bites or scratches from infected animals.
- Fatal once symptoms appear, but 100% preventable if treated before symptom onset.

Two forms of the disease

- Encephalitic rabies:** Hyperactivity, hydrophobia.
- Paralytic rabies:** Muscle paralysis, often less recognizable.

Zoonotic, Neglected Tropical Disease.

- In India, dogs are responsible for about 97% of human rabies cases, followed by cats (2%), jackals, mongooses, and others (1%).
- Estimated to cause 59 000 human deaths annually in over 150 countries.
- Underreported by a factor of up to 20 times in Asia and 160 times in Africa.



Centre for One Health, NCDC, MoHFW

RABIES

Historical Background

- 23rd century BC (Eshnunna Code) – Early legal recognition of the dangers of rabid dogs.
- The most significant breakthrough came in 1885 when Louis Pasteur developed the first rabies vaccine.
- First successful treatment was for Joseph Meister, a boy bitten by a rabid dog.



Centre for One Health, NCDC, MoHFW

RABIES

Microbiology of Rabies Virus

Structure

Bullet-shaped, Negative-sense, single-stranded RNA virus (60nm x 180nm).

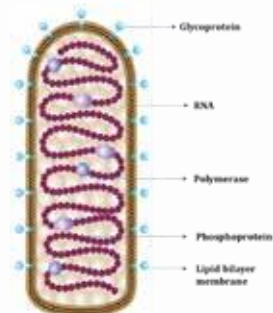
- Internal nucleocapsid - Protects the viral RNA.
- External lipid bilayer - Embedded with glycoprotein spikes.

Key Proteins

- L Protein** – RNA-dependent RNA polymerase, critical for viral replication.
- N Protein** – Nucleoprotein, encapsulates RNA.
- NS Protein** – Transcriptase-associated protein, involved in viral mRNA synthesis.
- M Protein** – Matrix protein, crucial for viral assembly.
- G Protein** – Glycoprotein spikes that bind to host cell receptors, triggering the immune response.

Negri Bodies

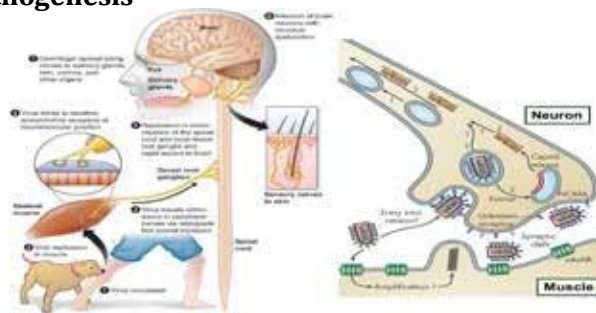
- Pathognomonic feature in rabies: Cytoplasmic inclusions in infected neurons.
- Most commonly found in the cerebellum and hippocampus.



Centre for One Health, NCDC, MoHFW

RABIES

Pathogenesis



The virus spreads centripetally along peripheral nerves toward the spinal cord or brainstem via retrograde fast axonal transport at a rate of up to 250 mm per day.

Centre for One Health, NCDC, MoHFW

RABIES

Notes

Session-2

Epidemiology of Rabies

Course No. 002	Session 2: Epidemiology of Rabies
Duration	20 minutes
Learning Objective	• Explain the global burden and incidence of rabies. • Describe the impact of rabies in different socioeconomic regions, with a focus on South Asia and India. • Explain agent, host factors and modes of transmission
Pre-requisite knowledge/skill	• Expertise in rabies epidemiology and global health trends. • Ability to interpret disease burden data and trends.
Competencies to be achieved	• Learners will gain knowledge of the global burden of rabies, including incidence and mortality trends. • Ability to interpret data on rabies incidence, mortality rates, and disability-adjusted life years (DALYs). • Awareness of socioeconomic disparities in rabies incidence and the impact of regional control efforts.

EPIDEMIOLOGY OF RABIES

Global Burden and Incidence

Rabies remains a significant global health challenge with the disease being present in 150 countries and territories worldwide. This is particularly the case in low- and middle-income countries.

Distribution of Risk-Levels for Humans Contracting Rabies

The WHO map from 2009 categorizes global rabies risk levels for humans into four main regions -

- **High-Risk Countries:** Primarily located in sub-Saharan Africa, South Asia, Southeast Asia, and parts of Central and South America, high-risk areas include India, Bangladesh, Myanmar, Nigeria, and Brazil. Rabies is common here due to limited animal vaccination, low public awareness, and frequent exposure to rabid animals, especially dogs.
- **Moderate-Risk Countries:** Countries like Egypt, Turkey, Russia, and parts of South America (e.g., Argentina) fall under moderate risk. These regions have some control measures, with rabies mainly transmitted by wildlife but still pose occasional threats to humans.
- **Low-Risk Countries:** Western Europe, the U.S., and Canada are low-risk due to extensive rabies control and animal vaccination, with human cases being rare and generally travel-related.
- **No-Risk Countries:** Nations such as Australia, Japan, and New Zealand are rabies-free due to strict import regulations and eradication efforts.

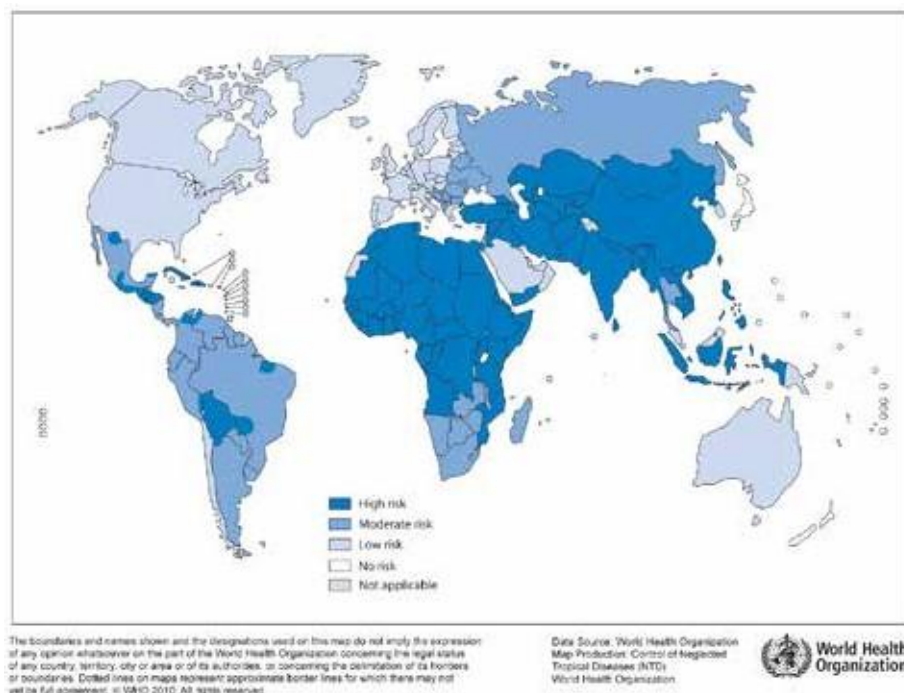


Fig 3: Distribution of risk levels for humans contracting rabies worldwide, 2009

Presence of Dog-Mediated Human Rabies, by Country, 2022

World Health Organization map from 2024 highlights the global distribution and risk of dog-mediated human rabies.

- **High-Risk Areas:** Countries marked in red, including much of sub-Saharan Africa, South Asia (notably India, Bangladesh, and Pakistan), Southeast Asia, and parts of Central America and the Middle East, experience widespread dog-mediated human rabies. In these areas, rabies is commonly transmitted to humans by dogs, often due to limited vaccination and control measures, and poses a significant public health burden.
- **Sporadic Dog-Mediated Rabies:** Countries shaded in yellow, such as Russia, some parts of Eastern Europe, and a few areas in South America, report sporadic cases of dog-mediated human rabies. While rabies is controlled to some extent, dog rabies persists in certain regions, posing occasional risks to humans.
- **Dog Rabies Present but No Human Cases:** Areas in light green, including the United States, Canada, much of South America (e.g., Brazil), and most European countries, have successfully eliminated dog-mediated human rabies, meaning human cases are rare or absent. However, rabies in dog populations remains in certain areas, which necessitates ongoing monitoring and vaccination efforts.
- **Rabies-Free Regions:** Countries marked in dark green, such as Australia, Japan, New Zealand, and parts of Western Europe, are free of both dog-mediated human rabies and rabies in dog populations. These countries have implemented strict rabies control measures and import restrictions to prevent reintroduction.

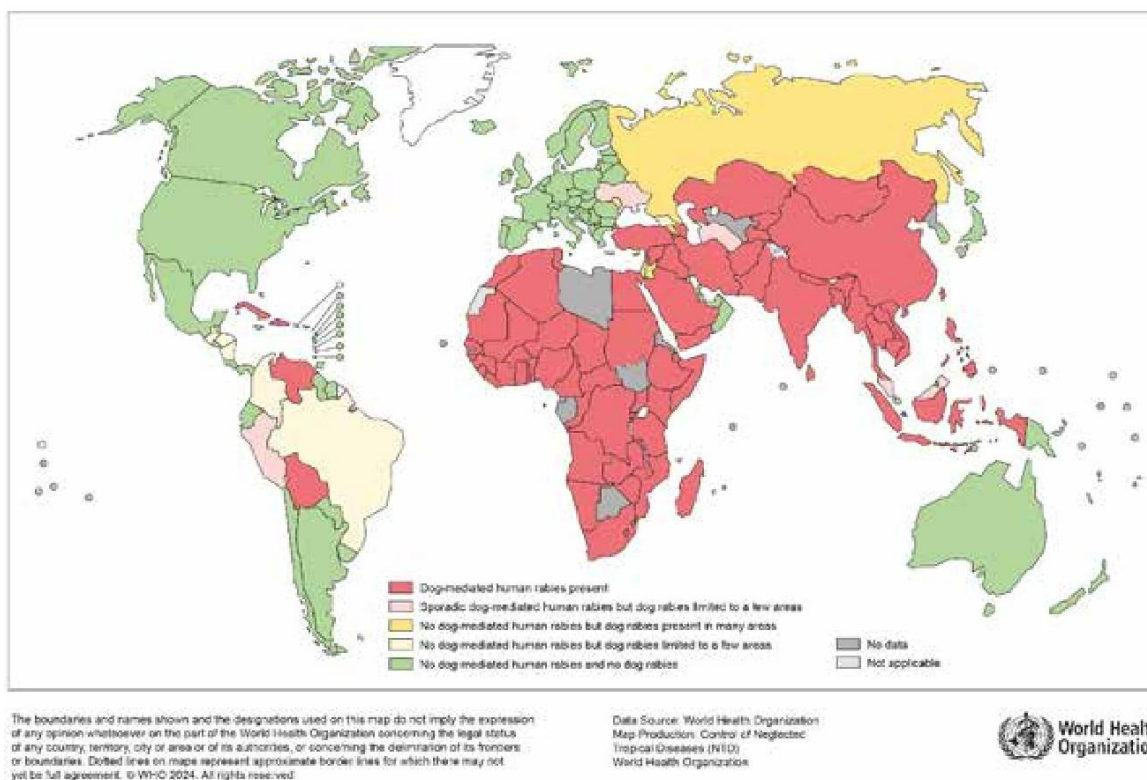


Fig 4: Presence of Dog-mediated Human Rabies, by country, 2022

Use of Intramuscular or Intradermal Rabies Vaccination Regimens, by Country, 2022

World Health Organization map shows how countries around the world approach rabies vaccination, highlighting the types of vaccination regimens used. The countries marked in dark blue, like India, Bangladesh, Nepal, Mali, and the Democratic Republic of the Congo, have adopted the **intradermal (ID) vaccination regimen**. This method uses smaller doses and is more cost-effective, which is particularly useful in high-risk regions where access to vaccines can be limited.

Meanwhile, the countries shaded in light blue, including the United States, Canada, Australia, Brazil, and parts of Southeast Asia, rely on the **intramuscular (IM) vaccination regimen**. The IM method is more widely used, especially in places where rabies risk is lower, or healthcare systems are better funded, making cost less of a constraint.

Gray-shaded regions represent areas with **no data** or where rabies vaccination is **not** applicable due to the low or non-existent risk of rabies—these include much of Europe, Central Asia, and North Africa. This map underscores the varied approaches countries take to rabies prevention, balancing cost, availability, and the level of risk.

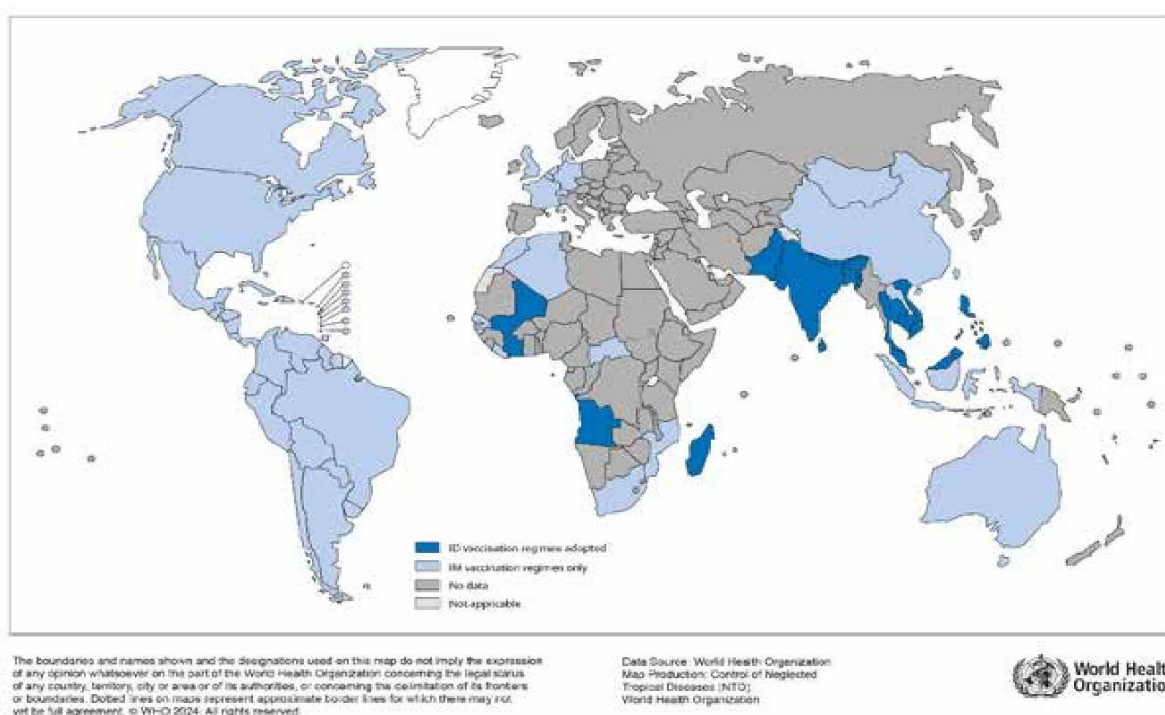


Fig 5: Use of Intramuscular or Intradermal Rabies Vaccination Regimens, by country, 2022

To address the global rabies burden, the World Health Organization (WHO), in collaboration with other international organizations, launched the “Zero by 30” strategy, which aims to eliminate dog-mediated human rabies deaths by 2030. This initiative emphasizes dog vaccination, PEP availability, and public awareness campaigns to educate at-risk populations on rabies prevention. Achieving this goal will require sustained funding, government commitment, and international cooperation, particularly in regions with high rabies incidence.

Burden in India

Rabies is endemic in India, contributing to approximately 36% of global rabies-related deaths. While the precise burden remains unclear, estimates suggest that rabies is responsible for 18,000 to 20,000 deaths annually in the country. A significant proportion of these cases, around 30-60%, occur in children under 15 years of age, as bites in this age group frequently go unnoticed and unreported.

According to the Central Bureau of Health Intelligence, the incidence of human rabies cases has shown a declining trend in mortality over the past decade, as illustrated in Figure 4. Data from the National Rabies Control Program indicate that a total of 6,644 clinically suspected human rabies cases and related deaths were reported across states and union territories between 2012 and 2020.

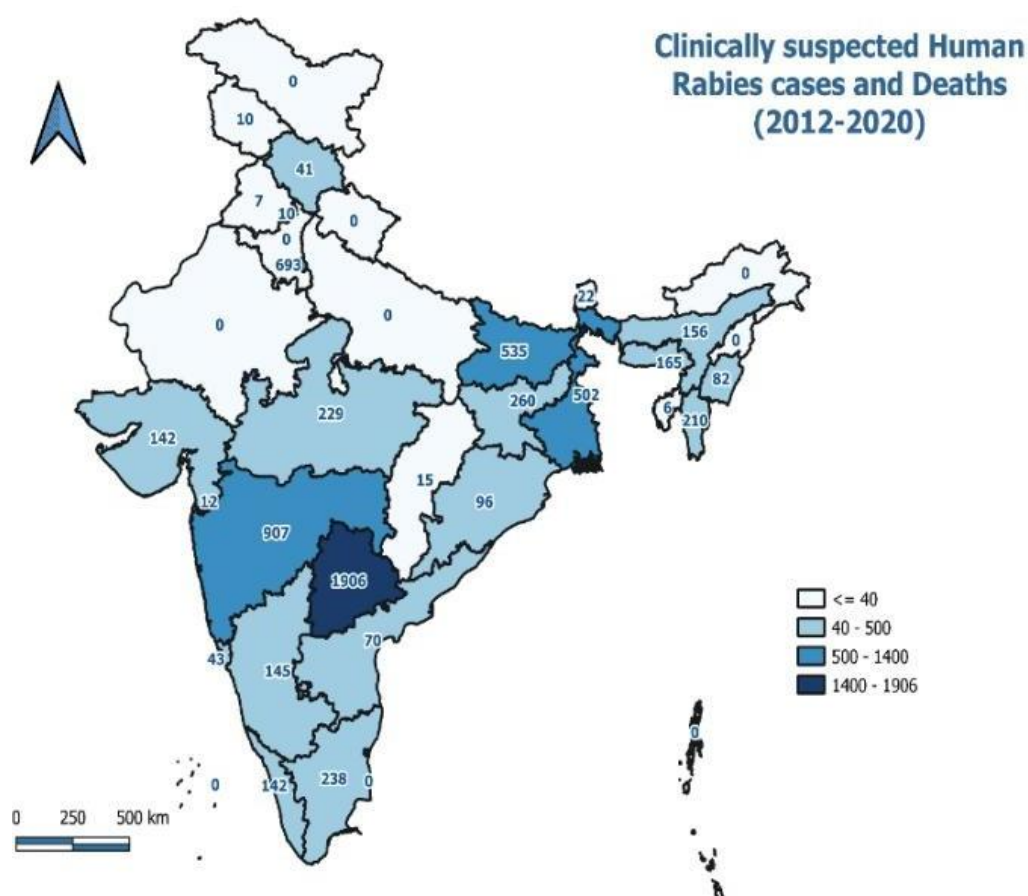


Fig 6: State-wise cases of Dog bites per million human population from 2012 to 2020. Source of Data- IDSP, GoI

The incidence of animal bites reported under the Integrated Disease Surveillance Project (IDSP) has risen significantly, from 4.2 million cases in 2012 to 7.2 million cases in 2020. These bites are primarily from dogs, cats, and monkeys, and necessitate Rabies Post-Exposure Prophylaxis (PEP). Figure 5 provides a geographic overview of the incidence of animal bites per 100,000 population across various States and Union Territories (UTs) in India.

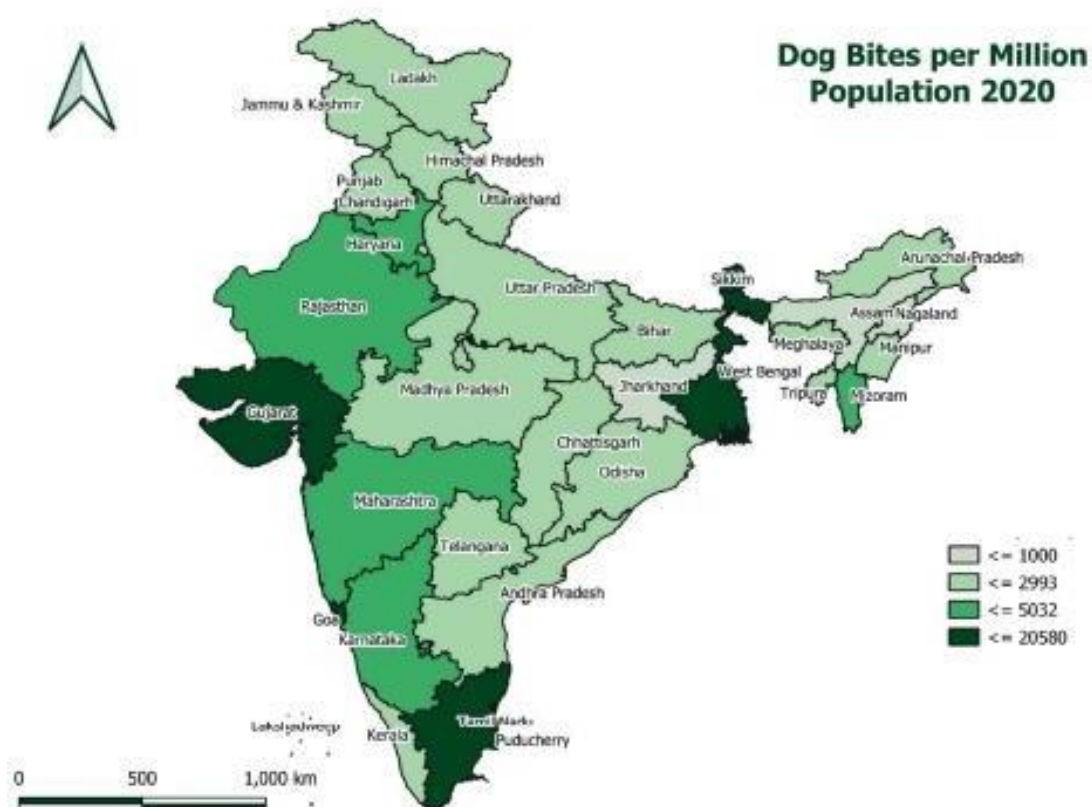


Fig 7: State-wise cases of Dog bites per million human population from 2012 to 2020. Source of Data- IDSP, GoI

National Rabies Control Program

Rabies control efforts in India gained significant traction during the 11th Five-Year Plan (2007–2012). The Ministry of Health and Family Welfare launched the “Pilot Project for the Control of Human Rabies,” allocating ₹8.65 crores. For the first time, the plan incorporated rabies control in animals, including animal birth control and vaccination of stray dogs, under the Animal Welfare Board of India. The project, initiated in January 2008, was implemented by the National Centre for Disease Control (NCDC) in five cities: Delhi, Ahmedabad, Pune, Bangalore, and Madurai. The primary objectives included preventing human rabies deaths, raising public awareness, training health personnel, enhancing diagnostic capabilities, and strengthening surveillance systems. The project demonstrated the feasibility and replicability of these strategies.

Building on the success of the pilot, the National Rabies Control Programme (NRCP) was launched during the 12th Five-Year Plan (2012–2017) for nationwide implementation. A pilot program to test animal health strategies was conducted in Haryana and Chennai, managed by the Animal Welfare Board of India under the Ministry of Environment, Forest, and Climate Change. Since 2017, NCDC has overseen the implementation of the Human Health Component of the NRCP. State and district-level human health activities have been funded through the National Health Mission’s planning and implementation framework from the 2019-20 Financial Year.

Infectious Agent

Rabies is caused by neurotropic viruses in the family Rhabdoviridae, genus Lyssavirus.

The rabies virus demonstrates significant resistance to cold, desiccation, and decay, remaining infectious in cadavers for several weeks. However, it is highly thermolabile, with a half-life of approximately 4 hours at 40°C and just 35 seconds at 60°C. The presence of serum proteins and chelating agents can reduce thermal inactivation. In brain tissue at room temperature, the virus can survive for 1-2 weeks.

At temperatures between 0-4°C, the virus remains stable for several days and can persist indefinitely when stored at -70°C or in freeze-dried conditions. The rabies virus is sensitive to extreme pH, with inactivation occurring at pH levels below 4 or above 10. It is also susceptible to oxidizing agents, organic solvents, surface-active agents, and quaternary ammonium compounds. Proteolytic enzymes, ultraviolet light, and X-rays rapidly inactivate the virus. Soaps and detergents are particularly effective due to their ability to disrupt the virus's lipid envelope, rendering it non-infectious.

Host Range in India

All warm-blooded animals are vulnerable to infection by the Rabies virus. However, the degree of species susceptibility varies considerably. In India, the domestic dog is the major reservoir of Rabies.

Frequent	Occasionally		Not Reported
Dogs & cats	Monkeys	Bears	Bats*
	Mongoose, shrew	Pigs	Rodents*
	Cows & buffaloes	Donkeys	Birds
	Foxes, wolves & jackals	Horses	Squirrels
	Sheep & goats	Camels	

Note: All exposures with wild animals are considered Category III exposures.

*Bite by bats or rodents do not ordinarily necessitate rabies vaccination in India.

Transmission

Rabies virus is primarily transmitted through the bite of a rabid animal, which serves as the most common and efficient mode of infection. As a neurotropic virus, rabies gains entry to the nervous system by infiltrating peripheral nerve synapses at the site of the bite. From this entry point, the virus travels along peripheral nerves to the central nervous system (CNS), where it undergoes rapid replication. Subsequently, the virus spreads from the CNS back to the peripheral nervous system (PNS), including tissues such as the salivary glands. This migration allows the virus to be secreted in saliva, facilitating further transmission.

