Original Research Article

DIAGNOSTIC AND CONTROL MEASURES TO TACKLE THE EMERGENCE OF THE NIPHA VIRUS IN PAKISTAN FROM ONE HEALTH PERSPECTIVE

SUBHAN A[1], IJAZ S[2], FAIZ S[3], KHAN MS[4], KHOSA SA[5], KHAN R[6], RIZVI SBH[2], ZAFAR MB[7], SOHAIL M[3]

[1]*Department of Pathobiology, Section Microbiology College of Veterinary and Animal Sciences, Jhang sub campus university of Veterinary and Animal Sciences Lahore, Pharmakon International Enterprises, Islamabad, Pakistan,*
[2]*Department of Epidemiology and Public Health, University of Veterinary and Animal Sciences Lahore, Pakistan*
[3]*Department of Pathology, University of Agriculture Faisalabad, Pakistan*
[4]*College of Veterinary Science, University of Agriculture Peshawar, Pakistan*
[5]*Veterinary Research Institute, Livestock and Dairy Development Department Balochistan Quetta, Pakistan*
[6]*Department of Epidemiology and Public Health, College of Veterinary and Animal Sciences Jhang, Pakistan*
[7]*AZRI Bahawalpur, Pakistan Agriculture Research Council Pakistan*
Corresponding author email address: sohailch275@gmail.com

Abstract: *The emergence of the Nipah virus (NiV) presents a significant global health concern due to its potential for severe outbreaks and high fatality rates. The study's primary aim was to find the diagnostic and control measures to tackle the emergence of the nipa virus in Pakistan from one health perspective. This cross-sectional study was conducted in Lahore from August 2023 to November 2023. The study utilizes multidisciplinary collaboration, encompassing human health, veterinary sciences, environmental sciences, and public health experts, ensuring a holistic evaluation of the situation. Data was collected from different regions of Pakistan. The study encompassed 500 suspected cases, ultimately confirming 80 cases of Nipah virus. Geographically, the North region exhibited a higher incidence, with 35 confirmed cases, while the South region reported 20 confirmed cases. Among age groups, individuals aged 25-45 accounted for 45 confirmed cases, followed by 46-65 years with 25 confirmed cases. It is concluded that Effective control measures were observed in certain aspects, such as surveillance systems' ability to pinpoint clusters. Still, gaps in intersectoral collaboration and environmental involvement were evident, demanding immediate attention to fortifying these strategies.*

Keywords: Nipah Virus (NiV), Global Health Concern, Diagnostic Measures, Control Measures, Human Health

Introduction

The emergence of the Nipah virus (NiV) presents a significant global health concern due to its potential for severe outbreaks and high fatality rates. Nipah virus, primarily transmitted from animals to humans, causes severe respiratory and neurological symptoms, posing a considerable public health threat. Since its discovery in the late 1990s, sporadic outbreaks have been reported in South and Southeast Asia, with potential risks of more comprehensive transmission due to its zoonotic nature and person-to-person spread (Bruno et al., 2022). Nipah virus (NiV) is a zoonotic virus transmitted between animals and humans, primarily associated with fruit bats, also known as flying foxes. Its transmission can occur through pigs, goats, horses, and dogs. Preventing Nipah virus infection involves avoiding contact with infected animals, especially bats and pigs, in areas known for transmission (Hengjan et al., 2017). This includes removing food items susceptible to contamination, such as raw date palm sap or fruit. The virus also spreads through bodily fluids, necessitating caution when near individuals with Nipah virus. The infection can range from mild to severe, causing conditions like encephalitis and sometimes resulting in fatalities. Unfortunately, there are currently no

specific medications or vaccines for treating NiV. Management revolves around symptom alleviation (Yong et al., 2020).