Viral shedding typically begins shortly before the onset of clinical signs in both animals and humans. Since early symptoms may be nonspecific, public health professionals must conduct a thorough risk assessment to determine the need for medical intervention. Bite wounds in highly innervated areas, such as the face and hands, or those closer to the CNS (e.g., head and neck), can increase the likelihood of infection and may shorten the incubation period.

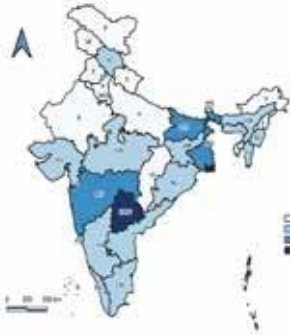
While rabies virus is most commonly found in saliva, it can also be present in CNS and PNS tissues, as well as tears. Although rare, non-bite transmission—such as through organ transplantation from infected individuals—has occurred. However, direct human-to-human transmission is exceedingly uncommon.

All mammals are considered susceptible to rabies, with terrestrial mesocarnivores and bats serving as the primary reservoirs. In many low- and middle-income countries, dogs remain the principal reservoir, with the epidemiology of rabies varying by region. Any patient bitten by a mammal should undergo medical evaluation to determine the need for rabies post-exposure prophylaxis (PEP).

Points to Remember

- Rabies is present in 150 countries and territories, with the highest burden in low- and middle-income regions, particularly South Asia and sub-Saharan Africa.
- India contributes to about 36% of global rabies deaths, with an estimated 18,000–20,000 deaths annually, disproportionately affecting children under 15 years.
- The WHO's "Zero by 30" initiative aims to eliminate human rabies deaths by 2030, focusing on dog vaccination, post-exposure prophylaxis (PEP), and public awareness.
- Dogs are the primary rabies reservoir in India, with transmission primarily occurring through bites.
- While rabies is primarily transmitted through animal bites, direct human-to-human transmission is rare, though documented in cases like organ transplantation from infected donors.

Clinically suspected Human Rabies cases & deaths in India (2012 -2020)



- The Central Bureau of Health Intelligence reports a declining trend in human rabies mortality over the past decade.
- Between 2012 and 2020, 6,644 clinically suspected human rabies cases and related deaths were reported.

National Action Plan, 16 Dec 2016 (ndk.gov.in)

Dog bites per million human population

State-wise cases of Dog bites per million human population from 2012 to 2020

- The incidence of animal bites reported under the Integrated Disease Surveillance Project (IDSP) increased significantly from 4.2 million cases in 2012 to 7.2 million cases in 2020.
- A geographic overview of animal bite incidence per 100,000 population is depicted in Figure 5, showing variations across States and Union Territories in India.



National Action Plan, 16 Dec 2016 (ndk.gov.in)

National Rabies Control Program

- Rabies control efforts in India advanced significantly during the 11th Five-Year Plan (2007–2012), with ₹8.65 crores allocated for the "Pilot Project for the Control of Human Rabies."
- The project, initiated in January 2008, included animal birth control, vaccination of stray dogs, and human rabies prevention measures in five cities: Delhi, Ahmedabad, Pune, Bangalore, and Madurai.
- Key objectives focused on preventing rabies deaths, raising awareness, training health personnel, enhancing diagnostics, and strengthening surveillance systems.
- Building on the pilot's success, the National Rabies Control Programme (NRCP) was launched during the 12th Five-Year Plan (2012–2017) for nationwide implementation.
- Since 2017, NCDC has managed the Human Health Component of the NRCP, with activities funded through the National Health Mission framework starting from the 2019–20 Financial Year.



Agent - Rabies

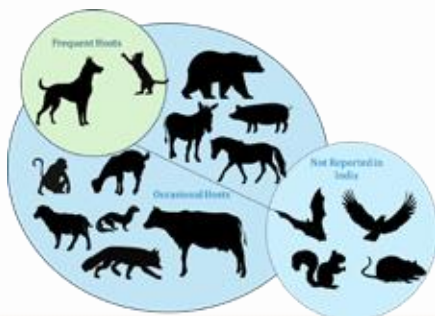
- Neurotropic viruses in the family *Rhabdoviridae*, genus *Lyssavirus*.
- High resistance to cold, desiccation, and decay, remaining infectious in cadavers for several weeks.
- Thermolabile, with a half-life of approximately 4 hrs. at 40°C and 35 secs. at 60°C.
- In brain tissue at room temperature – survives for 1 to 2 weeks.
- Sensitive to extreme pH – inactivated at pH levels < 4 or > 10.
- Susceptible to oxidizing agents, organic solvents, surface-active agents, and quaternary ammonium compounds.
- Proteolytic enzymes, ultraviolet light, and X-rays rapidly inactivate the virus. Soaps and detergents are also very effective.

Centre for One Health, NCDC, MoHFW

RABIES

Notes

Host Range in India



All warm-blooded animals are vulnerable to infection by the Rabies virus.

Notes

Modes of Transmission

- Bites from infected animals
- Licks on Broken Skin / Mucous Membrane
- Scratches
- Organ transplantation



CDC confirmed the first reported cases of rabies transmission through solid organ transplantation in 2004

Session-3

Rabies in Humans

Course No. 003	Session 3: Rabies in Humans
Duration	20 minutes
Learning Objective	• Define the incubation period and case fatality rate of rabies. • Describe the clinical presentation and prodromal features of rabies. • Differentiate between encephalitic and paralytic forms of rabies. • Identify key methods for laboratory confirmation of rabies in humans.
Pre-requisite knowledge/skill	• Basic understanding of zoonotic disease transmission. • Knowledge of post-exposure prophylaxis (PEP) principles. • Awareness of clinical signs of central nervous system infections. • Familiarity with laboratory diagnostic techniques.
Competencies to be achieved	• Identify rabies symptoms and classify cases using standard definitions. • Interpret clinical and laboratory findings for diagnosing rabies. • Differentiate rabies from other conditions with similar symptoms. • Emphasize the importance of timely PEP and its role in rabies prevention.

RABIES IN HUMANS

Incubation Period

The incubation period of rabies (defined as the interval between exposure and the onset of clinical disease) is usually 20–90 days, but in rare cases is either as short as a few days or >1 year.

Case Fatality Rate (CFR)

Rabies has a fatality rate of almost 100% once symptoms appear.

Clinical Presentation

In order to prevent rabies, the focus must be on timely administration of post-exposure prophylaxis (PEP), which should be initiated following a known exposure and before the onset of any symptoms. Rabies is typically suspected based on the clinical presentation, even in the absence of a confirmed history of exposure. The disease commonly manifests as atypical encephalitis, with relative preservation of consciousness. Rabies can however become difficult to recognize in the later stages, especially after the onset of coma. Approximately 20% of patients may present with acute flaccid paralysis. Rabies progresses through prodromal, acute neurologic, and comatose phases, leading to death despite aggressive treatment.

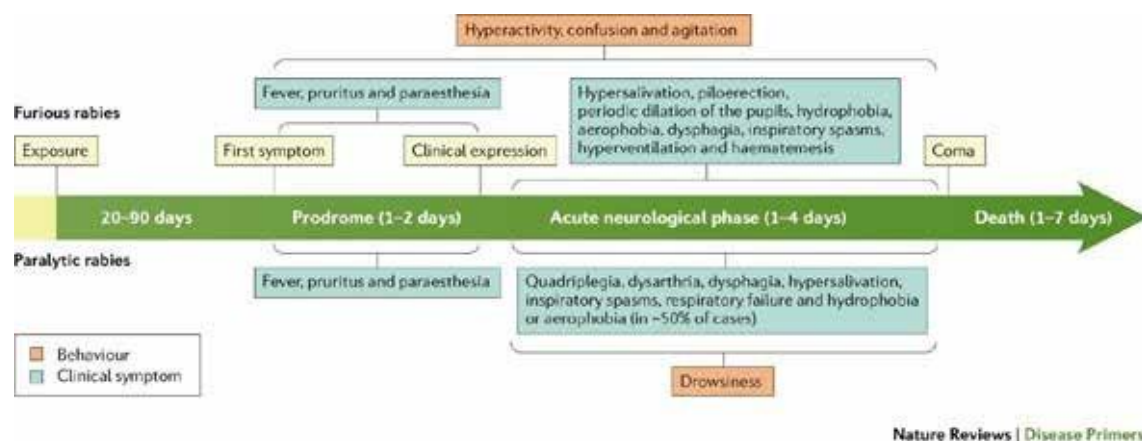


Fig 8: The spectrum of clinical rabies.

Prodromal Features

The initial stage of rabies is characterized by nonspecific symptoms such as fever, malaise, headache, nausea, and vomiting. Anxiety or agitation may also be present. The earliest neurological signs often include paraesthesia, pain, or itching at the site of the exposure, occurring in 50–

80% of cases. These symptoms, which usually appear after the wound has healed, are thought to result from local inflammation affecting the dorsal root or cranial sensory ganglia.

Encephalitic Rabies

There are two main forms of rabies: the encephalitic (furious) form, which occurs in 80% of cases, and the paralytic form, seen in 20%.

Encephalitic rabies is often marked by fever, confusion, hallucinations, combativeness, and seizures—symptoms that may overlap with other viral encephalitis. Autonomic dysfunction is common, leading to hypersalivation, cardiac arrhythmias, and priapism. As the disease advances, periods of lucidity shorten, and rabies-specific symptoms, such as hydrophobia and aerophobia, emerge. These are thought to result from dysfunction of brainstem neurons involved in respiratory reflexes. The combination of hypersalivation and pharyngeal dysfunction produces the well-known “foaming at the mouth” appearance. Without intervention, rapid progression to coma and death is typical, though supportive care may prolong survival. Complications at this stage can include respiratory and cardiac failure, water balance disorders (e.g., inappropriate anti-diuretic hormone secretion, diabetes insipidus), pulmonary edema, gastrointestinal hemorrhage, and multi-organ failure.



Fig 8: Hydrophobic spasm of inspiratory muscles associated with terror in a patient with encephalitic (furious) rabies who is attempting to swallow water.
(Copyright DA Warrell, Oxford, UK; with permission.)

Paralytic Rabies

In about 20% of cases, rabies presents primarily as muscle weakness, with a lack of hyperexcitability, hydrophobia, and aerophobia. Early flaccid paralysis often starts in the bitten limb and spreads, leading to quadriplegia and facial muscle weakness. Sphincter involvement is common, while sensory disturbances are generally mild. Paralytic rabies is frequently misdiagnosed as Guillain-Barré syndrome. Although patients with this form of rabies may survive a few days longer than those with encephalitic rabies, the outcome is similarly fatal due to multi-organ failure.

Case Definition of Rabies

Suspected Case

Death of a human with history of dog bite few weeks/months preceding death.

Probable Case

A suspected human case plus history of exposure to a (suspect/probable) rabid animal. Exposure is usually defined as a bite or scratch from a rabies susceptible animal (usually dogs). It could also be licking, exposure to open wounds, abrasion, mucous membranes of the patient.

A suspect rabid animal is a rabies-susceptible animal (usually dogs) which presents with any of the following signs at the time of exposure or within 10 days following exposure: unprovoked aggression (biting people or animals or inanimate objects), hypersalivation, paralysis, lethargy, abnormal vocalization, or diurnal activity of nocturnal species. Whenever the history of mentioned signs cannot be elicited, the history of exposure to a rabies-susceptible animal would be considered adequate.

A probable rabid animal is a suspect rabid animal (as defined above) with additional history of a bite by another suspect / probable rabid animal and/or is a suspect rabid animal that is killed, died or disappeared within 4-5 days of observing illness signs.

Laboratory Confirmed Case

A suspect or a probable human case that is laboratory confirmed. Laboratory confirmation by one or more of the following –

Detection of rabies viral antigens by direct fluorescent antibody test (FAT) or by ELISA in clinical specimens, preferably brain tissue (collected postmortem)

or

Detection by FAT on skin biopsy (ante mortem).

or

FAT positive after inoculation of brain tissue, saliva or CSF in cell culture, or after intracerebral inoculation in mice or suckling mice.

or

The detectable rabies-neutralizing antibody titer in the serum or the CSF of an unvaccinated person.

or

Detection of viral nucleic acids by PCR on tissue collected postmortem or intra vitam in a clinical specimen (brain tissue or skin, cornea, urine or saliva).

Differential Diagnosis

Diagnosis can be particularly challenging when there is no clear history of animal exposure. In cases involving substance abuse, thorough investigation of possible animal bites is crucial. Clinically, rabies presents with distinct features compared to other forms of acute viral encephalitis, such as herpes simplex encephalitis or arboviral encephalitis (e.g., West Nile virus). Early neurological symptoms may manifest at the bite site, often accompanied by signs of brainstem involvement, with consciousness typically preserved during the initial stages.

Anti-N-methyl-D-aspartate receptor (anti-NMDA) encephalitis, predominantly affecting young patients (especially females), presents with behavioral changes, autonomic instability, hypoventilation, and seizures. Various other antibodies can also cause autoimmune encephalitis. Post-infectious (immune-mediated) encephalomyelitis, which may follow infections such as influenza, measles, or mumps, can also occur as a rare complication of rabies vaccination using neural tissue-derived vaccines though these kinds of vaccines are not used in India.

Differential Diagnosis for Human Rabies

- Guillain-Barré syndrome
- Viral encephalitis
- Poliomyelitis
- Transverse myelitis
- Cerebrovascular accident
- Psychosis
- Intracranial mass
- Epilepsy
- Atropine poisoning
- Creutzfeldt-Jakob disease.

Table 1: Differential diagnosis of Rabies

Disease	Epidemiological Clues	Key Clinical Differences	Laboratory Tests
Guillain-Barré Syndrome (GBS)	Post-infectious condition; often follows viral/bacterial infections (e.g., <i>Campylobacter jejuni</i> , EBV).	Symmetrical ascending paralysis; areflexia; absence of encephalitic features (e.g., hydrophobia).	Normal CSF glucose, high protein with albumin-cytological dissociation; MRI shows nerve root enhancement. Rabies shows CSF pleocytosis with elevated protein, and brain imaging highlights cerebral/spinal gray matter changes, absent in GBS
Viral Encephalitis	Arboviral exposure (e.g., West Nile, Japanese encephalitis) or history of herpes simplex virus (HSV) infection.	Global neurological dysfunction; fever and seizures more common than in rabies.	Viral PCR from CSF or blood confirms etiology. MRI for HSV shows temporal lobe involvement, differing from rabies' predilection for brainstem and gray matter
Poliomyelitis	Lack of immunization; recent travel to polio-endemic areas.	Predominantly lower motor neuron involvement; asymmetrical paralysis; no sensory loss, unlike rabies' sensory disturbance.	Virus isolation from stool; rabies is diagnosed via detection of viral RNA or neutralizing antibodies in CSF/saliva.
Transverse Myelitis	Idiopathic or post-infectious; may occur after vaccination or autoimmune disease.	Acute spinal cord dysfunction with sensory level; bladder/bowel dysfunction common; encephalopathy absent.	MRI shows spinal cord inflammation (T2 hyperintensities); rabies shows broader CNS involvement including brainstem regions.
Cerebrovascular Accident (Stroke)	Risk factors include hypertension, atrial fibrillation, or hyperlipidemia.	Acute onset of focal deficits; no prodrome. Rabies progresses more gradually and includes autonomic instability and hydrophobia.	CT/MRI shows vascular ischemia/hemorrhage. Rabies diagnosis requires viral RNA or antigen detection in brain tissue/saliva
Psychosis	Psychiatric history or substance use; no associated fever or neurological deficits.	Behavioral changes without autonomic instability (e.g., hydrophobia or aerophobia); consciousness usually preserved.	Normal laboratory findings in psychosis. Rabies-specific tests, such as RT-PCR for viral RNA in saliva/CSF, confirm diagnosis

Disease	Epidemiological Clues	Key Clinical Differences	Laboratory Tests
Epilepsy	History of seizures or known epilepsy syndrome.	Isolated seizures without preceding fever or autonomic dysfunction. Rabies features progressive encephalopathy and hydrophobia.	EEG shows epileptiform discharges in epilepsy; rabies encephalitis often has non-specific slowing. Rabies confirmed via viral antigen/antibody testing
Atropine Poisoning	Exposure to anticholinergic drugs; accidental or intentional ingestion.	Dry mouth, blurred vision, urinary retention; no encephalitis-like features such as agitation or hydrophobia.	Serum toxicology identifies atropine. Rabies diagnosis relies on detecting virus- specific antibodies/ antigens in serum or saliva.
Creutzfeldt-Jakob Disease (CJD)	Sporadic or familial prion disease; gradual onset of dementia, ataxia, and myoclonus.	Progressive dementia; myoclonus; no fever or autonomic instability.	CSF shows 14-3-3 protein or tau protein elevation; EEG has periodic sharp waves. Rabies shows specific viral RNA/antibody presence

Prognosis

When appropriate post-exposure prophylaxis (PEP) is administered promptly during the early incubation period following exposure, rabies can be prevented. Among documented rabies cases, there have been 30 known survivors, with all but one having received one or more doses of the rabies vaccine before the onset of clinical symptoms. The only unvaccinated survivor presented with detectable neutralizing antibodies to the rabies virus in both serum and cerebrospinal fluid (CSF) at the time of clinical manifestation. Despite intensive management, including critical care, the majority of rabies patients succumb to the disease within a few days of symptom onset.

Points to Remember

- The incubation period for rabies usually ranges from 20–90 days, though it can be as short as a few days or exceed a year in rare cases.
- Rabies is nearly 100% fatal once symptoms appear, which highlights the importance of administering post-exposure prophylaxis (PEP) promptly.
- The disease has two main forms: the encephalitic form, seen in 80% of cases, marked by hydrophobia and hypersalivation, and the paralytic form, occurring in 20%, characterized by flaccid paralysis.
- Laboratory confirmation methods include tests like the direct fluorescent antibody test, PCR, and detection of neutralizing antibodies in clinical specimens.
- Rabies can be confused with conditions like Guillain-Barré syndrome or viral encephalitis, making a detailed history of exposure critical for diagnosis.

- Rabies is typically suspected based on the clinical presentation, even in the absence of a confirmed history of exposure.
- The disease commonly manifests as atypical encephalitis, with relative preservation of consciousness.
- Rabies can become difficult to recognize in the later stages, especially after the onset of coma.
- 20% of patients may present with acute flaccid paralysis.
- Rabies progresses through prodromal, acute neurologic, and comatose phases, leading to death despite aggressive treatment.



RABIES

The flowchart illustrates the clinical course of rabies, starting from exposure and progressing through prodrome, acute neurological phase, and death. It distinguishes between furious and paralytic forms.

Exposure (Yellow box) leads to the **Prodrome (1-2 days)** (Green arrow).

Prodrome (1-2 days) is characterized by **Fever, pruritus and paresthesia** (Blue box).

Acute neurological phase (1-4 days) (Green arrow) follows the prodrome. It branches into two forms:

- Furious rabies** (Furious rabies box):
 - First symptom** (Yellow box): **Fever, pruritus and paresthesia** (Blue box).
 - Clinical expression** (Yellow box): **Hyperaerivation, pill-rolling, aerobic dilation of the pupils, hydrophobia, emphyxia, dysphagia, respiratory spasms, hyperventilation and haematemesis** (Blue box).
 - Course** (Yellow box): **Death (1-7 days)** (Green arrow).
- Paralytic rabies** (Paralytic rabies box):
 - First symptom** (Yellow box): **Fever, pruritus and paresthesia** (Blue box).
 - Clinical expression** (Yellow box): **Quadriplegia, dysarthria, dysphagia, hyperaerivation, respiratory spasms, respiratory failure and hydrophobia or apnoeic (in ~50% of cases)** (Blue box).
 - Course** (Yellow box): **Death (1-7 days)** (Green arrow).

Death (1-7 days) (Green arrow) is the final outcome for both forms.

Legend:

- Yellow box: Behaviour
- Blue box: Clinical symptom

Foots, A. R. et al. (2017) Rabies. *Nat. Rev. Dis. Primers* doi:10.1038/nrdp.2017.9

Center for Oral Health, MC 26, Memphis

RABIES

Case	Definition
Suspect Case	Death of a human with a history of dog bite a few weeks/months preceding death. Wherever available, the details of such cases should be shared in a line list– Name, Age, Gender, Address A suspected human case plus history of exposure to a (suspect / probable) rabid animal. Exposure is usually defined as a bite or scratch from a Rabies-susceptible animal (usually dogs). It could also be lick exposure to open wounds, abrasion, mucous membranes of the patient. A suspect rabid animal is a Rabies-susceptible animal (usually dogs) which presents with any of the following signs at the time of exposure or within 10 days following exposure: • unprovoked aggression (biting people or animals or inanimate objects), • hypersalivation, • paralysis, • lethargy, • abnormal vocalization, or diurnal activity of nocturnal species.

NationalActionPlan 16dec.indd /nrc/ovw/in

Center for Oral Health, MC20C, Manhattan

RABIES

Case	Definition
Laboratory Confirmed Case	A suspect or a probable human case that is laboratory-confirmed by one or more of the following tests:
	• Detection of Rabies viral antigens by direct fluorescent antibody test (FAT)
	OR
	• ELISA in clinical specimens, preferably brain tissue (collected postmortem)
	OR
	• Detection by FAT on skin biopsy (ante mortem)
Laboratory Confirmed Case	OR
	• FAT positive after inoculation of brain tissue, saliva or CSF in cell culture, or after intracerebral inoculation in mice or in suckling mice
	OR
	• The detectable Rabies-neutralizing antibody titer in the serum or the CSF of an unvaccinated person
	OR
	• Detection of viral nucleic acids by PCR on tissue collected postmortem (brain tissue or skin) or anti-mortem (skin, urine, CSF or saliva)

NationalActionPlan_16-dec.indd (nrc.gov.in)

Center for Oral Health, MCHC, Memphis

RABIES

[illegible]

Differential Diagnosis

Diagnostic Challenges –

- Difficult when no clear history of animal exposure.
- Substance abuse cases require thorough investigation for possible animal bites.

Differentiation from Anti-NMDA Encephalitis –

- Primarily affects young females.
- *Symptoms* – behavioral changes, autonomic instability, hypoventilation, seizures.
- Other antibodies may also cause autoimmune encephalitis.

Post-Infectious Encephalomyelitis –

- Rare complication after infections like influenza, measles, mumps.
- May follow rabies vaccination with neural tissue vaccines, although these are not used in India.

- Guillain-Barré syndrome
- Viral encephalitis
- Poliomyelitis
- Transverse myelitis
- Cerebrovascular accident
- Psychosis
- Intracranial mass
- Epilepsy
- Atropine poisoning
- Creutzfeldt-Jakob disease.

Centre for One Health, NCDC, MoHFW

RABIES

Differential Diagnosis

Disease	Epidemiological Clues	Key Clinical Differences	Laboratory Tests
Guillain-Barré Syndrome (GBS)	Post-infectious condition; often follows viral/bacterial infections (e.g., Campylobacter jejuni, EBV).	Symmetrical ascending paralysis; areflexia; absence of encephalitic features (e.g., hydrophobia).	Normal CSF glucose, high protein with albumin-cytological dissociation; MRI shows nerve root enhancement. Rabies shows CSF pleocytosis with elevated protein, and brain imaging highlights cerebral/spinal gray matter changes, absent in GBS.
Viral Encephalitis	Arboviral exposure (e.g., West Nile, Japanese encephalitis) or history of herpes simplex virus (HSV) infection.	Global neurological dysfunction; fever and seizures more common than in rabies.	Viral PCR from CSF or blood confirms etiology. MRI for HSV shows temporal lobe involvement, differing from rabies' predilection for brainstem and gray matter.
Poliomyelitis	Lack of immunization; recent travel to polio-endemic areas.	Predominantly lower motor neuron involvement; asymmetrical paralysis; no sensory loss, unlike rabies' sensory disturbance.	Virus isolation from stool; rabies is diagnosed via detection of viral RNA or neutralizing antibodies in CSF/saliva.

Centre for One Health, NCDC, MoHFW

RABIES

Differential Diagnosis

Disease	Epidemiological Clues	Key Clinical Differences	Laboratory Tests
Transverse Myelitis	Idiopathic or post-infectious; may occur after vaccination or autoimmune disease.	Acute spinal cord dysfunction with sensory level; bladder/bowel dysfunction common; encephalopathy absent.	MRI shows spinal cord inflammation (T2 hyperintensities); rabies shows broader CNS involvement including brainstem regions.
Cerebrovascular Accident (Stroke)	Risk factors include hypertension, atrial fibrillation, or hyperlipidemia.	Acute onset of focal deficits; no prodrome. Rabies progresses more gradually and includes autonomic instability and hydrophobia.	CT/MRI shows vascular ischemia/hemorrhage. Rabies diagnosis requires viral RNA or antigen detection in brain tissue/saliva
Psychosis	Psychiatric history or substance use; no associated fever or neurological deficits.	Behavioral changes without autonomic instability (e.g., hydrophobia or aerophobia); consciousness usually preserved.	Normal laboratory findings in psychosis. Rabies-specific tests, such as RT-PCR for viral RNA in saliva/CSF, confirm diagnosis.

Centre for One Health, NCDC, MoHFW

RABIES

Differential Diagnosis

Disease	Epidemiological Clues	Key Clinical Differences	Laboratory Tests
Epilepsy	History of seizures or known epilepsy syndrome.	Isolated seizures without preceding fever or autonomic dysfunction. Rabies features progressive encephalopathy and hydrophobia.	EEG shows epileptiform discharges in epilepsy; rabies encephalitis often has non-specific slowing. Rabies confirmed via viral antigen/antibody testing.
Atropine Poisoning	Exposure to anticholinergic drugs; accidental or intentional ingestion.	Dry mouth, blurred vision, urinary retention; no encephalitis-like features such as agitation or hydrophobia.	Serum toxicology identifies atropine. Rabies diagnosis relies on detecting virus-specific antibodies/antigens in serum or saliva.
Creutzfeldt-Jakob Disease (CJD)	Sporadic or familial prion disease; gradual onset of dementia, ataxia, and myoclonus.	Progressive dementia; myoclonus; no fever or autonomic instability.	CSF shows 14-3-3 protein or tau protein elevation; EEG has periodic sharp waves. Rabies shows specific viral RNA/antibody presence.

Centre for One Health, NCDC, MoHFW

RABIES

Notes

Session-4

Rabies in Animals

Course No. 004	Session 4: Rabies in Animals
Duration	10 minutes
Learning Objective	• Describe the host range and reservoirs for rabies in animals. • Identify clinical manifestations of rabies in different animal species.
Pre-requisite knowledge/skill	• Understanding of animal health and zoonotic disease transmission. • Familiarity with common domestic and wild animal species affected by rabies. • Basic knowledge of clinical signs of infectious diseases in animals.
Competencies to be achieved	• Learners will gain knowledge of rabies epidemiology and clinical presentations in various animal species.

RABIES IN ANIMALS

Rabies is a neuro-invasive viral zoonosis that induces fatal encephalitis in affected animals. The disease predominantly targets the central nervous system, leading to severe inflammation of the brain.

Symptoms in Animals

Cattle

Cattle do not exhibit hydrophobia (fear of water) as seen in humans with rabies. Key clinical signs include:

- Anorexia and lack of water intake for 2-3 days.
- Behavioral changes and irritability.
- Excitation upon sight of dogs or poultry, often attempting to attack them.
- Digging at the ground with their forelegs, excavating soil.
- Despite being off feed, frothy saliva may be observed on their lips, mimicking mastication.
- Excessive frothy salivation.
- Repeated butting and striking of the head against walls or trees, leading to injuries, often without the animal ceasing its actions.
- Pica (eating non-food items such as sand), an important symptom.
- Dribbling urine and frequent urination.
- A tucked-up abdomen, a notable feature.
- Sexual hyperactivity, even in young animals.
- Prolonged estrus in cows and buffaloes, with repeated mating behaviors.
- Continuous bellowing.
- Rapid emaciation within days due to profuse salivation and frequent urination.

Dogs

Rabid dogs do not display hydrophobia. The clinical presentation can vary widely, making diagnosis challenging even for experienced veterinarians. Two primary forms of rabies are observed in dogs: the furious form and the dumb (paralytic) form.

Early Symptoms

- Anorexia followed by nervous signs such as restlessness.
- The dog may attempt to hide.
- Running away from home for long distances.
- Loss of recognition of the owner.
- Failure to respond to usual commands (though some rabid dogs may obey their master until death).
- Hallucinations, manifested as fly-biting behavior, suggestive of imaginary objects.

Later Symptoms

- Extreme aggression, becoming dangerously violent.
- Biting inanimate objects such as wooden logs, trees, or iron bars.
- Paralysis of the jaw muscles (dropped jaw), a hallmark of rabies.
- Tongue discoloration to a coffee-brown hue.
- Progressive paralysis, starting from the hind legs and advancing to the head.
- Seizures, ultimately leading to death.



Fig 8: Furious Rabies and Dumb Rabies

Cats

In cats, the clinical signs of rabies are similar to those observed in dogs. Approximately 75% of cases present in the furious form. Early signs include restlessness, facial grimacing, and abnormal movements of the forelimbs. Cats tend to be more aggressive than dogs, with frequent muscle incoordination and seizures.

Horses

Early signs in horses include lameness, aimless walking, and a staggering gait. These animals may display marked excitement or aggressiveness, though periods of calm are also possible. Common symptoms include salivation, sexual excitement, colic, self-biting, and self-mutilation.

Sheep and Goats

Symptoms in sheep and goats largely mirror those in cattle. Key signs include butting other animals or objects. This excitement phase is followed by depression, weakness, paralysis, and death.

Pigs

Pigs exhibit hyperexcitement and difficulty walking. They may attack other pigs and even jump into neighboring pens.

Standard Case Definitions for Animal Rabies

As per the WHO guidelines proposed case definitions and surveillance activities to be undertaken by the veterinary officer in case of Suspected, Probable and lab Confirmed animal Rabies are mentioned below -

Suspected Animal Rabies

A case that is compatible with a clinical case definition of animal Rabies An animal that presents with any of the following signs- 'hyper salivation, paralysis, lethargy, unprovoked abnormal aggression (biting two or more people or animals and/or inanimate objects), abnormal vocalization and diurnal activity of nocturnal species'

Or

any animal showing the signs of dumb form of Rabies

Probable Animal Rabies

A suspected case + reliable history of contact with a suspected, probable or confirmed rabid animal

And/or

An animal with suspected Rabies that is killed, died or disappears within 4–5 days of observation of illness

Confirmed Animal Rabies

A suspected or probable animal case confirmed in a laboratory

Not a Case

A suspected or probable case that is ruled out by laboratory tests or epidemiological investigation (i.e., appropriate quarantine period in eligible animals).

VACCINATION IN ANIMALS

Vaccination of more than 70% of the dog population annually can interrupt rabies transmission, and sustained efforts over several years could lead to elimination of the disease. Alternative methods, such as culling, have proven to be less effective. Mass dog vaccination campaigns have shown significant success in many regions globally. In countries like India, where a large proportion of dogs are free-roaming and unowned, the catch-vaccinate-release (CVR) method has been adopted. CVR involves a team of 4–7 people capturing dogs with nets, administering the vaccine, and then releasing them. An example of this approach is the synchronized mass vaccination campaign carried out in 2013 by the charity Mission Rabies (<https://missionrabies.com/>) across 12 cities in India, during which 54,227 dogs were vaccinated.

HANDLING AND CONSUMPTION OF ANIMAL PRODUCTS

Handling and consuming tissues from animals exposed to rabies poses a transmission risk. Factors influencing this risk include the site of exposure, the viral load, the severity of the wounds, and whether contaminated tissue has been removed adequately. If an exposed animal is to be slaughtered for consumption, this should occur immediately after exposure, ensuring all tissues are thoroughly cooked. Individuals handling exposed animals, carcasses, or tissues must use appropriate barrier precautions. Federal guidelines have historically mandated that animals exposed to rabies within the past eight months be deemed unsuitable for slaughter. It is essential to notify USDA Food Safety and Inspection Service (FSIS) meat inspectors of any exposure in food animals before slaughter.

Rabies virus can be present in various tissues of infected animals, making products from such animals unsafe for human or animal consumption. However, rabies virus is inactivated by pasteurization temperatures, meaning consuming pasteurized milk or thoroughly cooked animal products from exposed animals does not constitute a rabies exposure risk.

Points to Remember

- Rabies presents differently in animals, with two primary forms in dogs—furious and dumb (paralytic). Other animals like cattle, cats, and pigs show species-specific symptoms such as aggression, frothy salivation, and self-mutilation.
- Once clinical symptoms appear, rabies is almost always fatal in animals, leading to severe neurological symptoms like paralysis and seizures.
- Common symptoms include aggressive behavior in dogs and cats, pica and frothy salivation in cattle, and hyperexcitement and self-mutilation in horses and pigs.

	• Anorexia, behavioral changes, and irritability. • Excessive salivation, pica (eating non-food items), frequent urination. • Aggressive behavior like butting and head striking, prolonged estrus. • Rapid weight loss, frothy saliva, and tucked abdomen.
	• Early signs – Anorexia, nervousness, hiding, running away, and disorientation. • Advanced – Extreme aggression, hallucinations, paralysis of jaw, seizures, death.
	• Similar to dogs, mainly in furious form. • Restlessness, facial grimacing, and abnormal movements of the forelimbs. • Cats tend to be more aggressive than dogs

	• Early signs in horses include lameness, aimless walking, and a staggering gait. • Marked excitement or aggressiveness, though periods of calm are also possible. • Common symptoms include salivation, sexual excitement, colic, self-biting, and self-mutilation.
	• Symptoms in sheep and goats largely mirror those in cattle. • Key signs include butting other animals or objects. • This excitation phase is followed by depression, weakness, paralysis, and death.
	• Pigs exhibit hyperexcitement and difficulty walking. • They may attack other pigs and even jump into neighbouring pens.

Case	Definition
Suspected Animal Rabies	A case that is compatible with a clinical case definition of animal Rabies. An animal that presents with any of the following signs- • hyper salivation, paralysis, lethargy, unprovoked abnormal aggression (biting two or more people or animals and/or inanimate objects) • abnormal vocalization and • diurnal activity of nocturnal species' Or any animal showing the signs of dumb form of Rabies
Probable animal Rabies	A suspected case + reliable history of contact with a suspected, probable or confirmed rabid animal and/or An animal with suspected Rabies that is killed, died or disappears within 4-5 days of observation of illness
Confirmed animal Rabies	A suspected or probable animal case confirmed in a laboratory
Not a case	A suspected or probable case that is ruled out by laboratory tests or epidemiological investigation (i.e., appropriate quarantine period in eligible animals).

- Vaccination of more than **70%** of the dog population **annually** can **interrupt rabies transmission**.
- Sustained efforts over several years could lead to elimination of the disease.
- **Mass dog vaccination campaigns** have shown significant success in many regions globally.
- In countries like India, where a large proportion of dogs are free-roaming and unowned, the **catch-vaccinate-release (CVR) method** has been adopted.
- CVR involves a team of 4–7 people capturing dogs with nets, administering the vaccine, and then releasing them.

[illegible]

Handling and Consumption of Animal Products



- Handling and consumption of tissues from exposed animals may carry a risk of rabies transmission as Rabies virus may be widely distributed in tissues of infected animals.
- If an exposed animal is to be slaughtered for consumption, it should be done immediately after exposure and all tissues should be cooked thoroughly.
- Persons handling exposed animals, carcasses and tissues should use barrier precautions.
- Tissues and products from a rabid animal should not be used for human or animal consumption.
- Pasteurization temperatures will inactivate rabies virus; therefore, drinking pasteurized milk or eating thoroughly cooked animal products does not constitute a rabies exposure

Centre for One Health, NCDC, MoHFW

RABIES

Notes

Session-5

Laboratory Diagnosis

Course No. 005	Session 5: Laboratory Diagnosis
Duration	20 minutes
Learning Objectives	• Describe appropriate procedures for sampling, transport, and storage of specimens in rabies cases. • Gain familiarity with diagnostic techniques, including presumptive and confirmatory tests for rabies. • Acquire knowledge about key referral laboratories in India for rabies diagnosis and confirmation.
Pre-requisite knowledge/skill	• Basic knowledge of laboratory safety and specimen handling procedures. • Familiarity with diagnostic workflows and infectious disease testing. • Awareness of the diagnostic network and public health laboratory system in India.
Competencies to be achieved	• Understanding the necessary materials, equipment, and conditions for the safe and accurate sampling of rabies specimens. • Proficiency in explaining the differences between various diagnostic tests used for rabies, including presumptive and confirmatory methods. • Capability to accurately identify and describe the roles of referral laboratories for rabies diagnostics in India.

LABORATORY DIAGNOSIS OF RABIES

Rabies diagnostics can be broadly categorized into two types based on the timing of the tests: those conducted while the patient is still alive (ante-mortem) and those performed after death (post-mortem). The choice of diagnostic method depends on the type of specimen used, and the sensitivity and specificity of the tests can vary accordingly.

Ante-mortem diagnostics involve testing biological fluids and secretions, such as saliva, cerebrospinal fluid (CSF), tears, and serum, as well as tissues like skin biopsy samples, particularly from the nape of the neck including hair follicles. In contrast, post-mortem diagnostics typically rely on brain tissue samples for definitive diagnosis.

Specimen Consultation, Collection, Packing, and Transportation

Consultation

Due to the risks involved in handling specimens and the complexity of rabies diagnostic methods, it is essential to seek consultation prior to submitting samples. Contact your state health department with details about any suspected human rabies cases before sending specimens. Referral laboratories, listed with their contact details, should be contacted as necessary.

Specimen Collection

All specimens from suspected rabies cases must be considered infectious and handled accordingly. They should be collected in a leak-proof, sealed primary container for transportation to the designated laboratory.

Sampling Window

Table 2: Sampling window for rabies diagnosis

Sampling Window Time (Days/Weeks)	Symptoms	Sample	Diagnostic Tests
Day 0 (After Exposure)	Asymptomatic or mild anxiety due to bite/exposure.	N/A	No immediate diagnostic tests recommended; prophylactic vaccination or RIG administration considered.
Day 1–7 (Incubation Period)	No symptoms; variable duration (typically 1–3 months post-exposure).	N/A	No diagnostic testing applicable; vaccination (PEP) is critical.
Day 7 Onwards (Prodromal Phase)	Fever, malaise, paresthesia/itching at the bite site.	Serum/CSF, saliva	RT-PCR for viral RNA from saliva; ELISA or RFFIT for rabies-neutralizing antibodies in serum/CSF.

Sampling Window Time (Days/Weeks)	Symptoms	Sample	Diagnostic Tests
Week 1–2 (Neurological Phase)	Hydrophobia, aerophobia, muscle spasms, hyperactivity, altered mental status.	Saliva, nuchal skin biopsy	RT-PCR for viral RNA from saliva; immunofluorescent antigen detection on nuchal biopsy.
Week 1–2 (Neurological Phase)	Progressive neurological symptoms (paralysis, hypersalivation, agitation); autonomic instability.	CSF	Antibody detection (neutralizing or specific IgM/IgG).
Week 2 Onwards (Late Neurological)	Paralysis, coma, respiratory failure.	Saliva, CSF	Repeated RT-PCR; antibodies (serum/CSF).
Post-Mortem	Advanced neurological damage; death due to respiratory failure or cardiac arrest.	Advanced neurological damage; death due to respiratory failure or cardiac arrest.	Direct fluorescent antibody test (DFA); RT-PCR or antigen detection from brain tissue.

Antemortem Specimens

When collecting samples such as serum, saliva, cerebrospinal fluid (CSF), or skin biopsies, strict aseptic techniques and proper personal protective equipment (PPE) are required. Restraining animals prior to sample collection is critical to prevent bites. Multiple tests are typically needed for rabies diagnosis, as no single test is sufficient to confirm a case antemortem.

- **Saliva:** Collect 500 µl using a sterile pipette into a small, sterile container without preservatives. Collect one sample daily for three consecutive days, if possible. Tests include rabies RNA detection by RT-PCR.
- **Corneal Impression:** Using a marked slide, obtain corneal impressions by applying gentle pressure to the eye. Air-dry the slide before further processing for the Direct Fluorescent Antibody Test (DFAT), though this method is not commonly reliable.
- **Nuchal Skin Biopsy:** A biopsy from the nape of the neck (5-7 mm deep) should include hair follicles and cutaneous nerves. It is used for viral antigen detection by DFAT/DRIT, RT-PCR, or virus isolation by RTCIT.
- **Serum and CSF:** Collect 2-3 ml of each in sterile vials. Rabies antibodies in serum (if unvaccinated) and CSF (regardless of immunization history) may indicate infection. Tests include ELISA, indirect immunofluorescence, or virus neutralization.

Postmortem Specimens

Postmortem specimens, such as brain tissue, spinal cord, and salivary glands, should be treated as highly infectious. During autopsy, ensure the use of protective gear, including laboratory coats, aprons, gloves, and masks.

Brain and Salivary Glands: Brain samples are preferred for rabies diagnosis. Use the occipital foramen route for brain collection without breaking the skull. If full postmortem is not possible, a Vim-Silverman needle can be used to obtain small brain sections. Send the sample in a screw-top container with half submerged in glycerol-saline and the other half in PBS. Avoid formalin as it renders the sample unsuitable for key tests like DFAT, RT-PCR, or RTCIT.

Labelling

Each specimen (slides, vials) must be properly labelled with patient and sample details, including animal species and preservative used. Use permanent markers and include relevant clinical information. Consult the Sample Requisition Proforma for specific details.

Packing and Transportation

All biological specimens should be treated as potentially infectious.

1. Sample Shipment Requirements

- Nuchal skin samples: Ideally, these should be shipped frozen at -20°C or lower. However, if this is not feasible, shipping with ice packs (maintaining a temperature of 2-8°C) is also acceptable.
- Saliva samples: These should always be shipped frozen at -20°C or below.
- Brain samples: These must either be frozen or, in the absence of freezing capabilities, preserved partially in a 50% glycerol-saline solution and the remainder in sterile PBS. Formalin should never be used to preserve brain samples.

It is critical to ensure that the cold chain is maintained at either 2-8°C or -20°C, depending on the sample's requirements. If immediate transportation is not possible, store samples at -20°C or below until shipment.

2. Specimen Packaging

- All samples should be placed in a watertight, leak-proof primary container, which must be securely sealed (using tape around the cap to prevent accidental opening during transit).
 - This primary container should be placed into a secondary container, such as a zip-lock plastic bag, with insulating material between the primary and secondary containers.
 - Finally, the secondary container must be placed inside a rigid outer packaging box for transportation.
3. It is mandatory to inform the reference laboratory before shipping any samples suspected of containing the rabies virus.
 4. Samples should be enclosed in double-layered waterproof containers, containing cooling materials and absorbent materials. This assembly must then be placed in a leak-proof outer container, in compliance with national guidelines.
 5. Transport of these specimens should be prioritized. Delays, particularly in tropical climates, leading to sample degradation and rendering them unsuitable for testing.
 6. Use priority mail or courier services to minimize transportation time and ensure sample integrity upon arrival at the destination.

LABORATORY DIAGNOSIS OF RABIES

Rabies diagnosis in the laboratory involves several techniques, divided into direct and indirect methods to detect viral antigens or antibodies, respectively, or to isolate the virus itself. Each method is tailored to the nature of the sample, whether ante-mortem (e.g., saliva, cerebrospinal fluid, skin biopsy) or post-mortem (e.g., brain tissue).

Direct Diagnostic Tests

Antigen Detection

Seller's Staining

Sellar's Staining is a histological technique used for the detection of *Negri bodies*, which are characteristic intracytoplasmic inclusion bodies found in the neurons of rabid animals and humans. Though less sensitive than more modern methods, Seller's staining can be a valuable tool for educational or academic purposes. It involves staining brain tissue impressions to identify the presence of Negri bodies, which appear pink or purplish pink in the stained tissue.

Principle:

Negri bodies are intracytoplasmic, eosinophilic inclusion bodies that can be visualized in infected cells. These structures are stained using basic fuchsin or eosin in combination with methylene blue, highlighting them against a background of blue-stained nerve cells and pink stroma.

Direct Fluorescent Antibody Test (DFAT)

The DFAT is considered the gold standard for rabies diagnosis. It identifies viral antigens in tissue specimens, especially brain tissue. This test uses fluorescent labelled antibodies that bind specifically to rabies antigens, which are then visualized under a fluorescence microscope.

Direct Rapid Immunohistochemistry Test (DRIT)

DRIT is an alternative test for rabies antigen detection, particularly useful in resource-limited settings. It relies on enzyme-conjugated antibodies that bind to viral antigens, forming a complex that is visible under a light microscope after color development.

Rapid Antigen Detection Test (RADT)

RADT offers a quick way to identify rabies antigen in brain tissue through lateral flow immunochromatography. Results are typically available within minutes, though RADT lacks the sensitivity and specificity of DFAT and DRIT.

Molecular Methods

Nucleic Acid Amplification Test (NAAT)

NAAT, particularly Reverse Transcription Polymerase Chain Reaction (RT-PCR), is used to detect rabies RNA in samples. This method amplifies small quantities of viral RNA to detectable levels, allowing for rabies confirmation even in cases where antigen detection may be challenging, such as with ante-mortem samples like saliva or skin biopsies.

Virus Isolation

Mouse Inoculation Test (MIT)

This traditional biological assay involves injecting a sample, typically brain tissue or saliva, into mice to observe for the development of rabies symptoms. While reliable, MIT is labor-intensive and time-consuming, taking up to three weeks to yield results.

Rabies Tissue Culture Infection Test (RTCIT)

RTCIT is another method of isolating the virus, using tissue cultures instead of live animals. The virus's presence is confirmed by its ability to infect cell cultures, which can be visualized using rabies-specific fluorescent antibodies.

Indirect Diagnostic Tests

Serology

Enzyme-Linked Immunosorbent Assay (ELISA)

ELISA detects rabies-specific antibodies in serum or cerebrospinal fluid (CSF), quantifying the immune response. It is particularly useful for monitoring vaccination responses or diagnosing rabies post-exposure.

Rapid Fluorescent Focus Inhibition Test (RFFIT)

RFFIT is a sensitive and accurate method for measuring neutralizing antibodies against the rabies virus. It is commonly used to evaluate the immune response in vaccinated individuals or in the context of rabies exposure.

Each diagnostic method has its advantages and limitations, and selecting the appropriate test depends on the clinical scenario, sample availability, and laboratory capacity. For instance, the DFAT and NAAT are critical for rapid and accurate diagnosis, while serological tests like ELISA and RFFIT are crucial for post-exposure surveillance and vaccination monitoring.

ALGORITHMS FOR LABORATORY DIAGNOSIS OF RABIES

Algorithm for laboratory diagnosis of rabies in antemortem and postmortem samples from humans is given in Figure 19 and Figure 20, respectively.

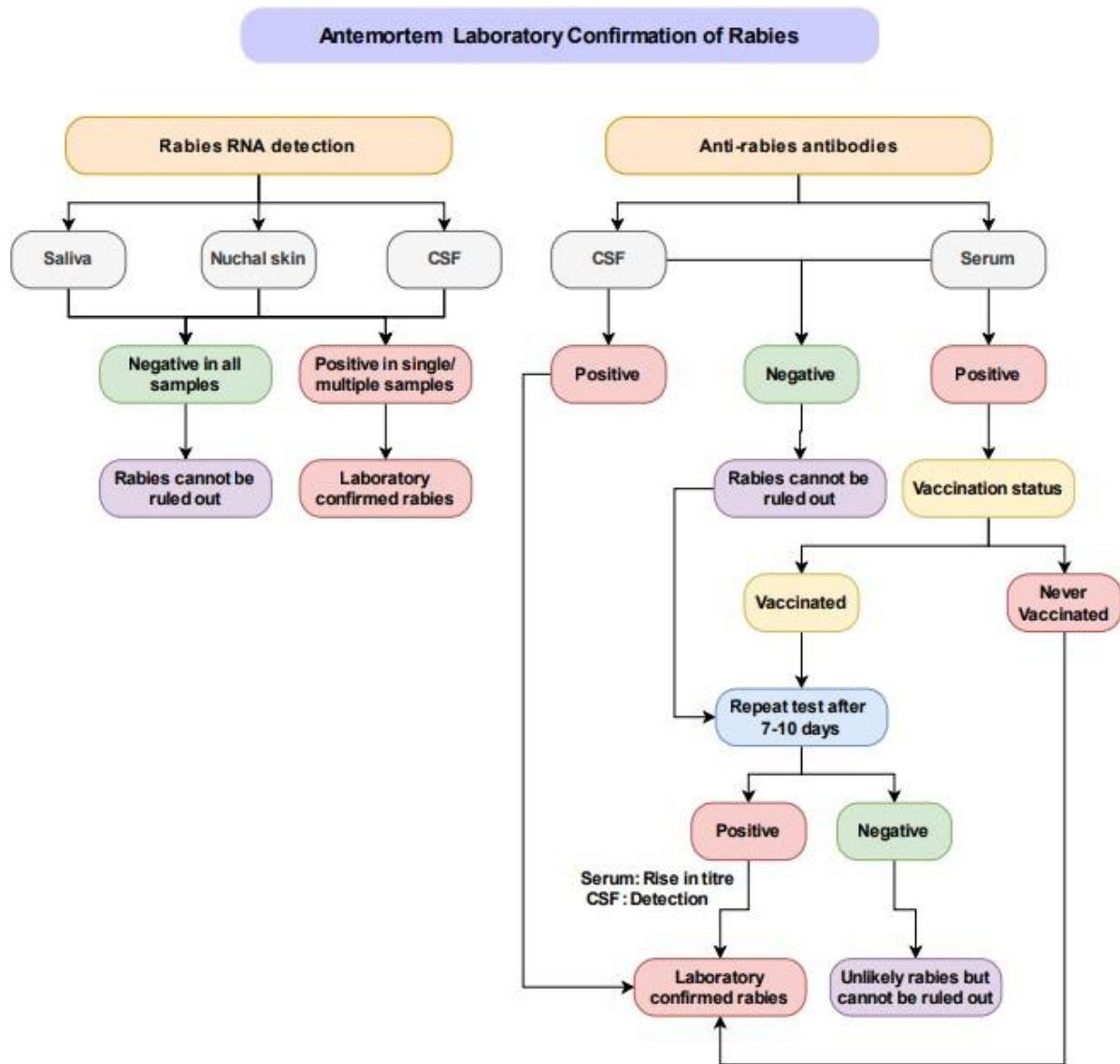


Fig 9: Algorithm for antemortem laboratory diagnosis of rabies in humans.