Encephalitis, often fatal, remains the primary manifestation, occasionally accompanied by pulmonary illness or even asymptomatic cases. Diagnostic approaches involving serology and enhanced MRI imaging techniques like fluid-attenuated inversion recovery (FLAIR) aid in visualizing high-signal lesions with reduced cerebrospinal fluid impact. Molecular techniques and serological tests help in definitive diagnosis (Anyamba et al., 2019). Containing the spread of NiV is crucial. Current strategies emphasize limiting contact with reservoir species, practicing proper animal farming techniques, and improving hygiene in affected areas (Orusa et al., 2021).

Although scarce, ongoing research focuses on potential drug and vaccine development, urging further studies to understand NiV's interaction with the immune system and enhance preventive and curative therapies. Experimental vaccines based on NiV immunogenic proteins aim to induce antibody responses and mediate viral clearance, addressing the need for effective countermeasures against this emerging and potentially dangerous disease (McMichael et al., 2017). Thus, the study's primary aim is to find the
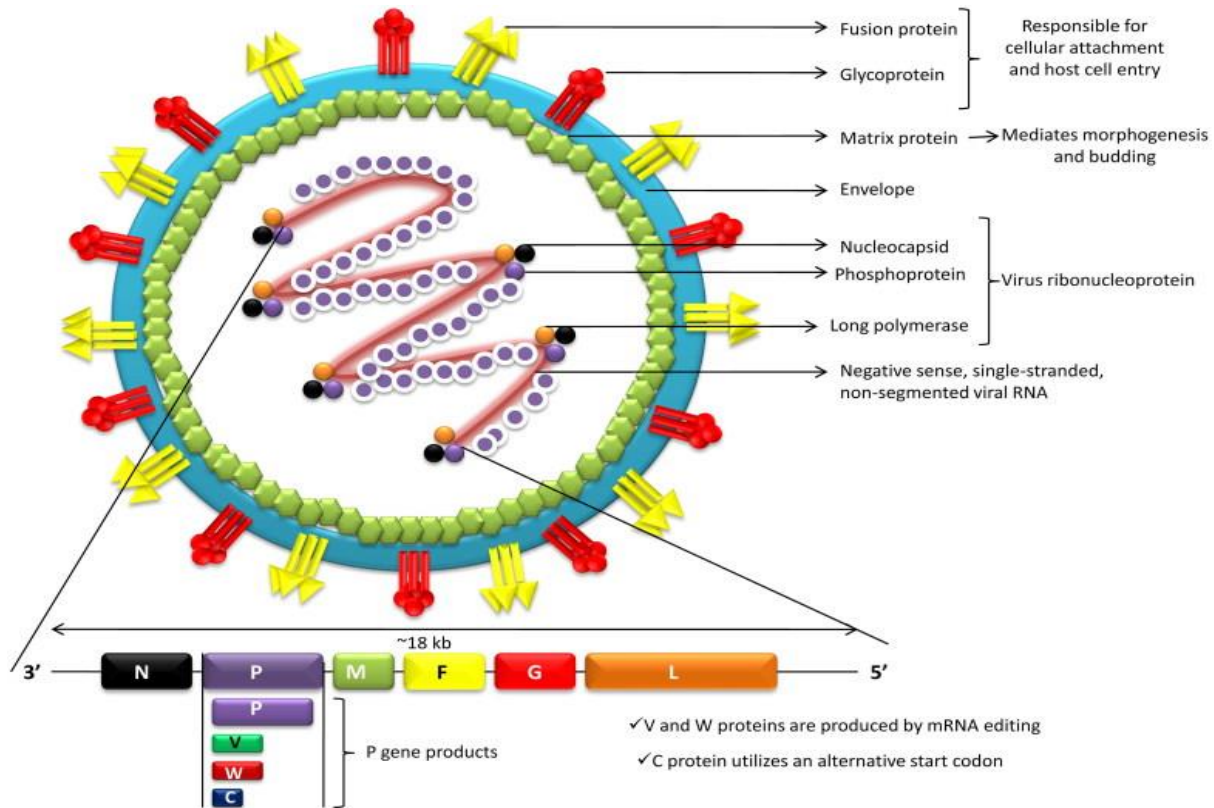
diagnostic and control measures to tackle the emergence of the nipa virus in Pakistan from a one-health perspective.