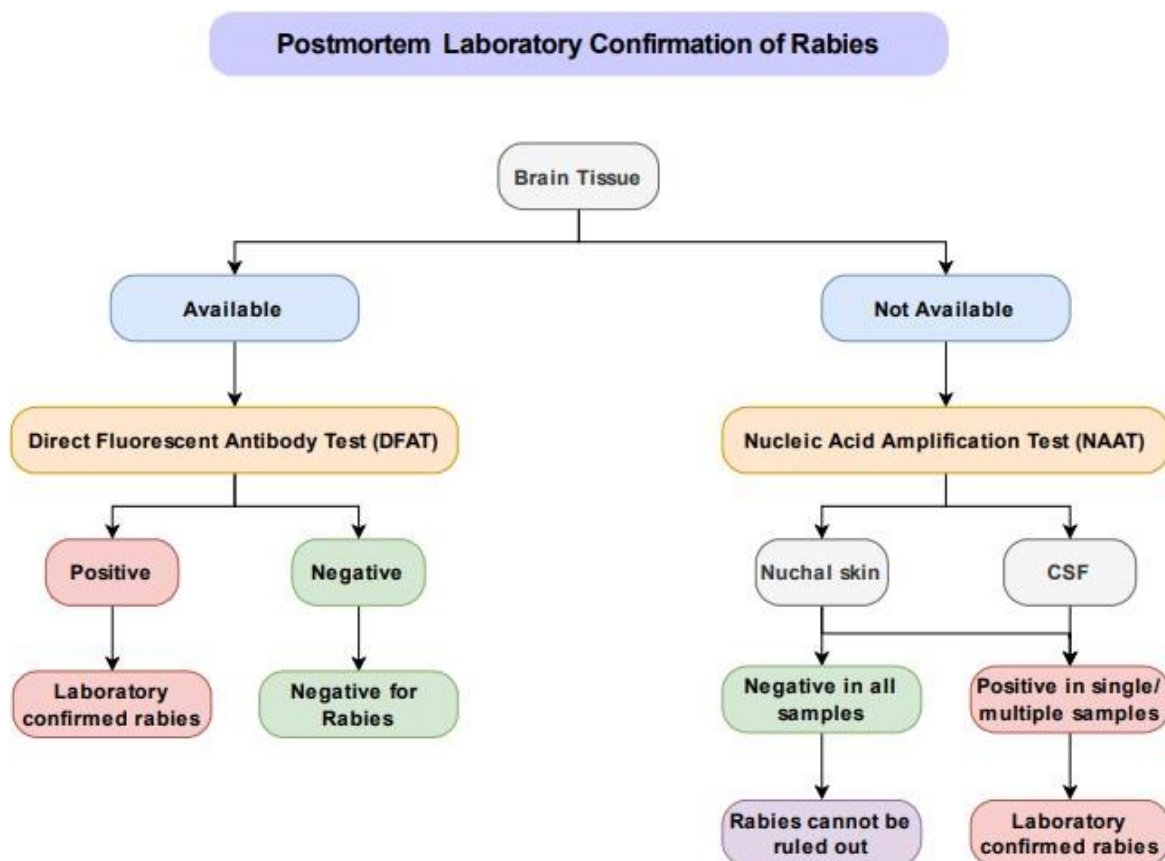


Fig 10: Algorithm for postmortem laboratory diagnosis of rabies in humans.

LIST OF LABORATORIES FOR DIAGNOSIS OF RABIES

Human Rabies Diagnostic Laboratories

1. Department of Neurovirology, NIMHANS, Bangalore 560029
2. Zoonosis Division, National Centre for Disease Control, Sham Nath Marg, Delhi – 110 054
3. Pasteur Institute of India, Coonoor- 64310, Tamil Nadu
4. Central Research Institute, Solan, Kasauli, Himachal Pradesh 173204
5. Haffkine Institute, Acharya Donde Marg Parel, Mumbai 400012, Maharashtra

Animal Rabies Diagnostic Laboratories

1. OIE Twinned Rabies Diagnostic Laboratory, Dept. of Microbiology, Veterinary College, KVAFSU, Bangalore
2. Rabies Diagnostic Laboratory, ICAR - National Institute of Veterinary Epidemiology and Disease Informatics, Yelahanka, Bengaluru
3. Department of Pathology, College of Veterinary and Animal Sciences, Mannuthy, Thrissur
4. Rabies Diagnostic Laboratory, Dept. of Animal Biotechnology, Madras Veterinary College, TANUVAS, Chennai

5. Institute of Animal Health and Veterinary Biologicals, Bellary Rd, Bengaluru
6. Disease Investigation Office, Dept. of Animal Husbandry, Palode, Thiruvananthapuram
7. Department of Pathology, College of Veterinary and Animal Sciences, Kerala Veterinary and Animal Sciences University, Pookode, Wayanad
8. Department of Microbiology, Anand Agricultural University, Anand
9. Department of Veterinary Microbiology, Bombay Veterinary College, Mumbai
10. Rabies Laboratory, Dept. of Veterinary Pathology, Ludhiana
11. Department of TVCC, Veterinary College, KVAFSU, Shivamoga
12. Department of Pathology, ICAR-Indian Veterinary Research Institute, Izzatnagar, Bareilly.

Points to Remember

- Rabies diagnostics are divided into ante-mortem (alive patients) and post-mortem (after death) tests, with brain tissue used post-mortem for definitive diagnosis.
- Ante-mortem tests include saliva, CSF, tears, serum, and skin biopsy from the nape of the neck, with multiple tests required due to the lack of a single confirmatory test.
- Specimens are handled as infectious, collected using strict aseptic techniques, and transported in leak-proof, cold-chain conditions to maintain sample integrity.
- Direct diagnostic tests include the gold-standard Direct Fluorescent Antibody Test (DFAT) for antigen detection, and molecular methods like RT-PCR for rabies RNA detection.
- Virus isolation methods like Rabies Tissue Culture Infection Test (RTCIT) or Mouse Inoculation Test (MIT) can confirm the presence of the virus but are time-consuming.
- Indirect diagnostic tests, such as ELISA and RFFIT, measure the presence of rabies antibodies and are useful for post-exposure surveillance or vaccination monitoring.
- Proper labelling, packaging, and timely transportation of samples are critical to preserving the integrity of rabies specimens, especially in tropical climates.

Two main diagnostic types –

- ### Selection of Diagnostic Methods –

-

Copyright © 2004 John Wiley & Sons, Inc.

RAREFS

Consultation Before Sample Submission

-

- Treat all samples from suspected cases as infectious.
- Collect specimens in leak-proof primary containers to avoid contamination and ensure safety during transportation.

Journal of Management Inquiry 20(4) 401-416

RAREES

Sampling Window Time (Days/Weeks)	Symptoms	Sample	Diagnostic Tests
Day 0 (After Exposure)	Asymptomatic or mild anxiety due to bite/exposure.	N/A	No immediate diagnostic tests recommended; prophylactic vaccination or RIG administration considered.
Day 1–7 (Incubation Period)	No symptoms; variable duration (typically 1–3 months post-exposure).	N/A	No diagnostic testing applicable; vaccination (PEP) is critical.
Day 7 Onwards (Prodromal Phase)	Fever, malaise, paresthesia/itching at the bite site.	Serum/CSF, saliva	RT-PCR for viral RNA from saliva; ELISA or RFFIT for rabies-neutralizing antibodies in serum/CSF.
Week 1–2 (Neurological Phase)	Hydrophobia, aerophobia, muscle spasms, hyperactivity, altered mental status.	Saliva, nuchal skin biopsy	RT-PCR for viral RNA from saliva; immunofluorescent antigen detection on nuchal biopsy.

© 2000 John Wiley & Sons, Inc.

REFERENCES

Sampling Window Time (Days/Weeks)	Symptoms	Sample	Diagnostic Tests
Week 1-2 (Neurological Phase)	Progressive neurological symptoms (paralysis, hypersalivation, agitation); autonomic instability.	CSF	Antibody detection (neutralizing or specific IgM/IgG).
Week 2 Onwards (Late Neurological)	Paralysis, coma, respiratory failure.	Saliva, CSF	Repeated RT-PCR; antibodies (serum/CSF).
Post-Mortem	Advanced neurological damage; death due to respiratory failure or cardiac arrest.	Brain tissue (hippocampus, brainstem, cerebellum)	Direct fluorescent antibody test (DFA); RT-PCR or antigen detection from brain tissue.

Journal of Interpersonal Violence 30(16)

WABEFC

[illegible]

Notes

1.Saliva	1.Corneal Impressions	1.Nuchal Skin Biopsy	1.Serum and CSF
- Collect 500 µL with a sterile pipette into a sterile container without preservatives. - Collect daily samples over three days, if possible. - Primary test: RT-PCR for rabies RNA detection.	- Use a marked slide and apply gentle pressure to the eye. - Air-dry the slide; process for the Direct Fluorescent Antibody Test (DFAT). <i>Note:</i> DFAT on corneal impressions is generally less reliable.	- Take a 5-7 mm deep biopsy from the nape, including hair follicles. - Tests include DFAT /DRIT for viral antigens, RT-PCR, and virus isolation by RTCIT.	- Collect 2-3 mL of each in sterile vials. - Detects rabies antibodies; serum (for unvaccinated) and CSF (irrespective of immunization). - Testing methods include ELISA, indirect immunofluorescence, and virus neutralization.

Use strict aseptic techniques and full PPE.
Animal restraint is crucial to avoid bites during collection.

Copyright © 1999 by John Wiley & Sons, Inc.

RAREFS

Post-mortem Specimen Types –

- Brain tissue is preferred for rabies diagnosis.
- Obtain through the occipital foramen route to avoid skull damage.
- If a full autopsy isn't feasible, use a Vim-Silverman needle to sample brain tissue.

- Store in a screw-top container: one portion half-submerged in glycerol-saline, the other in PBS.

- Use laboratory coats, aprons, gloves, and masks during specimen handling to prevent infection.

Center for New Jewish Studies, 3000

REFERENCES

Lab coat or gown

Head cover and mask

Protective disposable gloves

Protective eye gear/ goggles

Shoe/Footwear covers

Copyright © 1994 by John Wiley & Sons, Inc.

REFERENCES

- Include patient and sample details, animal species, and preservatives used.
- Use permanent markers for clarity and durability.
- Refer to the Sample Requisition Proforma for required information.

- **Double containment** - Primary container (watertight, leak-proof) inside a secondary container (e.g., zip-lock bag).
- Place secondary container into a rigid, insulated outer packaging box for secure transport.
- Include cooling agents and absorbent material between layers to maintain sample integrity.



Center for New Media, NYU, New York

WARRING

Notes

[illegible]

Comprehensive Learning Guide-Rabies | 68
Centre for One Health, NCDC, MoHFW

Session-6

Management of Rabies

Course No. 006	Session 6: Management of Rabies
Duration	10 minutes
Learning Objectives	• Explain about the palliative care measures for rabies patients • Recognize ways to manage symptoms like fever, anxiety, seizures, and hypersecretion • Describe hydration strategies for patients with hydrophobia or swallowing difficulties • Learn pain management and sedation protocols to minimize suffering in rabies patients
Pre-requisite knowledge/skill	• Expertise in rabies management • Familiarity with palliative care protocols • Ability to assess and manage symptoms holistically in terminal care
Competencies to be achieved	• Ability to deliver compassionate, effective end-of-life care for rabies patients • Understanding of symptom-specific management approaches (e.g., fever, pain, dehydration) • Skill in providing culturally sensitive care to patients and their families

MANAGEMENT OF PATIENTS WITH RABIES

Although rabies almost always results in the death of the patient, healthcare providers play a crucial role in delivering prompt, effective, and compassionate care. This can be achieved even in settings with limited resources, focusing on culturally sensitive, holistic management of the patient. Given the near inevitability of death in most cases, the primary focus should be on palliative care, with strong sedation (using barbiturates or morphine) and avoidance of invasive measures such as intubation or life support once rabies is confirmed.

In cases of rabies encephalomyelitis, alleviating the patient's symptoms and distress becomes the primary concern of the medical staff. However, in many rabies-endemic regions, patients suspected of having rabies are often considered untreatable and are either sent home without guidance or drugs, or isolated and neglected in healthcare facilities. Such practices disregard the fundamental medical duty to relieve suffering, even when there is no chance of cure.

Palliative Care in Rabies

Compassionate care is essential in minimizing suffering during palliative treatment for rabies patients. To prevent triggering spasms caused by hydrophobia or aerophobia, patients should be placed in a calm, quiet environment, ideally in a dimly lit, draught-free, single-bed room. If restraint is needed, it should be done initially with loose, comfortable ties, accompanied by sedation. Families should be allowed to communicate with the patient with dignity, safety, and privacy in accordance with their cultural and religious beliefs, while non-essential visitors, including hospital staff, should be restricted. However, regular monitoring is crucial to provide supportive care as needed.

Thirst and Dehydration

Patients with hydrophobia may be unable to drink, and those with paralytic rabies may have difficulty swallowing, leading to dehydration and extreme thirst. Small amounts of fruit, such as bananas or citrus, can help alleviate thirst, and the patient's lips and mouth can be moistened with a sponge. Rehydration should be achieved via intravenous (IV) fluids, with a stable IV line immobilized using a splint. Isotonic fluids, such as 5% glucose, 0.9% saline, or Ringer's lactate, are recommended. Other routes for administering fluids include subcutaneous, intraosseous, intraperitoneal, or intrarectal, depending on available resources.

Fever

Physical methods of cooling, such as tepid sponging and fanning, are often intolerable for patients with rabies. Therefore, fever must be managed pharmacologically with antipyretics like aspirin, ibuprofen, diclofenac, or paracetamol, which can be administered via IV, intramuscular (IM), or rectal routes. If the fever is neurogenic in origin, standard antipyretics may be ineffective.

Drugs like baclofen, bromocriptine, amantadine, dantrolene, and propranolol, though not widely available in resource-limited settings, have shown efficacy in treating central hyperthermia.

Anxiety, Agitation, and Seizures

Benzodiazepines, such as diazepam, are the first-line treatment for anxiety, agitation, and seizures in rabies patients. They can be administered via IV, IM, or rectally, but care must be taken to avoid rapid IV injection, which could depress respiration. Diazepam helps to ease the patient's suffering and allows the family time to consider end-of-life preferences, such as taking the patient home. Midazolam is another option, with its short half-life allowing for frequent IM, subcutaneous, or IV administration, titrated to the patient's condition.

Hypersecretion (Salivation, Lacrimation, Sweating)

Excessive secretions may be controlled with anticholinergic agents, such as hyoscine (scopolamine) hydrobromide, which reduces parasympathetic secretory activity.

Pain Management

Opioids, including morphine, should be used when available to manage pain and discomfort in rabies patients. Morphine can be administered IV, IM, subcutaneously, or rectally. Fentanyl patches may also be useful, particularly in terminal care when the patient is at home. As the disease progresses, complications involving the respiratory, cardiovascular, neurological, and gastrointestinal systems will arise.

**A detailed list of the medications and their dosages to be used for the management of rabies symptoms is provided in Annexure – 1.*

Points to Remember

- Healthcare providers should focus on palliative care, using sedation and avoiding invasive life-support measures once rabies is confirmed, as the disease is almost always fatal.
- Patients with rabies should be treated with dignity and compassion, with efforts to alleviate distressing symptoms such as hydrophobia, fever, anxiety, and pain.
- Dehydration is a major concern, and rehydration through intravenous fluids is crucial, with other parenteral routes available depending on the resources.
- Fever in rabies patients may need antipyretics, while neurogenic fever may require specialized drugs, though these may be limited in resource-poor settings.
- Opioids and benzodiazepines should be administered carefully to manage pain, agitation, and seizures, with attention to maintaining patient comfort and family involvement in end-of-life care.

Palliative Care in Rabies

- Although rabies is almost always fatal, healthcare providers play a critical role in delivering **compassionate care**, even in resource-limited settings.
- The **primary focus** should be on **palliative care**, using **sedation** (barbiturates or morphine) and **avoiding invasive procedures** like intubation once rabies is confirmed.
- In rabies encephalomyelitis cases, **symptom relief** is the priority.
- To avoid triggering spasms, place the patient in a **calm, quiet, dimly lit, and draught-free room**.
- Use **gentle restraints** only if necessary, with sedation.
- Allow family communication respectfully, considering cultural and religious beliefs, while limiting non-essential visitors.
- **Regular monitoring** is essential for supportive care.

Centre for One Health, NCDC, MoHFW

RABIES

Notes

Palliative Care in Rabies

Thirst and Dehydration

Hydrophobia and difficulty swallowing in rabies can lead to dehydration. Small amounts of fruit and moistening the mouth can help, with IV fluids (e.g., 5% glucose, saline) for rehydration. Other options include subcutaneous, intraosseous, or intrarectal fluids.

Fever

Pharmacological management with antipyretics (aspirin, ibuprofen, paracetamol) is preferred, as physical cooling may be intolerable. For neurogenic fever, drugs like baclofen or propranolol may be needed, though they may not be widely available.

Anxiety, Agitation & Seizures

Diazepam or midazolam are first-line options, administered IV, IM, or rectally, to ease symptoms and allow families time for end-of-life decisions.

Hypersecretion

Excessive secretions may be controlled with anticholinergic agents, such as hyoscine (scopolamine) hydrobromide, which reduces parasympathetic secretory activity.

Pain Management

Opioids, including morphine, should be used when available to manage pain and discomfort in rabies patients.

Centre for One Health, NCDC, MoHFW

RABIES

Session-7

Prevention of Rabies

Course No. 007	Session 7: Prevention of Rabies
Duration	20 minutes
Learning Objectives	• Describe the components of Post-Exposure Prophylaxis (PEP) for rabies • Detail the wound management process • Explain vaccination protocols • Understand the use of Rabies Immunoglobulin (RIG) in high-risk cases • Recognize management of special situations (pregnancy, immunocompromised, etc.)
Pre-requisite knowledge/skill	• Familiarity with rabies exposure and PEP protocols • Understanding of immunization guidelines • Ability to effectively communicate the urgency of PEP
Competencies to be achieved	• Thorough comprehension of wound management, including disinfection • Understanding of the vaccination schedules for PEP • Knowledge of Rabies Immunoglobulin (RIG) and its role in exposure prophylaxis • Ability to evaluate and manage special cases such as pregnancy, lactation, and immunocompromised individuals

POST-EXPOSURE PROPHYLAXIS

Administering PEP can be lifesaving, offering immediate relief to both bite victims and their caregivers. The urgency of this treatment cannot be overstated, as any delay can result in fatal outcomes. Importantly, conditions such as pregnancy, infancy, advanced age, or concurrent illnesses do not contraindicate anti-rabies treatment.

PEP is a comprehensive, multi-step approach designed to prevent the onset of rabies. Each component is vital and should be administered simultaneously when applicable, depending on the exposure category. The three key elements include:

1. Wound Management and Exposure Assessment
2. Active Immunization with Anti-Rabies Vaccines (ARV)
3. Passive Immunization with Rabies Immunoglobulin (RIG) when necessary

EXPOSURE ASSESSMENT

Rabies exposure primarily occurs through bites, scratches, or licks on broken skin. The physician's first task is to assess the wound and categorize the exposure risk. Based on this assessment, appropriate treatment is initiated, as outlined in relevant guidelines.

This structured approach ensures that each step in PEP is effectively implemented, reducing the likelihood of a rabies infection becoming fatal.

Table 3: Type of contact, exposure and recommended post-exposure prophylaxis

Category of Exposure	Type of Exposure	Recommended Post-Exposure Prophylaxis
Category I	• Touching or feeding of animals • Licks on intact skin • Contact of intact skin with secretions/excretions of rabid animal or human case	• None (if reliable case history is available)
Category II	• Nibbling of uncovered skin • Minor scratches or abrasions without bleeding • Licks on broken skin • Contamination of mucous membrane with saliva (e.g., from licks)	• Wash exposed areas with soap and running water for 15 minutes and then apply antiseptic • Rabies vaccine
Category III	• Single or multiple transdermal bites or scratches	• Wound management: Wash exposed areas with soap and running water for 15 minutes, then apply antiseptic • Rabies Immunoglobulin • Rabies vaccine

NOTE: Bites by wild animals and all bites in forest areas should be considered as Category III exposure and treated accordingly

WOUND MANAGEMENT

Wound Cleansing

Immediate and thorough washing of all wounds is essential as the first step in wound management. It is recommended to flush and cleanse the wound with soap and running water for a minimum of 15 minutes. If a virucidal agent like Povidone Iodine is available, it should be applied after washing. In the absence of soap or virucidal agents, washing with water alone is recommended with particular attention to rinsing the eyes and mucosa if involved.

Timely washing is crucial to maximize the removal of viral particles, especially when wounds are fresh. Even if a patient presents after a delay, proper wound care is still necessary, as the rabies virus may persist and even replicate at the bite site. The application of irritants (e.g., oil, turmeric, lime, etc.) is not only unnecessary but harmful. If these substances have been applied, they should be removed with gentle washing using soap or detergent, followed by rinsing with ample water.

Antiseptic Application

An antiseptic agent, such as alcohol, should be applied to the affected area after proper wound cleaning. Tetanus prophylaxis and antibiotic treatment should be administered as necessary to prevent secondary infections.

Suturing Wounds

In most cases, severe bite wounds are managed with daily dressings, and suturing is performed secondarily, as it reduces the risk of infection and results in better cosmetic outcomes. If suturing is needed, it is critical to first infiltrate the wound with Human or Equine Rabies Immunoglobulin (RIG). Suturing should be delayed for several hours to ensure the proper diffusion of the immunoglobulin into the tissues before applying minimal sutures.

ROUTE OF ADMINISTRATION OF RABIES VACCINE

The National Rabies Control Program endorses the use of the intradermal route for rabies vaccination due to its economic and immunological advantages. Administering the vaccine intradermally significantly reduces the overall quantity of vaccine required for full pre- or post-exposure prophylaxis, which translates into cost savings. Numerous studies have demonstrated that intradermal administration induces an immune response comparable to that achieved via intramuscular injection.

Intradermal Route

The updated regimen recommended by the Thai Red Cross (TRC) involves administering 0.1 mL of the rabies vaccine at two separate sites on the deltoid area on days 0, 3, 7, and 28 (2-2-2-0-2 schedule). Notably, there is no dose administered on day 14. This regimen is currently the only one approved by the Drug Controller General of India (DCGI) for intradermal rabies vaccination.

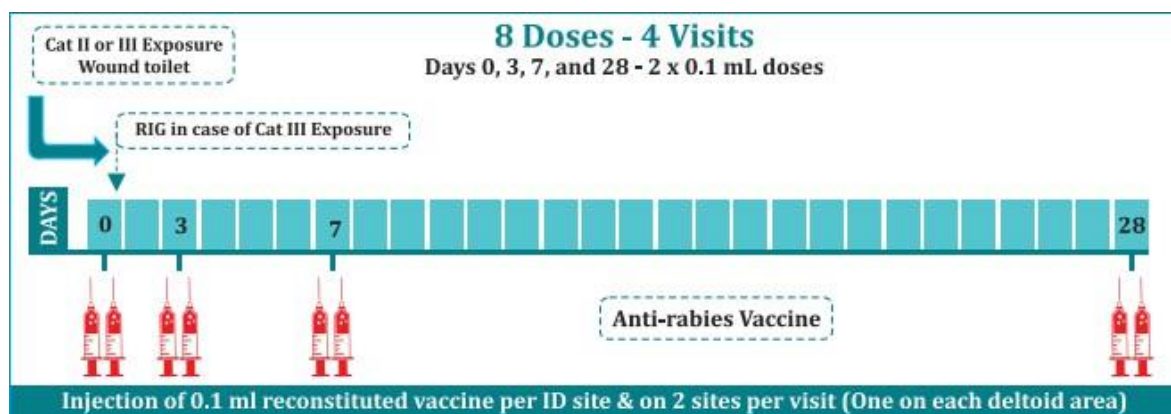


Fig 11: Updated Thai Red Cross Regimen

Technique for Intradermal Injection

The process begins with reconstituting the lyophilized vaccine using the diluent provided by the manufacturer. The specific volume of the diluent (0.5 mL or 1 mL) is determined by the vaccine brand and must not be altered. The vaccine should be used immediately after preparation or within six hours if stored between 2-8°C.

The World Health Organization (WHO) has recommended a standardized dose of 0.1 mL per intradermal site for all cell culture rabies vaccines (CCVs) with a potency of at least 2.5 IU per intramuscular dose. This dosage is based on rigorous clinical trials conducted in 2004.

Using a 1 mL syringe, 0.2 mL of vaccine is drawn for each patient (0.1 mL per site). To minimize waste, it is crucial to expel any air bubbles from the syringe. The injection should be performed using the BCG inoculation technique, where the skin is stretched, and the needle is inserted almost parallel to the skin surface with the bevel facing upward. A small, raised bleb, giving the skin an “orange peel” appearance, should appear upon correct administration. This process is repeated for the second injection site on the opposite deltoid area.

Any remaining vaccine in an opened vial can be stored at 2-8°C for up to six hours. To avoid wastage, leftover vaccine can be used for pre-exposure prophylaxis (PrEP), particularly for individuals in high-risk professions, such as those involved in animal disease control.

Intramuscular Route

The Essen regimen, which involves intramuscular injections, is another approved method for rabies vaccination. It follows a 1-1-1-1-1 schedule, with one dose administered on days 0, 3, 7, 14, and 28. The intramuscular injection is given in the deltoid region for adults or the anterolateral thigh for young children. The gluteal region is not used due to poor absorption.

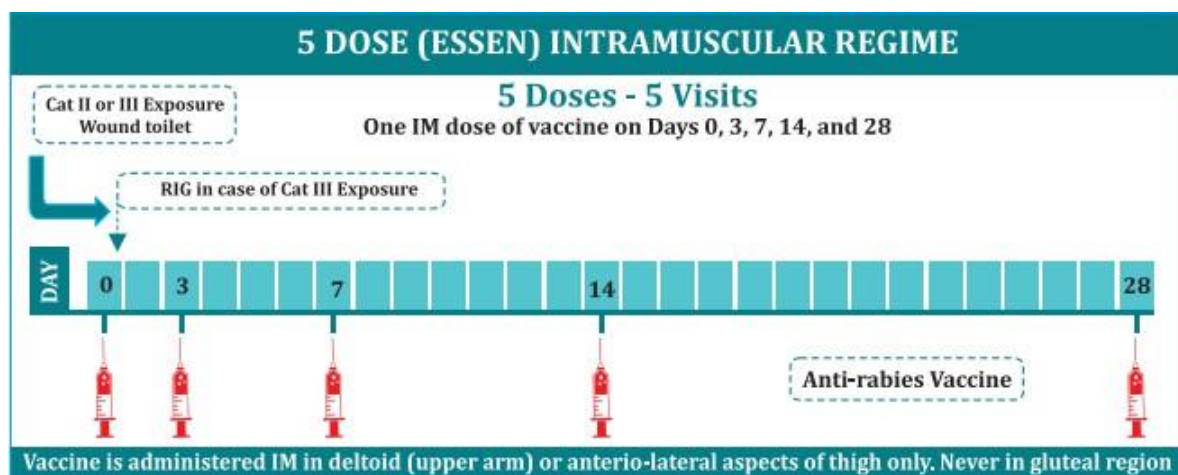


Fig 12: 5 Dose (Essen) Intramuscular Regime

Switching between intradermal and intramuscular routes, or between different vaccine brands, during post-exposure prophylaxis (PEP) is not recommended. Completing the full PEP course, regardless of the route, is essential to prevent rabies progression. Incomplete PEP may result in the development of the disease.

PASSIVE IMMUNIZATION WITH RABIES IMMUNOGLOBULIN (RIG)

Rabies immunoglobulins (RIGs) are antibodies that neutralize the rabies virus at the site of exposure. These are administered in conjunction with the rabies vaccine to provide immediate passive immunity, covering the window period before the vaccine induced immune response develops. RIGs are particularly crucial for individuals with severe (Category III) exposures and immunocompromised patients.

Types Of Rabies Immunoglobulin (RIG)

Two types of the RIG are available for passive immunization: equine rabies immunoglobulin (ERIG) and human rabies immunoglobulin (HRIG). ERIG, derived from horses, carries a slight risk of anaphylactic reactions, although this risk has been significantly reduced with modern purification techniques. Skin tests are generally not required for ERIG administration. HRIG, derived from human donors, is considered safer and does not require a skin sensitivity test.

Administration Guidelines

The dose of ERIG is 40 IU per kg body weight, while HRIG is administered at 20 IU per kg body weight. The immunoglobulin should be brought to room temperature before administration and should be infiltrated directly into the wound to neutralize the virus locally. Care should be taken to avoid excessive pressure during injection, especially in areas such as the fingers, toes, and ear lobes, where compartment syndrome could occur.

Systemic administration of RIG (via intramuscular injection away from the wound site) is of limited value and is generally not recommended unless small, unreported wounds are suspected. After administering RIG, the patient should be observed for 15–20 minutes, and tetanus toxoid or a Td vaccine should also be provided.

Rabies immunoglobulin (RIG) is recommended for individuals with severe exposure (Category III) to rabies but is not advised for those who have previously received rabies vaccines or if more than seven days have passed since the first dose of post-exposure prophylaxis (PEP). RIG is most effective when administered locally and as early as possible, with maximum infiltration into and around the wounds. If the available RIG is insufficient to infiltrate all wounds, it can be diluted with normal saline (NS) to ensure adequate coverage.

There are two types of RIG: Human Rabies Immunoglobulin (HRIG), which is administered at 20 IU/kg body weight (BW), with a maximum dose of 1500 IU, and Equine Rabies Immunoglobulin (ERIG), given at 40 IU/kg BW, with a maximum dose of 3000 IU.

Precautions while administering RIGs

- Warm RIG vial(s) to room temperature before administration.
- Administer RIG preferably before anti-rabies vaccine, but no later than 7 days after vaccination start.
- Do not mix RIG and vaccine in the same syringe or inject at the same site.
- Avoid blood vessels and nerves when infiltrating RIG into bite wounds; consider anatomical feasibility.
- Take care to prevent compartment syndrome when injecting into fingertips.
- For small children with multiple bites, dilute RIG with sterile saline if volume is insufficient.
- Observe patient for 1 hour post-ERIG administration and avoid giving RIG on an empty stomach.
- Pregnancy is not a contraindication for RIG or vaccination.

Test Dose (ERIG)

- Inject 0.1 ml of 1:10 dilution of the ERIG in normal saline, ID over flexor aspect of forearm.
- Observe for wheal, erythema, induration, itching, tachycardia, fall in BP, feeble pulse.
- Positive test reaction – Induration >10mm
- If skin test is positive – HRIG is preferred

- If ERIG must be administered, then pre-treat with Adrenaline with Antihistamine before administering full dose.



Fig 13: Induration, erythema with pseudopodia

Infiltration of RIG around the wound:

- The entire immunoglobulin dose, or as much as anatomically possible should be infiltrated carefully into the wound(s) or exposure sites.
- Evidence suggests that injecting the remaining RIG volume intramuscularly at a distance from the wound provides little or no additional protection against rabies as compared with infiltration of the wound(s) alone.



Fig 14: Infiltration of RIG around the wound

MANAGEMENT OF RABIES PEP DURING RE-EXPOSURE FOR PREVIOUSLY IMMUNIZED INDIVIDUALS

Previously Immunized Individuals with Documented Prep or Pep

- Wound management: Thorough washing and disinfection.
- Vaccine administration options:
 - Intradermal (ID) vaccine at a single site on days 0 and 3.
 - Intramuscular (IM) vaccine (entire vial) on days 0 and 3.
- Rabies immunoglobulin (RIG): Not required.

Individuals Without Documented Pep Equivalent to Prep

Full PEP should be administered, including RIG if necessary.

Re-Exposure Within 3 Months of Complete Pep/Prep

- Only thorough wound cleaning is required.
- If re-exposure occurs after 3 months, follow the vaccine schedule outlined for PEP.

PEP IN IMMUNOCOMPROMISED PATIENTS

Patients with immune deficiencies (e.g., HIV/AIDS, chemotherapy, long-term steroid use) often show reduced or absent neutralizing antibody responses to rabies vaccines. In cases of severe immunosuppression, consult an infectious disease specialist or the patient's treating clinician.

- Use the most immunogenic vaccines and high-quality RIG.
- Meticulous wound cleaning is critical.

Antibody response monitoring: If feasible, assess RABV-neutralizing antibody levels 2–4 weeks after the last vaccine dose to determine the need for additional doses.

For immunocompromised individuals, PEP protocol includes:

- Wound care: Thorough washing and antiseptic application.
- RIG administration for both Category II and III exposures.
- Complete vaccination course (IM) for both exposure categories.
- Antibody estimation 14 days post-vaccination, if available, to assess the need for further doses.

ANIMAL CONSIDERATIONS IN PEP

Observation of Biting Dog/Cat

- A 10-day observation period applies only to dogs and cats. For other animals, this period is not valid due to insufficient understanding of rabies natural history.
- If the observed animal remains healthy, PEP may be modified to a pre-exposure vaccination by skipping the day-14 vaccine dose and administering the next dose on day 28.

Vaccination Status of Biting Animal

- The animal's rabies vaccination status should not be considered in risk assessment, as vaccinated animals can still transmit rabies in cases of ineffective vaccination.
- PEP should be administered irrespective of the animal's vaccination history.

Provoked Vs. Unprovoked Bite

- Provoked bites should still be treated as potential rabies exposures, as the behavior of the animal is often unclear.
- PEP should be initiated immediately.

CONTRAINDICATIONS AND PRECAUTIONS IN PEP

- There are no absolute contraindications for PEP. It is safe for infants, pregnant women, and immunocompromised individuals (e.g., HIV/AIDS).
- All PEP recipients should be monitored for adverse reactions, with antihistamines or epinephrine administered in cases of hypersensitivity or anaphylaxis.

ADVERSE REACTIONS TO RABIES BIOLOGICS

- Common side effects: Mild and transient, including fever, headache, dizziness, or localized erythema, pain, or swelling at the injection site.
- Management of side effects: Anti-inflammatory or antipyretic medications (e.g., ibuprofen, acetaminophen) are effective. Antihistamines may be used for individuals with a history of hypersensitivity.
- Severe reactions: Patients with a history of severe reactions should consult experts, especially considering rabies fatality. Any serious adverse events should be reported to national pharmacovigilance systems.

SPECIAL SITUATIONS

1. Pregnancy and Lactation: PEP is safe and effective.
2. Immunocompromised Patients (e.g., HIV/AIDS): A complete vaccination course (IM route) should be administered, with RIG for Category II & III exposures.
3. Consumption of Rabid Animal Products: PEP is not required for milk consumption if the milk is boiled. However, PEP should be initiated if meat from a rabid animal is consumed.

PRE-EXPOSURE PROPHYLAXIS

Pre-exposure prophylaxis (PrEP) is recommended for individuals at high risk of rabies exposure. This includes:

1. Laboratory personnel handling rabies virus or infected materials, clinicians, and healthcare workers treating rabies patients.
2. Veterinarians, animal handlers, and dog catchers.
3. Wildlife officers and quarantine personnel.
4. Travelers moving from rabies-free regions to rabies-endemic areas.

The Indian Association of Pediatrics (IAP) suggests considering PrEP for children, which can be administered voluntarily.

SCHEDULE & DOSAGE

Vaccine Administration

- For intramuscular (IM) administration, a full vial of vaccine is given.
- For intradermal (ID) administration, 0.1 ml is administered at one site on days 0, 7, and either day 21 or 28.

Monitoring Antibody Titers

- High-risk individuals should undergo serological monitoring of rabies-neutralizing antibody levels every 6 months for the first two years post-vaccination.
- A booster dose is recommended if the antibody titer falls below 0.5 IU/ml.
- After this two-year period, antibody titer checks should be performed every two years.

Booster Vaccination

- In most cases, immunological memory persists for years. A booster is required only if neutralizing antibody titers decrease to below 0.5 IU/ml.

- Individuals who have successfully completed pre-exposure immunization and are subsequently exposed to rabies will only need two booster doses of the vaccine, administered on days 0 and 3.
- Rabies immunoglobulin (RIG) is not necessary for these individuals.

Table 6: Summary of PEP

Type of Prophylaxis	Route of Administration	Dose of Vaccine	Day of Dose	Number of injections Per Visit	Total Number of Visits	Site of Injection
Post Exposure Prophylaxis	Intra Dermal	0.1ml per dose	Day 0, 3, 7 and 28	2	4	Adults: Deltoid Muscle, Infants and small Children: Anterolateral Thigh
	Intra Muscular	1 entire vaccine vial	Day 0, 3, 7, 14 and 28	1	5	
Pre-Exposure Prophylaxis	Intra Dermal	0.1ml per dose	Day 0, 7, and 21 or 28	1	3	
	Intra Muscular	1 entire vaccine vial	Day 0, 7, and 21 or 28	1	3	
Re-exposure	Intra Dermal	0.1ml per dose	Day 0 & 3	1	2	
	Intra Muscular	1 entire vaccine vial	Day 0 & 3	1	2	

Points to Remember

- The management of animal bite cases follows a structured approach
 - a. Begin with thorough local wound treatment and exposure assessment.
 - b. Administer anti-rabies vaccination, either through intramuscular (IM) or intradermal (ID) routes.
 - c. Administer rabies immunoglobulin (RIG) when indicated and provide counselling to the patient and their caregivers.
- Proper wound care alone can reduce the risk of rabies infection by approximately 50%. Wounds should be washed as soon as possible with soap and water for up to 15 minutes. Suturing should be avoided.
- For Category I exposure (touching or feeding of animals, or licks on intact skin), no further treatment is needed beyond washing exposed skin, provided the history is reliable.
- Category II exposure (minor scratches or abrasions without bleeding or nibbling on uncovered skin) requires local wound treatment along with anti-rabies vaccination.
- Category III exposure (transdermal bites or scratches with blood oozing, licks on broken skin, or saliva contact with mucous membranes) necessitates wound management, along with administration of both rabies immunoglobulin and anti-rabies vaccine.
- RIG should also be administered in cases of Category II or III exposure to wild animals, or if the patient is immunocompromised.
- There are no absolute contraindications for post-exposure prophylaxis (PEP).
- Anti-rabies vaccine should be injected into the deltoid region for adults, and the anterolateral thigh for young children. It should never be administered in the gluteal region.
- The updated Thai Red Cross (TRC) intradermal regimen (2-2-2-0-2), approved by the DCGI, involves administering 0.1 ml of vaccine at two sites in the deltoid region on days 0, 3, 7, and 28. No dose is given on day 14.
- The Essen intramuscular regimen (1-1-1-1-1), also approved by the DCGI, requires one dose of the vaccine to be given intramuscularly on days 0, 3, 7, 14, and 28.
- RIG is administered only once, ideally at or shortly after the initiation of post-exposure vaccination. It is not indicated if the patient has previously received pre-exposure prophylaxis (PrEP) or PEP, or after the seventh day following the first rabies vaccine dose.

- Administering PEP can be life-saving – Offers immediate relief to both bite victims and their caregivers.
- Pregnancy, infancy, advanced age, or concurrent illnesses do not contraindicate anti-rabies treatment.



RABIES

CATEGORY-1

- 

HAND WASH

CATEGORY-2

- 

HAND WASH

ARV

CATEGORY-3

-

RIG

- **Wash the site of the bite/scratch** - Immediately after exposure thoroughly wash the site of the bite or scratch with copious amounts of water & soap.
- Wound washing is the first life-saving measure.
- Apply an iodine-containing, or similarly viricidal, topical preparation (if available).
- Suturing only if required and after RIG.
- Simple, Non-occlusive dressing can be done if required.
- Tetanus toxoid and antibiotics to be given as appropriate.



Never apply

Substances like chili, salt, lemon, herbs, etc.
If applied, remove with gentle washing using soap or detergent, followed by rinsing with ample water.

5 Visits, with 1 site on each visit

DOSE: One IM dose (entire vial) into Deltoid (or thigh)



4 Visits, with 2 site on each visit

DOSE: 0.1ml per dose in two different lymphatic drainage sites (usually the left & right upper arm i.e. deltoid region of each arm)

[illegible]

Notes



Copyright © 2004 John Wiley & Sons, Inc.

BARRIES

Notes

- recommended for severe exposure (category III)
- not recommended if you have ever received rabies vaccines
- not recommended if you have received your first PEP dose more than 7 days ago

- RIG is most effective when administered locally and early.
- Infiltrate as much as possible into and around the wounds
- If RIG is insufficient to infiltrate all the wounds dilute it with NS

Human Rabies Immunoglobulin (HRIG)

20 IU/kg BW (Max of 1500 IU)



Equine Rabies Immunoglobulin (HRIG)

40 IU/kg BW (Max of 3000 IU)

Copyright © 1998 by John Wiley & Sons, Inc.

BARRIS

- Warm RIG vial(s) to room temperature before administration.
- Administer RIG preferably before anti-rabies vaccine, but no later than 7 days after vaccination start.
- Do not mix RIG and vaccine in the same syringe or inject at the same site.
- Avoid blood vessels and nerves when infiltrating RIG into bite wounds; consider anatomical feasibility.
- Take care to prevent compartment syndrome when injecting into fingertips.
- For small children with multiple bites, dilute RIG with sterile saline if volume is insufficient.
- Observe patient for 1 hour post-ERIG administration and avoid giving RIG on an empty stomach.
- Pregnancy is not a contraindication for RIG or vaccination.



Copyright © 1994 Blackwell Science Ltd, *Journal of Internal Medicine* 235: 449–455

REFERENCES

- Inject 0.1 ml of 1:10 dilution of the ERIG in normal saline, ID over flexor aspect of forearm.
- Observe for wheal, erythema, induration, itching, tachycardia, fall in BP, feeble pulse.
- Positive test reaction – Induration >10mm
- If skin test is positive – HRIG is preferred
- If ERIG has to be administered then pre-treat with Adrenaline with Antihistamine before administering full dose.



Induration, erythema with pseudopodia

[image source: <https://www.in.gov/IDC%20manual%20>]

Copyright © 2004 John Wiley & Sons, Inc.

WARNING

- The entire immunoglobulin dose, or as much as anatomically possible should be infiltrated carefully into the wound(s) or exposure sites.
- Evidence suggests that injecting the remaining RIG volume intramuscularly at a distance from the wound provides little or no additional protection against rabies as compared with infiltration of the wound(s) alone.



Image source: <https://cdn.royal.gov.in/wp-content/uploads/2024/02/Guidelines-for-Babies-Photographed>

Copyright © 1994 by John Wiley & Sons, Inc.

RABIES

Previously Immunized Individuals with Documented PrEP or PEP

- Wound management: Thorough washing and disinfection.
- Vaccine administration options:
 - ❑ Intradermal (ID) vaccine at a single site on days 0 and 3.
 - ❑ Intramuscular (IM) vaccine (entire viral) on days 0 and 3.
- Rabies immunoglobulin (RIG): Not required.

Individuals without Documented PEP Equivalent to PrEP

- Full PEP should be administered, including RIG if necessary.

Re-exposure within 3 Months of Complete PEP/PrEP

- Only thorough wound cleaning is required.
- If re-exposure occurs after 3 months, follow the vaccine schedule outlined for PEP.



Copyright © 1994 by The McGraw-Hill Companies, Inc.

RABIES

Patients with immune deficiencies show reduced or absent neutralizing antibody responses to rabies vaccines



HIV/AIDS



Chemotherapy



Long-term Steroid Use

- Wound care - Thorough washing and antiseptic application.
- RIG administration for both Category II and III exposures.
- Complete vaccination course (IM) for both exposure categories.
- Antibody estimation 14 days post-vaccination, if available, to assess the need for further doses.

Center for New Media, MIT, Cambridge

RABIES

Observation of Biting Dog/
Cat



A 10-day observation period applies only to dogs and cats.

If the observed animal remains healthy, PEP may be modified to a pre-exposure vaccination

Vaccination Status of Biting
Animal

As vaccinated animals can still transmit rabies in ineffective vaccination.

PEP should be administered irrespective of the animal's vaccination history.

Provoked vs. Unprovoked Bite



Provoked bites should still be treated as potential rabies exposures

PEP should be initiated immediately.

Journal for the Study of the New Testament, 30 (2007), 28–40

RABIES

[illegible]

Post-Exposure Prophylaxis

Contraindications and Precautions in PEP

- Safe for infants, pregnant women, and immunocompromised individuals; no absolute contraindications.
- Watch for adverse reactions; use antihistamines or epinephrine for hypersensitivity or anaphylaxis.

Adverse Reactions to Rabies Biologics

- Mild, like fever, headache, dizziness, or localized pain/swelling at the injection site.
- Use anti-inflammatory or antipyretic meds (e.g., ibuprofen, acetaminophen); antihistamines for those with hypersensitivity history.
- Consult experts if severe history; report serious events to national pharmacovigilance.

RABIES

Special Situations

Pregnancy and Lactation



PEP is safe
and
effective.

Immunocompromised Patients



A complete vaccination course (IM route) should be administered, with RIG for Category II & III exposures.

Consumption of Rabid Animal Products



PEP is not required for milk consumption if the milk is boiled.

RABIES

Pre-Exposure Prophylaxis (PrEP)

High Risk Groups



Laboratory personnel handling rabies virus or infected materials, clinicians, and healthcare workers treating rabies patients.



Veterinarians, animal handlers,
and dog catchers.



Wildlife officers and quarantine personnel.



Travellers moving from rabies-regions to rabies-endemic areas.

RABIES

Pre-Exposure Prophylaxis (PrEP)

Vaccine Administration

- IM (a full vial of vaccine) / ID (0.1 ml is administered at one site) on days 0, 7, and either day 21 or 28.

Monitoring Antibody Titres

- High-risk individuals should monitor rabies antibody levels every 6 months for the first 2 years post-vaccination.
- If titers fall below 0.5 IU/ml, a booster dose is recommended.
- After 2 years, check antibody levels every 2 years.

Booster Vaccination

- Immunological memory lasts for years; boosters are needed only if antibody levels drop below 0.5 IU/ml.
- Those with prior pre-exposure vaccination need only two booster doses on days 0 and 3 if exposed.
- Rabies immunoglobulin (RIG) is not needed for these individuals.

RABIES

Notes

[illegible]

Summary of PEP

Type of Prophylaxis	Route of Administration	Dose of Vaccine	Day of Dose	Number of injections Per Visit	Total Number of Visits	Site of Injection
Post Exposure Prophylaxis	Intra Dermal	0.1ml per dose	Day 0, 3, 7 and 28	2	4	Adults: Deltoid Muscle, Infants and small
	Intra Muscular	1 entire vaccine vial	Day 0, 3, 7, 14 and 28	1	5	
Pre-Exposure Prophylaxis	Intra Dermal	0.1ml per dose	Day 0, 7, and 21 or 28	1	3	Children: Anterolateral Thigh
	Intra Muscular	1 entire vaccine vial	Day 0, 7, and 21 or 28	1	3	
	Intra Dermal	0.1ml per dose	Day 0 & 3	1	2	
Re-exposure	Intra Dermal	0.1ml per dose	Day 0 & 3	1	2	
	Intra Muscular	1 entire vaccine vial	Day 0 & 3	1	2	

Centre for One Health, NCDC, MoHFW

RABIES

Notes

Session-8

Risk Communication & Community Engagement

Course No. 008	Session 8: Risk Communication & Community Engagement
Duration	15 minutes
Learning Objectives	• Explain the key components of risk communication and its role in preventing rabies outbreaks. • Describe effective communication strategies for different stakeholders. • Outline the importance of risk communication in modifying beliefs and behaviors regarding rabies prevention. • Identify key IEC (Information, Education, and Communication) activities to engage target populations.
Pre-requisite knowledge/skill	• Expertise in rabies risk communication and engagement techniques. • Ability to design and deliver effective communication and IEC strategies. • Knowledge of cultural and local dynamics for tailoring messages.
Competencies to be achieved	• Understanding of how to assess and communicate disease risks related to rabies. • Ability to engage various stakeholders using appropriate communication channels. • Capacity to deliver clear, balanced messaging to promote preventive measures. • Knowledge of IEC activities and tools for rabies prevention targeting different populations like healthcare professionals, veterinarians, and the general public.

RISK COMMUNICATION AND COMMUNITY ENGAGEMENT

The primary goal of risk communication is to provide essential information for saving lives, protecting health, and minimizing harm to both individuals and the community. It also aims to modify beliefs and behaviors. Effective risk communication allows stakeholders and the public to understand the basis for decisions related to health risks, ensuring these judgments are informed by scientific evidence, as well as cultural values and perceptions.

Key Components of Risk Communication

- **Process of Exchange:** Risk communication involves the exchange of information and opinions between individuals, communities, scientists, media, and institutions about the nature, severity, and control of health risks.
- **Risk Assessment and Management:** Effective communication incorporates both the assessment of disease risks and strategies for managing them.
- **Balanced Messaging:** It is important to not only convey warnings but also provide educational and constructive messages to promote awareness and preventive measures.

Stakeholders in Risk Communication

- **Involved Parties:** Government bodies, private sectors, educational institutions, media, non-governmental organizations (NGOs), and community groups all play critical roles in risk communication.
- **Target Audiences:** Efforts should focus on reaching the general public, experts, and media professionals.

Communication Channels

Modes of Delivery: Information can be disseminated through various media such as radio, posters, fact sheets, face-to-face talks, emails, videos, websites, and social media. Local channels, such as street plays and rallies, and tools like jingles and videos at schools, fairs, and theatres, can also be utilized.

Information, Education, and Communication (IEC) Activities

IEC activities are crucial for rabies prevention, focusing on promoting behavior change that is suited to local contexts. These activities aim to generate awareness, dispel myths, and encourage appropriate post-exposure treatment.

Target Populations for IEC

1. **Healthcare Professionals:** Including doctors, nurses, and pharmacists, who require training on rabies vaccination and post-exposure prophylaxis.
2. **Veterinary Professionals:** Need education on vaccination, population control, and animal birth control.
3. **Teachers and Students:** School health programs can play a key role in spreading awareness about animal behavior and bite prevention.
4. **General Public:** IEC efforts should counter misinformation and encourage prompt action after dog bites. Flyers, films, rallies, and announcements can help engage this group.
5. **Bite Victims and Exposed Persons:** One-on-one interaction with healthcare providers is essential to address non-compliance and fear of treatment.

Addressing Rabies Myths

In India, various misconceptions persist regarding rabies and its treatment. Common myths, such as the belief that rabies vaccines involve painful injections in the stomach or that alternative treatments like herbal remedies can prevent rabies, hinder timely medical intervention. Public education should focus on correcting these misunderstandings.

Preventing Dog Bites

The public should be educated on how to prevent dog bites, including recognizing warning signs in dogs (such as snarling, stiff posture, or laid-back ears), avoiding aggressive play, and teaching children how to interact safely with animals. Additionally, neutering pets can reduce the likelihood of aggressive behavior.

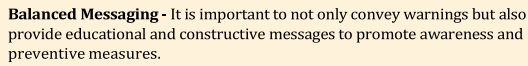
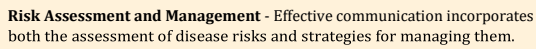
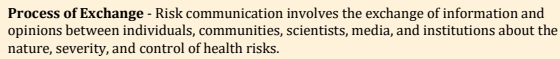


Fig 15: 5 steps to prevent dog bites

Points to Remember

- Effective risk communication aims to inform, change beliefs, and promote behaviors that minimize health risks related to rabies.
- Engage various stakeholders, including government bodies, healthcare professionals, educators, and communities, to enhance understanding and collaboration in rabies prevention efforts.
- Address and correct common myths about rabies and its treatment to encourage timely and appropriate medical responses after potential exposure.
- Use multiple channels—such as social media, community events, and educational materials—to effectively reach different audiences and promote awareness.

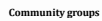
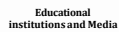
 Process of Exchange - Risk communication involves the exchange of information and opinions between individuals, communities, scientists, media, and institutions about the nature, severity, and control of health risks.



RABIES

The diagram is divided into two main horizontal sections. The top section, titled 'Involved Parties', contains five categories: Government bodies (represented by a government building icon), Private sectors (represented by a skyscraper icon), Educational institutions and Media (represented by a school building icon), NGOs (represented by a church-like building icon), and Community groups (represented by a group of people icon). The bottom section, titled 'Target Audiences', contains three categories: General public (represented by a group of people icon), Experts (represented by a person with a magnifying glass icon), and Media Professionals (represented by a person with a camera icon).

Government bodies



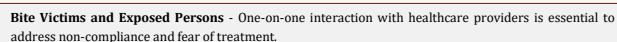
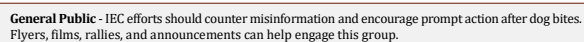
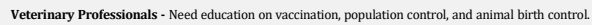
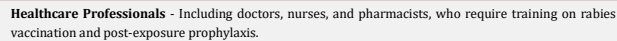
General public



- Information can be disseminated through various media such as **radio, posters, fact sheets, face-to-face talks, emails, videos, websites, and social media.**
- Local channels, such as **street plays and rallies**, and tools like **jingles and videos** at schools, fairs, and theatres, can also be utilized.

RABIES

- **Healthcare Professionals** - Including doctors, nurses, and pharmacists, who require training on rabies vaccination and post-exposure prophylaxis.
- **Veterinary Professionals** - Need education on vaccination, population control, and animal birth control.
- **Teachers and Students** - School health programs can play a key role in spreading awareness about animal behaviour and bite prevention.
- **General Public** - IEC efforts should counter misinformation and encourage prompt action after dog bites. Flyers, films, rallies, and announcements can help engage this group.
- **Bite Victims and Exposed Persons** - One-on-one interaction with healthcare providers is essential to address non-compliance and fear of treatment.



RABIES

- In India, various misconceptions persist regarding rabies and its treatment.
- Common myths, such as the belief that rabies vaccines involve painful injections in the stomach or that alternative treatments like herbal remedies can prevent rabies, hinder timely medical intervention.
- Public education should focus on correcting these misunderstandings.

- The public should be educated on how to prevent dog bites, including recognizing warning signs in dogs (such as snarling, stiff posture, or laid-back ears), avoiding aggressive play, and teaching children how to interact safely with animals.
- Neutering pets can reduce the likelihood of aggressive behaviour.



RABIES

[illegible]

Session-9

Surveillance

Course No. 009	Session 9: Surveillance
Duration	30 minutes
Learning Objectives	• Explain the key components of rabies surveillance • Describe data collection and reporting mechanisms for human and animal rabies • Explain event-based surveillance and public health actions in rabies control • Identify responsible officers and coordination mechanisms for rabies surveillance
Pre-requisite knowledge/skill	• Expertise on rabies surveillance and public health systems • Ability to effectively conduct training on surveillance systems • Knowledge of data collection and reporting procedures for disease surveillance
Competencies to be achieved	• Understanding of integrated rabies surveillance systems for both human and animal health sectors • Comprehension of data sharing and intersectoral coordination mechanisms in rabies control • Ability to describe surveillance reporting processes and guidelines for timely response • Knowledge of event-based surveillance and public health interventions in rabies

SURVEILLANCE OF RABIES

Surveillance refers to the systematic process of collecting, collating, and analyzing data, followed by its timely dissemination to relevant stakeholders to enable appropriate action. A robust disease surveillance system is crucial for the planning, implementation, monitoring, and evaluation of public health interventions. The effectiveness of rabies control and elimination efforts relies on an efficient, GIS-enabled surveillance system capable of monitoring the ongoing activities of both human and animal health sectors, while also tracking epidemiological trends related to animal bites and rabies fatalities. Surveillance is a cornerstone of the National Action Plan for Rabies Elimination (NAPRE), allowing for early problem detection and timely responses.

Under NAPRE, a dedicated portal and GIS-based electronic surveillance system will be developed to create an integrated Rabies Surveillance Network. This system will facilitate real-time data sharing among local, state, and national agencies, supporting strategic responses to rabies and animal bite cases. The portal will house vital information on rabies in both humans and animals, as well as on the availability of vaccines and immunoglobulins.

A separate surveillance system for both human and animal health, encompassing veterinary and wildlife sectors, is essential. These systems will feature appropriate linkages for systematic data sharing, which is necessary before initiating control measures in targeted geographic areas. The surveillance framework for NAPRE consists of several key components:

Components of the Surveillance System

1. **Priority Data Parameters:**
 - For human rabies, surveillance will focus on tracking animal bites, deaths from suspected or confirmed rabies cases, and vaccine coverage.
 - For animal rabies, clinical surveillance will identify animals exhibiting symptoms, and laboratory-based surveillance will confirm cases through virological testing of samples from animals like dogs and cats. Positive samples may be archived for molecular analysis and research to determine the circulating virus strain in a region.
2. **Disease Notification:** Human rabies cases will be reported under relevant laws, such as the Epidemic Diseases Act and Clinical Establishment Act, while animal cases will be reported under the Prevention & Control of Infectious and Contagious Diseases in Animals Act, 2009.
3. **Data Collection Points:**
 - For human cases, data will be collected from health facilities like Anti-Rabies Clinics and private health providers.
 - For animal health, data will come from veterinary clinics, animal husbandry departments, and laboratories conducting rabies diagnostics.
4. **Responsible Officers:** Designated officers at the village, block, district, state, and national levels will oversee surveillance activities for both human and animal health.
5. **Recording and Reporting:** Standardized formats will be used across health and veterinary facilities to document animal bite exposures, rabies cases, and outbreak investigations.

6. **Monitoring and Evaluation:** The surveillance system will be evaluated based on the timeliness, completeness, and utility of the data collected.
7. **Support Functions:** The development of guidelines, standard operating procedures (SOPs), and training programs will be organized by the respective national program management units.
8. **Data Sharing and Intersectoral Coordination:** The human health sector will share analyzed reports on rabies incidents with veterinary and wildlife departments to ensure appropriate interventions, while the animal health sector will provide updates on vaccination drives and dog population control efforts.
9. **Infrastructure and Logistics:** Web-based GIS-enabled systems, mobile applications, and adequate manpower will be established by state governments to support the surveillance of both human and animal rabies cases.
10. **Information, Education, and Communication (IEC):** IEC materials will be strategically displayed to ensure that communities are informed and can notify authorities about rabies-related events.

Surveillance of Human Health Component Under NAPRE

The surveillance program will include clinical, laboratory, and serological surveillance following the Ministry of Health and Family Welfare (MoHFW) guidelines. Systematic recording and reporting of animal bite incidents and rabies cases in the community are vital. This data will be managed through a dedicated NAPRE portal linked to the Integrated Disease Surveillance Programme (IDSP) and Integrated Health Information Platform (IHIP). Specific reporting formats will be implemented at various healthcare levels to enhance surveillance efficacy.



Fig 16: Rabies Surveillance (NRCP)

Surveillance of Animal Health Component Under NAPRE

The animal health surveillance framework will also incorporate laboratory and serological methods in line with the Department of Animal Husbandry and Dairying (DAHD) guidelines. Recording and reporting of animal bites and rabies cases will be facilitated via the NAPRE portal, integrated with the National Animal Disease Reporting System (NADRS 2.0) and the National Animal Disease Referral Expert System (NADRES). Standardized reporting formats will be available for government and private veterinary facilities to improve surveillance activities, accessible at all levels from block to state.

Surveillance in Wild Animals

Rabies is prevalent among various wild animal species, posing risks at the domestic-wildlife interface. Collaboration between livestock and forestry sectors is essential for effective surveillance and information sharing. The State Forest Department will coordinate these efforts with local veterinary departments and NGOs.

- Free-ranging wild animals: If rabies symptoms are observed, wildlife authorities must notify the veterinary department, which will facilitate sample collection for laboratory analysis.
- Captive wild animals: Zoo authorities should report any suspected cases, with samples sent for diagnostic testing.

Active surveillance will focus on identifying additional wild or domestic animals exhibiting symptoms, determining bite incidents involving domestic animals, and notifying authorities about any suspected rabies cases in local communities near wildlife areas.

Event-Based Surveillance and Public Health Actions for the Animal Health Sector

- Abnormal behavior in stray animals:
 - Conduct epidemiological investigations and case searches.
 - Track the status of involved animals and notify relevant authorities.
 - Ensure post-exposure prophylaxis (PEP) for those in contact with suspected animals.
- Death of a pet or livestock following a bite:
 - Investigate the event and assess vaccination status.
 - Notify authorities, submit samples for analysis, and provide PEP for those exposed.
- Unexplained death of wild animals:
 - Report findings to wildlife officials, conduct investigations, and collect samples.
 - Issue advisories regarding carcass disposal and PEP for contacts.
- Death of stray animals:
 - Notify municipal authorities for safe removal and testing.
 - Conduct case searches and ensure PEP for exposed individuals.

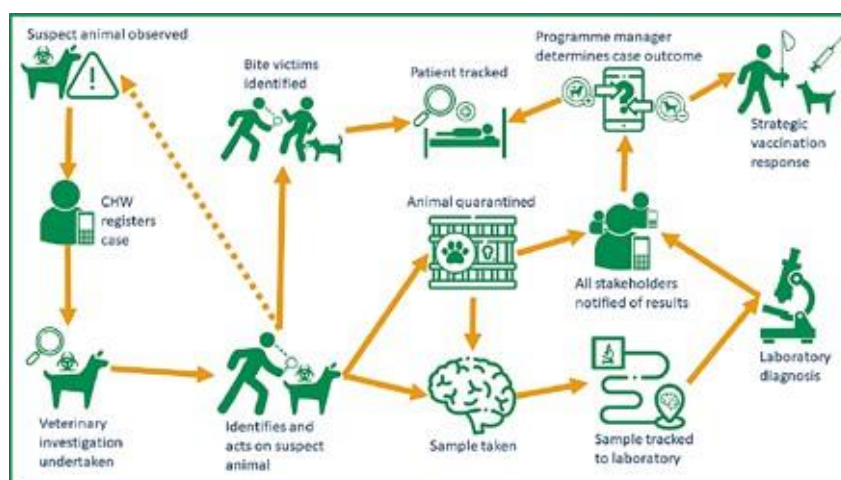


Fig 17: Diagrammatic overview of the event-based rabies surveillance components and how they interlink. (<https://rabiesalliance.org/tools/surveillance-tools/cbrs>)

Event-Based Surveillance and Public Health Actions for the Human Health Sector

- i. Human death following an animal bite:
 - Conduct thorough investigations, track the source animal, and collect samples.
 - Notify authorities and ensure PEP for contacts of suspected rabies cases.
- ii. Animal bite cases in humans:
 - Provide timely PEP and counselling for victims.
 - Analyze cases weekly for clustering and share data with relevant authorities.

Points to Remember

- Rabies surveillance involves systematic data collection, analysis, and dissemination to inform timely public health actions.
- Integrated surveillance systems for both human and animal health sectors are critical for rabies control and elimination.
- Data collection points include health facilities, veterinary clinics, and laboratories, with standardized formats for recording and reporting.
- Surveillance systems must ensure timely notification of rabies cases under relevant laws, supported by GIS-enabled platforms for real-time data sharing.
- Event-based surveillance focuses on investigating abnormal animal behavior, unexplained deaths, and animal bite cases to trigger public health responses.

Session-10

One Health - Rabies

Course No. 010	Session 10: One Health - Rabies
Duration	10 minutes
Learning Objectives	• Describe preventive measures for rabies control within a One Health framework • Explain intersectoral collaboration involving human, animal, and environmental health sectors • Discuss disinfection procedures in the context of rabies outbreaks • Detail vaccination protocols for both humans and animals • Describe comprehensive management strategies for rabies control across sectors
Pre-requisite knowledge/skill	• Expertise on the concept of One Health in zoonotic disease management, especially rabies • Ability to effectively train multi-disciplinary teams (health, veterinary, and environmental sectors) • Familiarity with evaluation techniques for diverse target audiences
Competencies to be achieved	• Comprehensive understanding of rabies treatment and control strategies within a One Health context • In-depth knowledge of preventive measures, including mass dog vaccination, disinfection, and bite prevention • Ability to describe and implement disinfection options tailored to rabies and cross-sectoral settings • Familiarity with vaccination protocols and procedures for both humans and animals

ONE HEALTH - RABIES

The Concept of One Health

The One Health approach fosters collaboration across multiple sectors—human health, animal health, and the environment—to design and implement policies, legislation, and research aimed at improving public health. This approach is particularly effective in areas like food safety, zoonotic disease control (e.g., rabies, Rift Valley Fever), and the fight against antimicrobial resistance. The interconnection between human, animal, and ecosystem health underscores the need for such an integrated strategy.

Rationale for One Health in Rabies Control

Microbes that affect both animals and humans often thrive within shared ecosystems. Isolated efforts by any single sector are insufficient for addressing zoonotic diseases like rabies. Effective prevention hinges on targeting the animal source, such as through mass dog vaccination campaigns to interrupt transmission from dogs to humans.

Key Stakeholders in One Health for Rabies Control

Collaboration among professionals across public health, animal health, and environmental sectors is vital. Efficient control of zoonotic diseases, including rabies, depends on data sharing between epidemiological and laboratory services. Various stakeholders, including government agencies, local authorities, researchers, and organizations such as the WHO, FAO, OIE, and NGOs, must coordinate their efforts. A prominent example of this is India's National Action Plan for Dog-Mediated Rabies Elimination, which promotes intersectoral coordination for zoonotic disease prevention.

Table 4: *Intersectoral collaboration for rabies prevention and control at the district*

S. No	Department	Responsibilities
1.	Public Health	Surveillance Field investigation, hot spots identification. Laboratory Services Clinical Management of cases/ Referral arrangements. Protocols for primary/secondary and tertiary care Anti-Rabies vaccination Animal bite control activities Health Education to masses Vaccination of vulnerable groups. Reporting to SSU/State Health directorate. Media management. Engagement with all stakeholders

S. No	Department	Responsibilities
2.	Animal Husbandry and Veterinary Colleges/ Institutes	Post-mortem investigation of suspected animal rabies cases Collection of brain tissue samples from suspected rabid animals IEC and Advocacy efforts in the district. Support in animal rabies surveillance. Participation in multidisciplinary RRT investigations. Technical support for rabies control among domestic animals
3.	Wildlife	Arrangements for the autopsy of suspected rabid animals Arrangements for capturing suspected rabid animals Isolation and observation of rabid animals Support to other departments.
4.	Tribal welfare	Tribal health promoters to support surveillance activities. Ambulance support for referral of cases to Hospitals. Arrangement for organizing Medical Camps in all difficult to reach colonies.
5.	Revenue	Financial support for conducting anti-rabies vaccination for animal and human component
6.	Education	Vaccination and IEC activities coordination in Schools Information to the surveillance system
7.	Women and Child Welfare	Taking services of Anganwadi workers, where there is no availability of ASHA
8.	Information and Broadcasting	Dissemination of IEC
9.	Local Self Government	Support anti-rabies vaccination, dog population control activities, animal vaccination and IEC activities
10.	NGOs	Support surveillance and IEC activities

Rabies Control in Animal Reservoirs

Rabies is a notifiable disease in India under the Prevention and Control of Infectious and Contagious Diseases in Animals Act of 2009. Reporting suspected cases of rabies is mandatory to facilitate swift action by local veterinary authorities. Eliminating dog-mediated rabies is critical, and strategies include post-exposure prophylaxis (PEP) for humans and large-scale mass dog vaccination.

Key actions for rabies control in animals:

- **Dog Census:** Estimating the population of free-roaming and pet dogs helps design effective vaccination programs.
- **Responsible Pet Ownership:** Pet licensing, vaccination starting at 2–3 months, and regular follow-ups are vital in controlling rabies spread.
- **Mass Dog Vaccination:** Vaccinating at least 70% of the dog population annually can break transmission cycles and maintain herd immunity.
- **Dog Population Management:** Through the Animal Birth Control (ABC) and Anti-Rabies Program (AR), stray dog populations are controlled without culling, improving vaccination coverage and reducing high-risk behaviors.

Environmental Factors Influencing Rabies

Environmental conditions, such as open garbage disposal and urban waste accumulation, contribute to dog population growth and increased aggression, leading to a higher risk of dog bites. Proper waste management practices, in collaboration with veterinary and human health sectors, can reduce these risks by decreasing dog populations and minimizing disease transmission.

Awareness, Education, and Community Engagement

Public education on dog behavior, bite prevention, and immediate care after an animal bite is essential. Awareness campaigns, coordinated between human health and veterinary sectors, can reduce rabies incidence and treatment costs. Information dissemination via mass media, schools, and public health programs can increase community understanding and participation in rabies prevention.

Training for Health and Veterinary Professionals

Rabies control requires training of human and veterinary health professionals at all levels. Physicians, veterinarians, health workers, and ASHA workers must be equipped to manage rabies cases, coordinate across sectors, and ensure that anti-rabies vaccines and resources are available in high-risk areas.

Table 5: Actions to be taken by medical officer In-charge centers health facility / District Nodal officer/ State Nodal officer NRCP

Animal cases	Human cases
• Identify areas of clustering of animal bite cases • Ensure the availability of ARV/ARS in centers catering for the identified areas • Notify Vet. Dept /Municipalities to initiate appropriate measures such as Dog population management, MDV. • In case of any animal is suspected of Rabies, Notify the local Vet. Dept /Municipalities • Conduct a meeting with the vet. Dept. as part of zoonotic committees for joint action • Follow up	• Identify areas with human rabies • Find out reasons (Incomplete treatment, NO PEP taken by victims, low awareness etc.) • Ensure the availability of ARV/ARS in centers catering for the areas • Intensify IEC activities in the area • Notify Vet. Dept/Municipalities to initiate appropriate measures- DPM, MDV. • Conduct a meeting with the vet. Dept. as part of zoonotic committees for joint action • Follow up

Integrated Bite Case Management (IBCM) for Human Rabies

IBCM is a surveillance method that integrates human and animal health systems, allowing for early detection of rabies cases and efficient response. When a bite case occurs, human health professionals manage the patient while animal health professionals assess the biting animal. This collaborative investigation, timely reporting, and sharing of data across sectors can improve treatment outcomes and prevent further transmission.

Actions following reported human rabies cases:

1. Collect biological samples from suspected rabies cases, both ante-mortem and post-mortem, for laboratory testing.
2. Conduct epidemiological investigations to identify sources of infection and at-risk individuals.
3. Ensure post-exposure prophylaxis (PEP) is provided to victims and exposed contacts.
4. Notify veterinary authorities about suspected rabid animals for appropriate follow-up.
5. Mobilize local authorities for animal population management and continued vaccination campaigns.

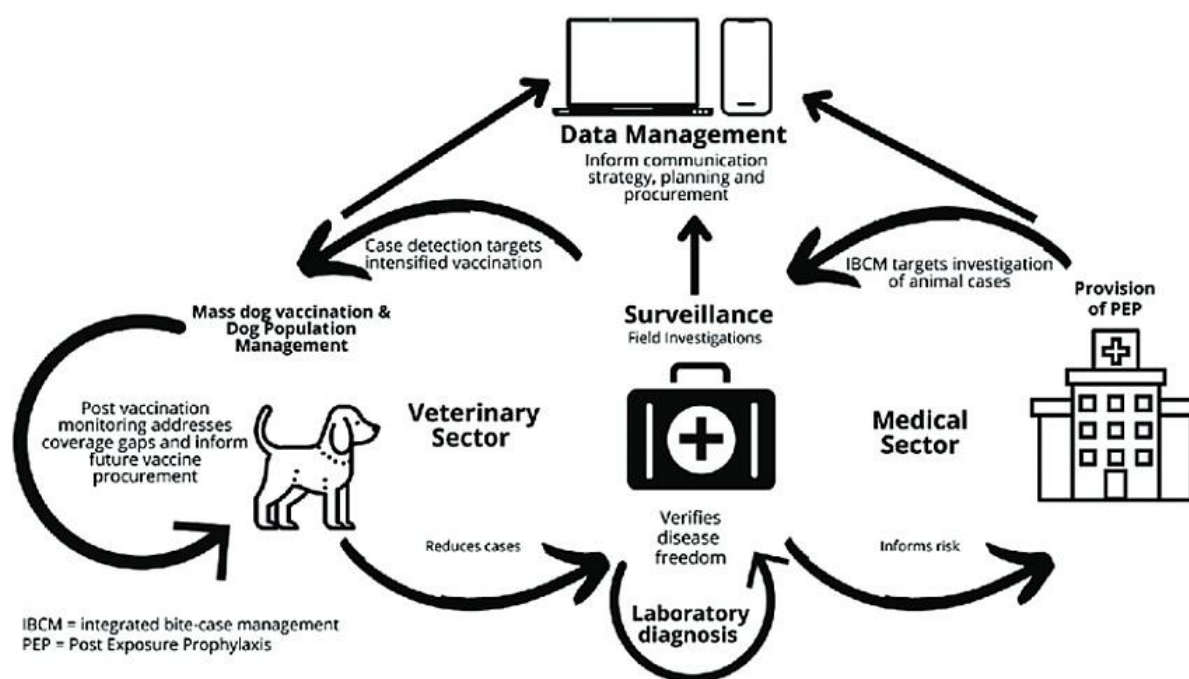


Fig 18: Illustration of One Health scheme for rabies prevention and control program

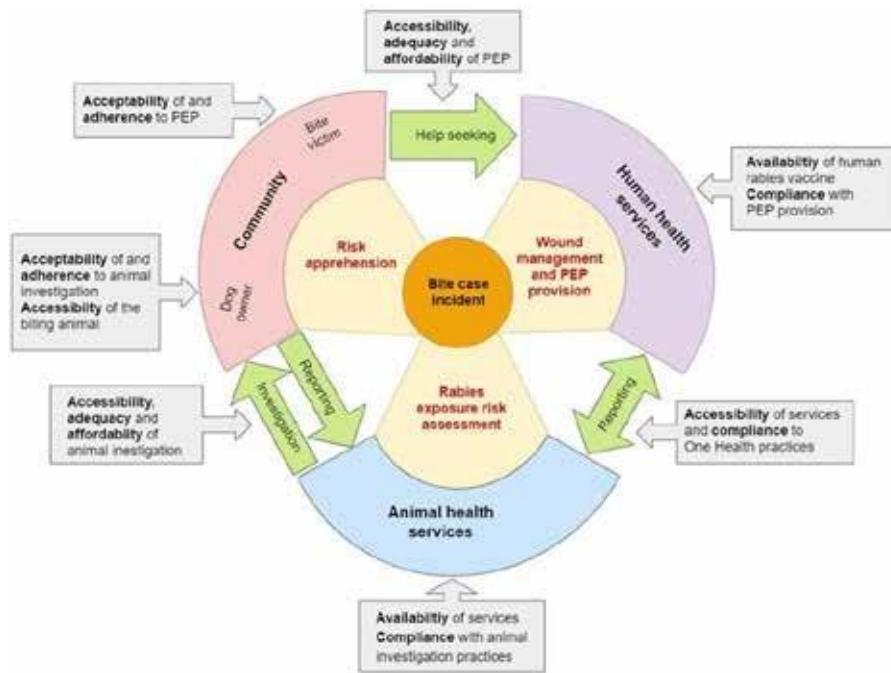


Fig 19: The integrated bite case management (IBCM) access cycle with the various access elements described by Obrist et al.

Points to Remember

- The One Health approach integrates human, animal, and environmental sectors to combat zoonotic diseases like rabies, emphasizing collaboration across these areas for effective prevention and control.
- Mass dog vaccination campaigns are a key strategy in rabies control, aiming to vaccinate at least 70% of the dog population annually to break the transmission cycle between animals and humans.
- Environmental factors, such as improper waste management, contribute to the growth of stray dog populations and increase rabies transmission risk, highlighting the importance of cross-sector collaboration.
- Integrated Bite Case Management (IBCM) allows human and animal health professionals to work together in managing suspected rabies cases, improving surveillance and treatment outcomes.
- Training for both human and veterinary professionals is critical for ensuring effective rabies management, vaccination delivery, and public awareness campaigns.
- Reporting suspected rabies cases in animals and humans is mandatory under Indian law, facilitating prompt action from veterinary and health authorities to control outbreaks.

ANNEXURES

Annexure 1-Indications and Dosages of Medications for Symptom Management

Drugs for the palliative management of patients with confirmed or strongly suspected rabies encephalomyelitis that are included in the WHO Model List of Essential Medicines 20th List (March 2017) and WHO Model List of Essential Medicines for Children 6th List (March 2017).

Source: <http://www.who.int/medicines/publications/essentialmedicines/en/>,

Recommended doses are taken from <https://www.bnf.org/products/bnf-online/> and <https://bnfc.nice.org.uk/>.

Indication	Drug	Route of Administration	Adult Dose	Pediatric Dose
Fever	Paracetamol	Intravenous infusion over 15 minutes	1 g every 4–6 hours, maximum 4 g/24 hours	125–500 mg every 4–6 hours
		Intrarectal	1 g every 4–6 hours, maximum 4 g/24 hours	125–500 mg every 4–6 hours
	Ibuprofen	Intrarectal	300–400 mg every 6–8 hours	Not indicated
	Aspirin	Intrarectal	450–900 mg every 4 hours, maximum 3.6 g/day	Not indicated
Anxiety, Agitation, Seizures	Diazepam	Intravenous (slow, with caution)	10 mg over 3–5 minutes, repeated every 1–4 hours	0.1–0.3 mg/kg over 3–5 minutes, repeated every 1–4 hours, total 2.4–12 mg/kg/day
		Intramuscular (painful)	20 mg every 2 hours	0.1–0.3 mg/kg every 1–4 hours
		Intrarectal	10 mg every 1–4 hours	0.1–0.3 mg/kg every 1–4 hours
		Intramuscular or slow IV (caution advised)	25–50 micrograms/kg every 6 hours	25–50 micrograms/kg every 6 hours
		Intramuscular	0.08–0.2 mg/kg every 1–4 hours	0.07–0.1 mg/kg every 1–4 hours
		Intravenous or subcutaneous	2.5 mg every hour	Not indicated
		Subcutaneous infusion	10–30 mg over 24 hours (via pump)	Not indicated
		Intrarectal	300–500 micrograms every 1–4 hours	Not indicated

Indication	Drug	Route of Administration	Adult Dose	Paediatric Dose
Anxiety, Agitation	Haloperidol	Intramuscular or subcutaneous	5 mg hourly until calm, then every 4–6 hours	Age 1 month–12 years: 25–85 micrograms/kg/day
		Intravenous or subcutaneous infusion	5–15 mg/24 hours	Age 12–18 years: 1.5–5 mg/24 hours
	Chlorpromazine	Deep intramuscular	25–50 mg every 6–8 hours	500 micrograms/kg every 6–8 hours
		Intrarectal	100 mg every 6–8 hours	Not indicated
Hypersecretion	Hyoscine (Scopolamine)	Subcutaneous or intravenous injection	400 micrograms every 4 hours	10 micrograms/kg every 4–8 hours
		Subcutaneous infusion	1.2–2 mg over 24 hours	40–60 micrograms/kg over 24 hours
Pain	Morphine	Slow intravenous, subcutaneous, or intramuscular	10 mg every 4 hours	100 micrograms/kg
		Intrarectal	15–30 mg every 4 hours	Not indicated

Annexure 2: Additional slides for Laboratory Personnel

Annexure 1

Principle DFA test

- A **WHO and OIE recommended** test for Rabies.
- Used directly on a brain impression smear.
- High sensitivity and specificity (between 96% and 99%), and gives reliable results on fresh specimens in less than 2 hours.
- Impression smears to be prepared from a composite sample of brain tissue, that includes the brain stem and the cerebellum.
- If the cerebellum is not available, a cross section of the Ammon's horns may be used
- DFA test result analysis should be carried out by two trained lab staff
- Ambiguous test should be repeated

RABIES

Annexure 2

Requirements for DFAT

Reagents -

1. Acetone
2. Conjugate diluent (PBS)
3. FITC-Conjugated anti RABV antibody reagents
4. 20% glycerol-TRIS buffer
5. Phosphate buffered saline 0.01 mol, pH 7.4-7.6

Other Materials –

1. Coverslips
2. Fluorescence microscope
3. Freezers
4. Humidified slide chambers
5. Slide tray
6. Incubator
7. Refrigerator
8. Syringe filters
9. Syringes 5 ml 0r 10-20 ml

Copyright © 2004, John Wiley & Sons, Inc.

RABIES

Annexure 3

Procedure DFA test

Fix the smear in 100% high-grade cold acetone (-20°C) for 20 minutes Or heat fixed by passing the slide 2-3 times through a flame.



↓
Air dry the slides



Stain with FITC -labelled polyclonal or monoclonal anti-rabies antibody conjugate



Cover the whole smear, for 30 minutes at 37°C in a humid chamber.



Examine under inverted fluorescence microscope (wavelength-490 nm and re-emits at 510 nm).



Aggregates of nucleocapsid protein are identified by specific fluorescence of bound conjugate

Copyright © 2004 Wolters Kluwer Health | Lippincott Williams & Wilkins

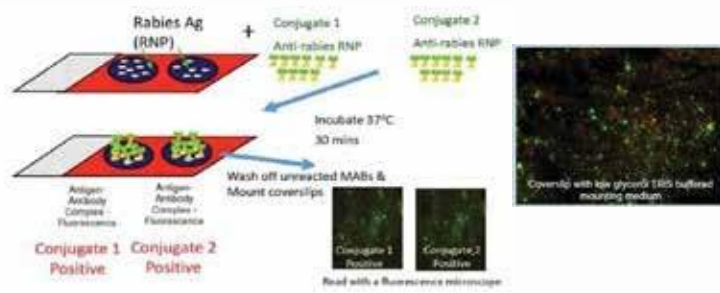
RABIES

Notes

[illegible]

Pictorial procedural steps of DFA test

Annexure 4



Source: WHO Laboratory Techniques in Rabies, 3rd Edition, Volume 1

Centre for One Health, NCDC, MoHFW

RABIES

Notes

Principle Rapid Tissue Culture Infection Test - (RTCIT)

Annexure 5

- The aim of RTCIT is to detect, in vitro, the presence of infectious rabies virus (RABV), or other lyssavirus in tissue suspension or other biological samples using cell culture technique.
- It is confirmatory tests if the DFA test, dRIT, other antigen detection tests or PCR give inconclusive results.
- Cell culture tests may be undertaken in multi-well plastic plates, multi-chambered glass slides, or on glass cover-slips.
- Viral infection in cells produces specific inclusions detectable generally 18-24 hours after infection by direct immunofluorescence, after cell fixation and staining with specific anti-rabies fluorescent conjugated antibody.
- Virus isolation is generally performed at the postmortem diagnosis of rabies on brain specimen.
- It can also be applied to the antemortem diagnosis using biological fluids such as CSF, saliva.

Centre for One Health, NCDC, MoHFW

RABIES

Principle Rapid Tissue Culture Infection Test - (RTCIT)

Annexure 6

- Neuroblastoma cells e.g. N2a, CCL-131 in the American Type Culture Collection (ATCC) are highly susceptible to infection with lyssaviruses.
- The cells are grown in Dulbecco's modified Eagle's medium (DMEM) with 5% fetal calf serum (FCS), incubated at 37°C with 0.5% or 5% CO₂ depending on the culture vessel.
- Additional passages could be considered, including use of T25 flasks, to increase sensitivity; usually three consecutive passages should be conducted to confirm a negative result.
- Cytotoxicity is a commonly reported factor limiting test robustness.
- Techniques proposed to reduce cytotoxicity include adding antibiotics, reducing the incubation time before changing media (to as short as 35 minutes) and dilution of samples.
- Cell culture tests and their variations should be fully validated before use.

Centre for One Health, NCDC, MoHFW

RABIES

Requirements for RTCIT

Annexure 7

Reagents

- Cell culture medium DMEM10
- Suspension medium
- Neutral PBS
- 80% acetone
- Trypsin
- DFAT's reagents
- Supernatant of positive & negative control

Equipment

- BSL-2 cabinet
- 8-chamber slides with flat bottom
- Dry incubator
- CO₂ controlled incubator
- centrifuge
- Incubator
- Glass rod
- Fluorescence microscope

Centre for One Health, NCDC, MoHFW

RABIES

Procedure for use in 8 chamber slide

Annexure 8

Distribute 400 µl of the neuroblastoma cell suspension (4×10^5 cells/ml) per chamber to reach an 80% confluent cell monolayer

↓

Add 50 µl of clarified brain homogenate (20% in a grinding substrate made of PBS, 0.1 M, pH 7.4 with heat-inactivated fetal calf serum)

↓

Incubate for 18-24 hours at $37^\circ\text{C} \pm 2^\circ\text{C}$ in a 5% $\text{CO}_2 \pm 2\%$ humidified incubator

↓

Remove the supernatant from each chamber, and 400 µl of fresh medium to each chamber.

↓

After a further 24 hours (or more) of incubation, remove the supernatant, Fix the cell layer with pure high grade 80% cold acetone.

↓

Stained the fixed cell layer with anti-rabies FITC-conjugated antibodies at 37°C for 30 min

↓

Read using fluorescence microscope

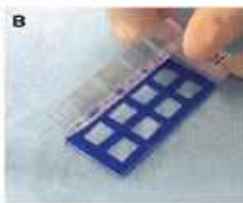
Centre for One Health, NCDC, MoHFW

RABIES

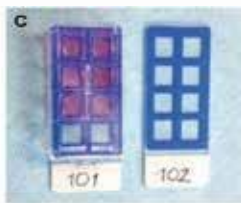
Notes



Deposition of cell medium in 8-chamber cell slide



Removing the 8-well incubating chamber



Slides with and without 8 well incubating chambers

Centre for One Health, NCDC, MoHFW

RABIES

Protocol for a 96-well plate

Annexure 10

Distribute 400 µl of the neuroblastoma cell suspension (4×10^5 cells/ml) per well in 4 well of 96-well plate to reach an 80% confluent cell monolayer

↓

Add 100 µl of clarified brain homogenate (20% w/v in PBS, 0.1 M, pH 7.4) to each of the 4 well and mix gently

↓

Incubate for 2-4 days at $37^\circ\text{C} \pm 2^\circ\text{C}$ in a 5% $\text{CO}_2 \pm 2\%$ humidified incubator

↓

Discard the supernatant from each well and perform one wash

↓

Fix the cell layer with pure high grade 80% cold acetone.

↓

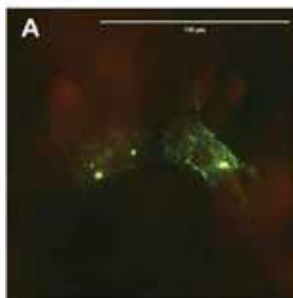
Stain the fixed cell layer with anti-rabies FITC-conjugated antibodies at 37°C for 30 min

↓

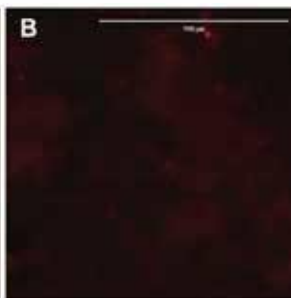
Read using fluorescence microscope

Centre for One Health, NCDC, MoHFW

RABIES



Positive slide (presence of infection), with the observation of bright green fluorescent inclusions in the cytoplasm indicating RABV infection



Negative slide (absence of infection), with cell observed in red after counter staining with Evans blue

Centre for One Health, NCDC, MoHFW

RABIES

Polymerase Chain Reaction

Annexure 12

- PCR assays are sensitive tools for the detection of lyssavirus-derived ribonucleic acid (RNA) within suspect specimens,
- PCR do not require the presence of live virus.
- PCR assays that target the 3' proximal viral gene are considered the most sensitive as the replication cycle of lyssaviruses
- Two reverse-transcriptase polymerase chain reaction (RT-PCR) methods for the detection of lyssavirus RNA in clinical samples are described.
 - The first is a conventional (gel-based) pan-lyssavirus hemi-nested RT-PCR assay (hnRT-PCR): include the applicability to laboratories that only have conventional PCR apparatus and the ability to obtain genetic data from the generated amplicons.
 - The second is a real-time pan-lyssavirus RT-PCR assay (based on a fluorescent DNA stain): include increased sensitivity over the conventional assay and a significantly reduced turnaround time.
- Both assays are based on a one-step approach, which reduces the risks of contamination and during manipulation.
- The fluorescent DNA stain-based assay is approximately one log more sensitive than the hemi-nested conventional RT-PCR.

Centre for One Health, NCDC, MoHFW

RABIES

Notes

Real-time RT-PCR techniques

Annexure 13

- Real-time PCR platforms enable a more rapid evaluation of the presence or absence of lyssavirus RNA in suspect samples.
- The use of a universal one-step RT-PCR kit that uses a fluorescent DNA stain for the detection of Lyssavirus species from clinical specimens has been demonstrated to be both highly sensitive and specific for lyssavirus RNA.
- Furthermore, by using a fluorescent DNA stain as the detection system it is able to detect all lyssaviruses based on the pan-lyssavirus primer specificity.
- This method includes a separate RT-PCR assay containing a fluorescent DNA stain for amplification of the internal housekeeping control, mRNA for beta-actin as a template control for RNA extraction.

Centre for One Health, NCDC, MoHFW

RABIES

Result Interpretation

Annexure 14

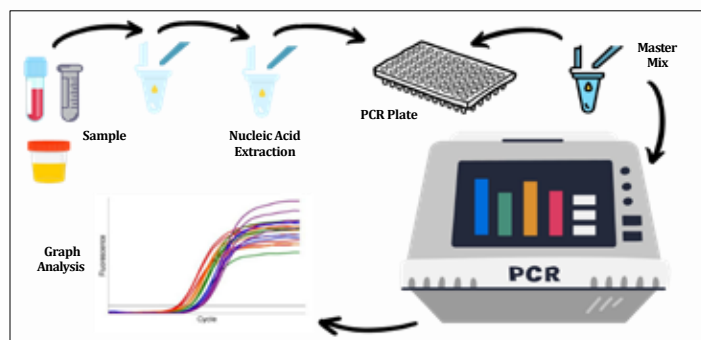
- Any sample in which the fluorescent signal rises significantly above the applied threshold prior to the end of the run is considered positive.
- The cycle at which the fluorescence statistically rises significantly above background levels, designated as the critical threshold cycle number (CT) can be used to estimate the amount of target sequence present in the reaction in comparison to values obtained for a series of standards of known amount.

Centre for One Health, NCDC, MoHFW

RABIES

Steps of Real-Time PCR

Annexure 15



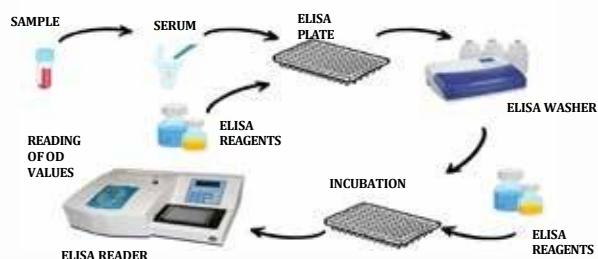
Centre for One Health, NCDC, MoHFW

RABIES

ELISA

Annexure 16

1. ELISA are suitable for monitoring the antibody response of vaccinated animals in the framework of rabies control.
2. ELISAs are available in kit format and may be indirect or competitive.
3. Use of an ELISA is acceptable after qualification of the assay for the purpose of testing.



Centre for One Health, NCDC, MoHFW

RABIES

Notes

Fluorescent Antibody Virus Neutralisation Test (FAVN Test)

Annexure 17

1. The principle of the fluorescent antibody virus neutralisation (FAVN) test is the *in vitro* neutralisation of a constant amount of rabies virus ('challenge virus standard' [CVS] strain adapted to cell culture) before inoculating cells susceptible to rabies virus such as BHK-21 or C13 cells.
2. The serum titre is the dilution at which 100% of the virus is neutralised in 50% of the wells.
3. This titre is expressed in IU/ml.

Centre for One Health, NCDC, MoHFW

RABIES

Procedure of FAVN test

Annexure 18

1. Add 100 μ l of medium and 50 μ l of undiluted serum to microtiter plate
2. Dilute it serially
3. Add 50 μ l of challenge virus standard in different wells in the range of 30 and 300 TCID₅₀/50 μ l.
4. Incubate the microplate at 35–37°C in a humid incubator with 5% CO₂ for 1 hour
5. Resuspend the BHK-21 cells to obtain a 4×10^5 cells/ml suspension in DMEM supplemented with 10% heat-inactivated FCS.
6. Add 50 μ l of the cell suspension to each well.
7. Incubate the microplates for 48 hours at 35–37°C in a humid incubator with 5% CO₂
8. Discard the medium and rinse the microplates once in PBS, pH 7.2, and once in 80% acetone for fixation
9. Fix the microplate at RT for 30 min in 80% acetone
10. Dry the microplate at RT for at least 30 minutes
11. Add 50 μ l of the FITC anti-rabies conjugate to each well for staining
12. Incubate at 35–37°C for 30 minutes
13. Discard the fluorescent conjugate and rinse the microplates twice with PBS
14. Remove the PBS by briefly inverting the microplates on absorbent paper

Centre for One Health, NCDC, MoHFW

RABIES

Result Interpretation

Annexure 19

- Observe the entire surface of each well
- Read the cell for fluorescence.
- The reading evaluation is qualitative (plus or minus)
 - Cell and virus controls are read first.
 - no fluorescent cell – a negative test result
 - fluorescent cells (one cell or more) – positive test result

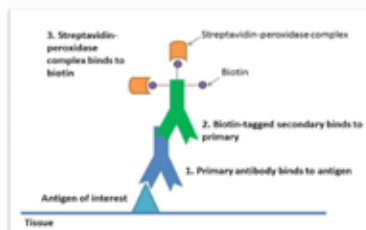
Centre for One Health, NCDC, MoHFW

RABIES

Direct Rapid Immunohistochemistry Test (dRIT)

Annexure 20

- The dRIT can be used as an alternative to DFA in routine rabies diagnosis
- it has similar sensitivity and specificity
- The principle is similar to the DFA except that the dRIT uses streptavidin-biotin peroxidase staining
- This test can be used in laboratories that do not have access to a fluorescence microscope.
- Primary antibodies should be fully validated for specificity and sensitivity before use, taking into consideration regional diversity of lyssaviruses.



Centre for One Health, NCDC, MoHFW

RABIES

Requirements for dRIT

Annexure 21

Reagents

1. Formalin, 10% buffered
2. PBS, pH-7.0
3. Hydrogen peroxide, 3%
4. Primary anti-rabies Ab conjugated to biotin
5. Streptavidin peroxidase
6. 3-amino 9-ethylcarbazole (AEC) substrate
7. Gill's hematoxylin formulation
8. Aqueous mounting media for coverslip

Other Materials

1. Glass microscope slides
2. Coplin jar or straining tray
3. Humidified slide chambers
4. Pipettes
5. Scalpel
6. Centrifuge tubes
7. Syringe filters
8. Syringes

Centre for One Health, NCDC, MoHFW

RABIES

Step wise procedure for dRIT

Annexure 22

1. Make touch impressions of suspect CNS tissues (including brainstem) on labelled glass microscope slides (always include standard positive and negative controls).
2. Air-dry slides for 5 minutes at room temperature.
3. Immerse slides in 10% buffered formalin at room temperature for 10 minutes in a Coplin jar or other suitable container.
4. Dip-rinse slides several times to wash off any excess fixative in wash buffer (PBS plus 1% Tween 80 – TPBS).
5. Immerse slides in 3% hydrogen peroxide for 10 minutes.
6. Remove excess hydrogen peroxide by dip-rinsing slides in TPBS. Transfer slides to another TPBS rinse.
7. Add enough primary antibody conjugate (e.g. biotinylated anti-nucleoprotein poly- or monoclonal antibodies) to cover the impression.
8. Incubate for 10 minutes in a "humidity chamber".
9. Shake off excess conjugate. Dip-rinse slides with TPBS. Shake off excess TPBS and blot buffer from slide edges surrounding the impression.
10. Treat each slide with enough streptavidin-peroxidase complex

Centre for One Health, NCDC, MoHFW

RABIES

Step wise procedure for dRIT

Annexure 23

11. Incubate in the humidity chamber at room temperature for 10 minutes. After incubation, shake off excess.
12. Dip-rinse slides with TPBS. Shake off excess buffer and blot excess buffer from slide edges surrounding the impression.
13. Incubate slides with amino-ethylcarbazole (AEC) substrate .
14. Dip-rinse slides in distilled water. Counterstain with diluted hematoxylin for 2 minutes.
15. Immediately dip-rinse stain from slides with deionized/distilled water.
16. Make a second dip-rinse of slides with fresh deionized/distilled water to ensure removal of excess stain.
17. Transfer slides to fresh distilled water.
18. Apply water-soluble mounting medium and cover-slip. Do not allow slides to air-dry prior to cover-slipping.
19. View slides by light microscopy, using a 20× objective to scan the field thoroughly, and a 40× objective for higher power inspection.

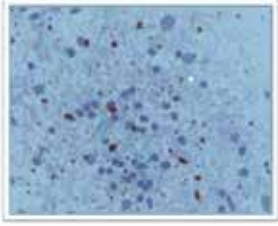
Centre for One Health, NCDC, MoHFW

RABIES

Notes

Result Interpretation

Annexure 24



Lyssavirus-positive CNS sample stained
using DRIT



Lyssavirus-negative CNS sample stained
using DRIT

Lyssavirus antigens appear as reddish, intra-cytoplasmic inclusions against a blue neuronal background, using AEC and Hematoxylin counterstain.

Centre for One Health, NCDC, MoHFW

RABIES

Notes

REFERENCES

1. Jameson J, Fauci AS, Kasper DL, Hauser SL, Longo DL, Loscalzo J, editors. Harrison's Principles of Internal Medicine. 20th ed. New York: McGraw-Hill Education; 2018.
2. WHO. Rabies [Internet]. Geneva: World Health Organization; 2023 [cited 2024 Oct 22]. Available from: <https://www.who.int/news-room/fact-sheets/detail/rabies>
3. National Centre for Disease Control. Training module for medical officers [Internet]. Delhi: NCDC; 2024 [cited 2024 Oct 22]. Available from: <https://ncdc.mohfw.gov.in/wp-content/uploads/2024/02/TRAINING-MODULE-FOR-MEDICAL-OFFICERS.pdf>
4. Baer GM. The history of rabies. In: Jackson AC, editor. Rabies. 3rd ed. London: Academic Press; 2013. p. 1–22.
5. Rupprecht CE. Rhabdoviruses: Rabies virus. In: Baron S, editor. Medical Microbiology. 4th ed. Galveston (TX): University of Texas Medical Branch at Galveston; 1996. Chapter 61. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK8618/>
6. Warrell MJ, Warrell DA. Rabies and other lyssavirus diseases. Lancet. 2004 Mar 20;363(9413):959–69. doi: 10.1016/S0140-6736(04)15792-9.
7. Gan H, Hou X, Wang Y, Xu G, Huang Z, Zhang T, et al. Global burden of Rabies in 204 countries and territories, from 1990 to 2019: results from the Global Burden of Disease Study 2019. Int J Infect Dis. 2022;126:1–10. doi: 10.1016/j.ijid.2022.10.046.
8. WHO. Rabies [Internet]. WHO India; 2023 [cited 2024 Oct 22]. Available from: <https://www.who.int/india/health-topics/rabies>
9. WHO. Rabies free India [Internet]. Ministry of Health and Family Welfare, India; 2023 [cited 2024 Oct 22]. Available from: <https://rabiesfreeindia.mohfw.gov.in/resources/uploads/PageContent-Pdf/169391359514.pdf>
10. WHO Expert Consultation on Rabies: Third Report, Bangkok, Thailand on 26–28 April 2017. Geneva: World Health Organization; 2018.
11. Cuddington K, McAuliffe WHB. Optimising rabies vaccination of dogs in India. Epidemiol Infect. 2023 Aug 22;151:e164. doi: 10.1017/S0950268823001334. PMID: 37606523; PMCID: PMC10600733.
12. Warrell M, Warrell DA, Tarantola A. The imperative of palliation in the management of rabies encephalomyelitis. Trop Med Infect Dis. 2017 Oct 4;2(4):52. doi: 10.3390/tropicalmed2040052. PMID: 30270909; PMCID: PMC6082067.
13. Fooks AR, Cliquet F, Finke S, Freuling C, Hemachudha T, Metlin A, et al. Rabies. Nat Rev Dis Primers. 2017;3:17091. doi: 10.1038/nrdp.2017.91.
14. Ap triana C, Sudarnika E, Basri C. Nationally and locally-initiated One Health approach in controlling rabies in West Kalimantan, Indonesia. Vet World. 2022;15(12):2953–61. doi: 10.14202/vet-world.2022.2953–2961.
15. National Centre for Disease Control. Manual on zoonotic diseases of public health importance [Internet]. Delhi: NCDC; 2024 [cited 2024 Oct 22]. Available from: <https://ncdc.mohfw.gov.in/wp-content/uploads/2024/05/Manual-on-Zoonotic-Diseases-of-Public-Health-Importance.pdf>
16. Centers for Disease Control and Prevention. Rabies [Internet]. Yellow Book; 2024 [cited 2024 Oct 22]. Available from: <https://wwwnc.cdc.gov/travel/yellowbook/2024/infections-diseases/rabies>
17. Compendium of Animal Rabies Control, 2008, National Association of State Public Health Veterinarians

NOTE TO FACILITATORS

This guide has been meticulously designed to enhance the understanding and expertise of doctors, veterinarians, paramedical staff, and laboratory personnel in dealing with rabies cases. Your role is crucial in ensuring the success of this training, so please follow these instructions carefully-

Familiarize Yourself with the Content

Thoroughly review all the materials provided in the rabies guide. This includes presentations, handouts, case studies and assessment tools.

Tailor the Training to Your Audience

Understand the professional backgrounds of your participants (doctors, veterinarians, paramedics, and lab personnel). Tailor your examples and discussions to make the training relevant to their specific roles.

Set Clear Objectives

Begin each session by clearly stating the objectives participants are expected to achieve by the end. This will give them a sense of direction and purpose throughout the training.

Create an Interactive Learning Environment

Encourage active participation and open discussions. Use real-world scenarios to prompt critical thinking and problem-solving.

Use Multimodal Techniques

Utilize a mix of teaching methods, such as presentations, group discussions and case-based learning, this will cater to different learning styles and keep participants engaged.

Encourage Questions

Welcome questions and create a safe environment for participants to seek clarifications. This fosters deeper understanding and engagement.

Provide Regular Feedback

Throughout the training, provide constructive feedback on participants' performance. This will help them identify areas for improvement and enhance their skills.

Summarize and Review

At the end of each module, summarize key points and takeaways. Conduct a brief re-view to reinforce learning before moving on to the next topic.

Assessment and Certification

Develop an assessment mechanism, such as quizzes, practical assessments, or case presentations. Issue certificates of completion to participants who meet the training requirements.

Adapt to Participants' Pace

Gauge the participants' pace of learning. Adjust the training speed, accordingly, ensuring that everyone can follow and grasp the content.

Facilitate Networking

Create opportunities for participants to interact and network with each other. This can lead to valuable knowledge exchange and collaboration.

Remember, your role as a trainer or facilitator is to guide participants through this comprehensive Rabies training with expertise, enthusiasm, and a dedication to enhance their professional skills. Your efforts will contribute to building a more capable and knowledgeable medical workforce prepared to handle Rabies cases effectively.

Course Outline

It is imperative to underscore that the course outline harmonizes with the course schedule. Consequently, any modifications or adaptations made to the course schedule should be duly reflected in this course outline. This synergy between the schedule and the outline ensures consistency and alignment between training plans and their actual implementation.

Note: Make copies of the schedule, one for each participant and include in the training material bag.

Time	Topics/Activities	Training/Learning Methods	Resources/Materials
20 min	Welcome participants Facilitate introductions of participants Explore participants' expectations for the course	Open course with a word of welcome by organizers, lead trainers, etc. Facilitate the introductions of all participants and trainers. Explore participants' expectations for the course. Allow participants to freely explore their expectations. In the next session on review of the course objectives, address which expectations can be met and which cannot be met.	Prepare welcome sign, Name badges
20 min	Review course objectives and schedule. Review components of the training guide	Review the course goals and objectives; the course design and expected outcomes; Review the course schedule, including starting and ending times and times for breaks and lunch; Review the materials to be used in the course and ensure that participants understand the use of course materials.	Copies of course schedule, one for each participant from Facilitators' Guide (FG). Full set of the training guide: Facilitators' Guide (FG) Questionnaire
20 min	Assess participants' pre-course knowledge	Distribute the Pre-course Knowledge Assessment sheet to each participant. Ask them to answer each question. Allow 15 minutes for assessment. Immediately review the correct responses—Have participants grade the papers while the trainer reviews the correct answers with them and collect the papers after reviewing all the answers.	Pre-Training Quiz Sheet for each participant
4-5 hours	Presentation/ Discussion	Use the PowerPoint slides to present information	Power Point slides on the sessions planned as per agenda
20 min	Assess participants' post training knowledge	Distribute the Post Training Knowledge Assessment sheet to each participant. Ask them to answer each question. Allow 15 minutes for the Post Training Knowledge Assessment.	Copies of Post Training Knowledge Assessment Sheets (one for each participant)
15 min	Course Evaluation	Ask questions of the participants and engage them in the presentation of the information.	
15 min	Closing	Closing remarks by training organizers. Distribute certificates to participants.	Certificate for each participant

PRE/POST TRAINING QUIZ

Instructions for the trainer:

- The trainer/instructor will administer the test before the training and collect the response.
- The same test will be given to the trainee after the completion of the training.
- The difference in scores will be recorded for training evaluation purpose.

Trainee Name:

Date:

Designation:

Test taken before the training (yes/no):

Test taken after the training (yes/no):

Instructions for the trainee:

- The test quiz carries 30 questions
- Attempt all the questions.
- Put a tick mark on the correct option or fill the blanks with True/ False
- Please check whether all questions are answered before submitting

1. During the furious form of rabies, which symptom is most characteristic?

- A. Paralysis
- B. Aggression
- C. Excessive salivation
- D. Myoclonus

2. Which animal is responsible for nearly 99% of human rabies cases globally?

- A. Cats
- B. Bats
- C. Dogs
- D. Foxes

3. What is the primary method of rabies transmission to humans?

- A. Respiratory droplets
- B. Bite or scratch from an infected animal
- C. Contaminated water
- D. Skin contact with infected body fluids

4. **Rabies belongs to which virus family?**
- A. Herpesviridae
 - B. Retroviridae
 - C. Rhabdoviridae
 - D. Paramyxoviridae
5. **Which of the following signs is NOT typically seen in human rabies infection?**
- A. Hydrophobia
 - B. Myoclonus
 - C. Aerophobia
 - D. Polyuria
6. **In rabies post-exposure prophylaxis (PEP), what is the first critical step after an animal bite?**
- A. Administering rabies vaccine
 - B. Thorough wound washing with soap and water
 - C. Antibiotic therapy
 - D. Administration of rabies immunoglobulin (RIG)
7. **A woman presents at your clinic after being scratched by a stray cat while feeding it. The scratch has not broken the skin. What category of exposure is this, and what PEP is recommended?**
- A. Category I; No PEP required
 - B. Category II; Administer rabies vaccine
 - C. Category III; Administer rabies vaccine and RIG
 - D. Category I; Administer rabies vaccine only
8. **A 25-year-old man received the full course of rabies vaccination six months ago after a dog bite. He is now bitten again by a different dog. The bite is deep, and the dog's rabies status is unknown. What PEP is required?**
- A. No treatment is needed due to previous vaccination
 - B. Administer a full course of rabies vaccine and RIG
 - C. Administer two booster doses of rabies vaccine on days 0 and 3 without RIG
 - D. Administer only RIG, no further vaccine is required

- 9. In India, which animal is most responsible for rabies transmission to humans??**
- A. Monkeys
 - B. Dogs
 - C. Cats
 - D. Mongoose
- 10. How long after vaccination does rabies immunoglobulin (RIG) provide protection in severe cases?**
- A. Immediately
 - B. 3 days
 - C. 7 days
 - D. 14 days
- 11. What is the recommended dose for human rabies immunoglobulin (RIG) in rabies PEP?**
- A. 10 IU/kg body weight
 - B. 20 IU/kg body weight
 - C. 30 IU/kg body weight
 - D. 40 IU/kg body weight
- 12. What is the purpose of the Integrated Bite Case Management (IBCM) system in rabies control?**
- A. Surveillance of dog bite incidents
 - B. Tracking rabies cases in humans
 - C. Managing human and animal rabies cases
 - D. Administering vaccines to animals
- 13. Which clinical sign differentiates furious rabies from paralytic rabies in humans?**
- A. Hydrophobia
 - B. Paralysis
 - C. Respiratory distress
 - D. Seizures

- 14.A 10-year-old boy is bitten on the hand by a neighbor's unvaccinated dog. The dog is displaying signs of aggression, and the wound is bleeding. What is the most appropriate initial management?**
- A. Clean the wound and administer antibiotics only
 - B. Wash the wound thoroughly with soap and water for 15 minutes and administer both rabies vaccine and rabies immunoglobulin (RIG)
 - C. Monitor the boy for signs of rabies before taking action
 - D. Suturing the wound and observing the dog for 10 days
- 15. In rabies surveillance, what percentage of the dog population must be vaccinated to interrupt transmission?**
- A. 50%
 - B. 60%
 - C. 70%
 - D. 80%
- 16. What is the primary reservoir for rabies virus in India?**
- A. Bats
 - B. Foxes
 - C. Dogs
 - D. Cats
- 17. Which type of diagnostic test is considered the gold standard for post-mortem rabies confirmation?**
- A. ELISA
 - B. Direct Fluorescent Antibody Test (DFAT)
 - C. PCR
 - D. Immunoblot
- 18. How soon should rabies vaccine be administered after potential exposure?**
- A. Within 12 hours
 - B. Within 24 hours
 - C. Within 48 hours
 - D. Within 72 hours

- 19. Which part of the rabies virus induces the production of neutralizing antibodies?**
- A. Glycoprotein spikes
 - B. Nucleocapsid
 - C. Lipid bilayer
 - D. RNA polymerase
- 20. How is rabies virus primarily transmitted in humans?**
- A. Contaminated food
 - B. Direct contact with blood
 - C. Bites from infected animals
 - D. Inhalation of viral particles
- 21. Which surveillance system is used under the National Action Plan for Rabies Elimination (NAPRE)?**
- A. IDSP
 - B. NADRS
 - C. GIS-based Surveillance
 - D. All of the above
- 22. During which phase of rabies infection do specific symptoms like hydrophobia typically appear?**
- A. Prodromal phase
 - B. Incubation phase
 - C. Acute neurologic phase
 - D. Recovery phase
- 23. Which sector is NOT involved in rabies surveillance under the One Health approach?**
- A. Human health
 - B. Veterinary health
 - C. Environmental health
 - D. Agriculture
- 24. Which method is most effective for preventing rabies transmission in humans?**
- A. Mass dog culling
 - B. Dog vaccination campaigns
 - C. Public awareness programs
 - D. Administering antibiotics

- 25. The WHO “Zero by 30” initiative aims to eliminate which form of rabies by 2030?**
- A. Bat-mediated rabies
 - B. Dog-mediated rabies
 - C. Wild animal rabies
 - D. Human-to-human rabies
- 26. In ante-mortem rabies diagnosis, which specimen is most commonly collected?**
- A. Blood
 - B. Saliva
 - C. Skin biopsy
 - D. Urine
- 27. How is rabies spread from the central nervous system to peripheral tissues like the salivary glands?**
- A. Hematogenous spread
 - B. Lymphatic spread
 - C. Centrifugal spread through nerves
 - D. Direct invasion of tissues
- 28. In rabies cases, what percentage of patients experience the paralytic form of the disease?**
- A. 10%
 - B. 20%
 - C. 30%
 - D. 40%
- 29. What is the recommended management for a bite by a rabid animal in the absence of symptoms?**
- A. Observation for 10 days
 - B. Immediate administration of PEP
 - C. Antibiotics and painkillers
 - D. Isolation
- 30. During the recovery phase of rabies, which organ is most commonly affected?**
- A. Kidneys
 - B. Lungs
 - C. Central nervous system
 - D. Liver

ANSWER KEY

1. **During the furious form of rabies, which symptom is most characteristic?**
 - A. Paralysis
 - B. Aggression**
 - C. Excessive salivation
 - D. Myoclonus
2. **Which animal is responsible for nearly 99% of human rabies cases globally?**
 - A. Cats
 - B. Bats
 - C. Dogs**
 - D. Foxes
3. **What is the primary method of rabies transmission to humans?**
 - A. Respiratory droplets
 - B. Bite or scratch from an infected animal**
 - C. Contaminated water
 - D. Skin contact with infected body fluids
4. **Rabies belongs to which virus family?**
 - A. Herpesviridae
 - B. Retroviridae
 - C. Rhabdoviridae**
 - D. Paramyxoviridae
5. **Which of the following signs is NOT typically seen in human rabies infection?**
 - A. Hydrophobia
 - B. Myoclonus
 - C. Aerophobia
 - D. Polyuria**
6. **In rabies post-exposure prophylaxis (PEP), what is the first critical step after an animal bite?**
 - A. Administering rabies vaccine
 - B. Thorough wound washing with soap and water**
 - C. Antibiotic therapy
 - D. Administration of rabies immunoglobulin (RIG)

7. A woman presents at your clinic after being scratched by a stray cat while feeding it. The scratch has not broken the skin. What category of exposure is this, and what PEP is recommended?
- A. Category I; No PEP required**
 - B. Category II; Administer rabies vaccine
 - C. Category III; Administer rabies vaccine and RIG
 - D. Category I; Administer rabies vaccine only
8. A 25-year-old man received the full course of rabies vaccination six months ago after a dog bite. He is now bitten again by a different dog. The bite is deep, and the dog's rabies status is unknown. What PEP is required?
- A. No treatment is needed due to previous vaccination
 - B. Administer a full course of rabies vaccine and RIG
 - C. Administer two booster doses of rabies vaccine on days 0 and 3 without RIG**
 - D. Administer only RIG, no further vaccine is required
9. In India, which animal is most responsible for rabies transmission to humans??
- A. Monkeys
 - B. Dogs**
 - C. Cats
 - D. Mongoose
10. How long after vaccination does rabies immunoglobulin (RIG) provide protection in severe cases?
- A. Immediately**
 - B. 3 days
 - C. 7 days
 - D. 14 days
11. What is the recommended dose for human rabies immunoglobulin (RIG) in rabies PEP?
- A. 10 IU/kg body weight
 - B. 20 IU/kg body weight**
 - C. 30 IU/kg body weight
 - D. 40 IU/kg body weight

- 12. What is the purpose of the Integrated Bite Case Management (IBCM) system in rabies control?**
- A. Surveillance of dog bite incidents
 - B. Tracking rabies cases in humans
 - C. Managing human and animal rabies cases**
 - D. Administering vaccines to animals
- 13. Which clinical sign differentiates furious rabies from paralytic rabies in humans?**
- A. Hydrophobia**
 - B. Paralysis
 - C. Respiratory distress
 - D. Seizures
- 14. A 10-year-old boy is bitten on the hand by a neighbor's unvaccinated dog. The dog is displaying signs of aggression, and the wound is bleeding. What is the most appropriate initial management?**
- A. Clean the wound and administer antibiotics only
 - B. Wash the wound thoroughly with soap and water for 15 minutes and administer both rabies vaccine and rabies immunoglobulin (RIG)**
 - C. Monitor the boy for signs of rabies before taking action
 - D. Suturing the wound and observing the dog for 10 days
- 15. In rabies surveillance, what percentage of the dog population must be vaccinated to interrupt transmission?**
- A. 50%
 - B. 60%
 - C. 70%**
 - D. 80%
- 16. What is the primary reservoir for rabies virus in India?**
- A. Bats
 - B. Foxes
 - C. Dogs**
 - D. Cats

- 17. Which type of diagnostic test is considered the gold standard for post-mortem rabies confirmation?**
- A. ELISA
 - B. Direct Fluorescent Antibody Test (DFAT)**
 - C. PCR
 - D. Immunoblot
- 18. How soon should rabies vaccine be administered after potential exposure?**
- A. Within 12 hours
 - B. Within 24 hours**
 - C. Within 48 hours
 - D. Within 72 hours
- 19. Which part of the rabies virus induces the production of neutralizing antibodies?**
- A. Glycoprotein spikes**
 - B. Nucleocapsid
 - C. Lipid bilayer
 - D. RNA polymerase
- 20. How is rabies virus primarily transmitted in humans?**
- A. Contaminated food
 - B. Direct contact with blood
 - C. Bites from infected animals**
 - D. Inhalation of viral particles
- 21. Which surveillance system is used under the National Action Plan for Rabies Elimination (NAPRE)?**
- A. IDSP**
 - B. NADRS
 - C. GIS-based Surveillance
 - D. All of the above
- 22. During which phase of rabies infection do specific symptoms like hydrophobia typically appear?**
- A. Prodromal phase
 - B. Incubation phase
 - C. Acute neurologic phase**
 - D. Recovery phase

23. Which sector is NOT involved in rabies surveillance under the One Health approach?
- A. Human health
 - B. Veterinary health
 - C. Environmental health
 - D. Agriculture**
24. Which method is most effective for preventing rabies transmission in humans?
- A. Mass dog culling
 - B. Dog vaccination campaigns**
 - C. Public awareness programs
 - D. Administering antibiotics
25. The WHO “Zero by 30” initiative aims to eliminate which form of rabies by 2030?
- A. Bat-mediated rabies
 - B. Dog-mediated rabies**
 - C. Wild animal rabies
 - D. Human-to-human rabies
26. In ante-mortem rabies diagnosis, which specimen is most commonly collected?
- A. Blood
 - B. Saliva**
 - C. Skin biopsy
 - D. Urine
27. How is rabies spread from the central nervous system to peripheral tissues like the salivary glands?
- A. Hematogenous spread
 - B. Lymphatic spread
 - C. Centrifugal spread through nerves**
 - D. Direct invasion of tissues
28. In rabies cases, what percentage of patients experience the paralytic form of the disease?
- A. 10%**
 - B. 20%
 - C. 30%
 - D. 40%

- 29. What is the recommended management for a bite by a rabid animal in the absence of symptoms?**
- A. Observation for 10 days
 - B. Immediate administration of PEP**
 - C. Antibiotics and painkillers
 - D. Isolation
- 30. During the recovery phase of rabies, which organ is most commonly affected?**
- A. Kidneys
 - B. Lungs
 - C. Central nervous system**
 - D. Liver

LIST OF CONTRIBUTORS

Key Contributors for Conceptualizing, Planning and Coordination

Dr. Simmi Tiwari, Joint Director and Head, Centre for One Health, National Centre for Disease Control, Ministry of Health and Family Welfare, New Delhi
Dr. Ajit Dadaji Shewale, Deputy Director, Centre for One Health, National Centre for Disease Control, Ministry of Health and Family Welfare, New Delhi
Dr. Tushar Nanasahab Nale, Deputy Director, Centre for One Health, National Centre for Disease Control, Ministry of Health and Family Welfare, New Delhi
Dr. Jitesh Kuwatada, Assistant Director, Centre for One Health, National Centre for Disease Control, Ministry of Health and Family Welfare, New Delhi
Dr. Aastha Singh, Research Officer, Centre for One Health, National Centre for Disease Control, Ministry of Health and Family Welfare, New Delhi
Dr. Arvind Prakash Srivastava, Senior Public Health Specialist, Centre for One Health, National Centre for Disease Control, Ministry of Health and Family Welfare, New Delhi
Dr. Dipti Mishra, Consultant, Centre for One Health, National Centre for Disease Control, Ministry of Health and Family Welfare, New Delhi
Dr. Gajendra Singh, Wildlife Officer, Centre for One Health, National Centre for Disease Control, Ministry of Health and Family Welfare, New Delhi
Dr. Hanul Thukral, Epidemiologist, Centre for One Health, National Centre for Disease Control, Ministry of Health and Family Welfare, New Delhi
Dr. Nidhi Khandelwal, Technical Officer (Ecology), Centre for One Health, National Centre for Disease Control, Ministry of Health and Family Welfare, New Delhi

Key Contributors for Resource Evaluation: Subject Matter Experts

Dr. Anissa Mary Thomas Thattil, Assistant Professor, Department of Community Medicine, Father Muller's Medical College, Mangalore, Karnataka
Dr. Anita Desai, Formerly Professor & Head, Department of Neurovirology, National Institute of Mental Health and Neurosciences, Bangalore, Karnataka
Dr. Bhagyashree Panda, Assistant Professor, Department of General Medicine, SCB Medical College and Hospital, Cuttack, Odisha
Dr. Bibhuti Saha, Professor and Head, Infectious Diseases and Advanced Microbiology, School of Tropical Medicine, Kolkata; Tata Medical Centre, Kolkata, West Bengal
Dr. Debduitta Haldar, Assistant Professor, Department of Community Medicine, Diamond Harbour Government Medical College and Hospital, Kolkata, West Bengal
Dr. Dewesh Kumar, Associate Professor, Department of Community Medicine, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand
Dr. Dhiren Yadav, Assistant Professor, Department of General Medicine, LTM Medical College and General Hospital, Mumbai, Maharashtra
Dr. Jyoti Iravane (Bajaj), Professor & HOD of Microbiology, Government Medical College, Aurangabad, Maharashtra

Dr. Kamla Kant, Associate Professor & HOD, Department of Microbiology, All India Institute of Medical Sciences (AIIMS), Bathinda, Punjab
Dr. Lakshmi Jyothi Tadi, Additional Professor, Dept of Microbiology, All India Institute of Medical Sciences (AIIMS), Bibinagar, Telangana
Dr. Meena Mishra, Professor and Head, Department of Microbiology, All India Institute of Medical Sciences (AIIMS), Nagpur, Maharashtra
Dr. Prashant Joshi, Professor and Head, Department of General Medicine, All India Institute of Medical Sciences (AIIMS), Nagpur, Maharashtra
Dr. Raman Swathy Vaman, Public Health Professional, Directorate of Health Services, Kerala
Dr. Sameer Gulati, Professor, Department of General Medicine, Lady Hardinge Medical College, New Delhi
Dr. Sneha K Chunchanur, Assistant Professor, Department of Microbiology, Bangalore Medical College and Research Institute (BMCRI), Bengaluru, Karnataka
Dr. Sugunan Attayur Purushottaman, Scientist - F, Division of Epidemiology, Regional Medical Research Centre (RMRC) ICMR, Port Blair, A&N Islands
Dr. Suruchi Shukla, Assistant Professor, Department of Microbiology, King George's Medical University (KGMU), Lucknow, Uttar Pradesh
Dr. Vijayachari Phuluru, Director, Scientist - G, Department of Microbiology, Regional Medical Research Centre (RMRC) ICMR, Port Blair, A&N Islands
Dr. Yogesh Bahurupi, Associate Professor, Department of Community and Family Medicine, All India Institute of Medical Sciences (AIIMS), Rishikesh, Uttarakhand
Dr. Amit Pritam Swain, Epidemic Intelligence Officer, National Centre for Disease Control, Ministry of Health & Family Welfare, New Delhi
Dr. Sowntappan Balasubramaniam, Epidemic Intelligence Officer, National Centre for Disease Control, Ministry of Health & Family Welfare, New Delhi

Resource Development team

Ms. Aditi Sharma, Program Officer - Laboratory Strengthening, Reaching Impact, Saturation, and Epidemic Control (RISE) – India, Jhpiego, New Delhi
Dr. Gaurav Thakral, Senior Program Officer - Health System Strengthening, Reaching Impact, Saturation, and Epidemic Control (RISE) – India, Jhpiego, New Delhi
Ms. L Nungshi Henbi, Program Officer - Laboratory Strengthening, Reaching Impact, Saturation, and Epidemic Control (RISE) – India, Jhpiego, Assam
Dr. Nochiketa Mohanty, Associate Director and Deputy Chief of Party, Health Systems Development, Reaching Impact, Saturation, and Epidemic Control (RISE) – India, Jhpiego, Odisha
Ms. Preetishirin Katapur, National Program Officer, Reaching Impact, Saturation, and Epidemic Control (RISE) – India, Jhpiego, New Delhi
Dr. Prashant Singh, Senior Advisor - Laboratory Strengthening, Reaching Impact, Saturation, and Epidemic Control (RISE) – India, Jhpiego, New Delhi
Dr. Pratik Kumar, Senior Program Officer - Lab Strengthening, Reaching Impact, Saturation, and Epidemic Control (RISE) – India, Jhpiego, New Delhi

Dr. Priyanka Kharakwal, Program Officer – Animal Health, Reaching Impact, Saturation, and Epidemic Control (RISE) – India, Jhpiego, New Delhi
Ms. Samiksha Wadekar, Program Officer - Laboratory Strengthening, Reaching Impact, Saturation, and Epidemic Control (RISE) – India, Jhpiego, Maharashtra
Ms. Shraddha Kumari Sikaria, Consultant, Reaching Impact, Saturation, and Epidemic Control (RISE) – India, Jhpiego, Rajasthan
Dr. Sithun Patro, Senior Monitoring Evaluation and Learning Officer, Reaching Impact, Saturation, and Epidemic Control (RISE) – India, Jhpiego, New Delhi
Dr. Vahini Anandkumar, Program Officer - Zoonotic Diseases, Reaching Impact, Saturation, and Epidemic Control (RISE) – India, Jhpiego, New Delhi
Dr. Vasundhara Razdan Tikku, Consultant, Reaching Impact, Saturation, and Epidemic Control (RISE) – India, Jhpiego, New Delhi
Dr. Vineet Kumar Srivastava, Sr. Program Director and Chief of Party, Reaching Impact, Saturation, and Epidemic Control (RISE) – India, Jhpiego, New Delhi

Content Drafting and Design Team

Ms. Preetishirin Katapur, National Program Officer, Reaching Impact, Saturation, and Epidemic Control (RISE) – India, Jhpiego, New Delhi
Mr. Harsh Bharti, Senior Program Associate-Programs, Reaching Impact, Saturation, and Epidemic Control (RISE) – India, Jhpiego, New Delhi
Mr. Kailash Jain and Mr. Shahwez Akhtar, 3P Solutions, New Delhi



Developed by
Centre for One Health
National Centre for Disease Control
Ministry of Health and Family Welfare
Government of India