Methodology

This cross-sectional study was conducted in Lahore from August 2023 to November 2023. The study utilizes multidisciplinary collaboration, encompassing human health, veterinary sciences, environmental sciences, and public health experts, ensuring a holistic evaluation of the situation.

Collection and analysis of existing epidemiological data on Nipah virus cases, including geographical distribution, affected demographics, and transmission dynamics in Pakistan. Evaluation of available diagnostic methods, including serological, molecular, and imaging techniques. They are assessing their efficacy, availability, and feasibility in the local context. Investigating the interconnectedness between human, animal, and environmental health emphasizes the role of reservoirs, potential vectors, and environmental factors influencing Nipah virus transmission.

In-depth analysis and comparison of diagnostic tools used for Nipah virus detection, including their sensitivity, specificity, cost-effectiveness, and applicability in resource-limited settings in Pakistan. Emphasis is placed on identifying gaps and proposing potential improvements in diagnostic methodologies.

We are conducting a risk assessment to identify high-risk areas, vulnerable populations, potential routes of transmission, and environmental factors contributing to the spread of the Nipah virus in Pakistan.

Results

Data was collected from different regions of Pakistan. The study encompassed 500 suspected cases, ultimately confirming 80 cases of Nipah virus. Geographically, the North region exhibited a higher incidence, with 35 confirmed cases, while the South region reported 20 confirmed cases. Among age groups, individuals aged 25-45 accounted for 45 confirmed cases, followed by 46-65 years with 25 confirmed cases.

Table 01: Epidemiological data

Parameter	Total Cases	Confirmed Nipah Virus Cases
Suspected Cases	500	-
Confirmed Nipah Virus Cases	-	80
Geographical Distribution		
North Region	-	35

South Region	-	20
Age Group Distribution		
25-45 years	-	45
46-65 years	-	25

The diagnostic evaluation revealed varying characteristics among different tests for Nipah virus detection. The serological test demonstrated a sensitivity of 75% and specificity of 90%, widely available across settings. The molecular assay exhibited higher sensitivity (85%) but lower specificity (80%), hampered by limited availability in rural areas. Imaging techniques like MRI/CT showed reasonable specificity (95%) but lower sensitivity (70%), primarily preferred in urban settings.

Table 02: Diagnosis and evaluation

Diagnostic Test	Sensitivity	Specificity	Availability
Serological Test	75%	90%	Widely available
Molecular Assay	85%	80%	Limited in rural
Imaging Techniques (MRI/CT)	70%	95%	Urban preference

The control measures assessment showcased several positive outcomes and areas requiring improvement in combating Nipah virus transmission. Surveillance systems proved effective in identifying clusters of cases, aiding targeted interventions. Implementing preventive strategies resulted in a 30% reduction in raw date palm sap consumption in high-risk zones.

Table 03: Assessment of control measures

Control Measures	Effectiveness/Findings
Surveillance Systems	Effective in identifying clusters
Preventive Strategies	Reduced raw date palm sap consumption by 30% in high-risk areas
Intersectoral Collaboration	Strengthened coordination between health and veterinary departments; Environmental involvement improvement is needed

Table 04: Risk assessment

Risk Assessment	Findings
High-Risk Areas	Identified [North Region] and [South Region]
Vulnerable Populations	Agricultural workers, Livestock handlers
Transmission Routes	Potential transmission via bat droppings in date palm orchards

Discussion

The findings from this study shed light on several critical aspects of the Nipah virus's emergence in Pakistan within a One Health framework. The evaluation of diagnostic tools showcased varying sensitivities and specificities, highlighting the need for a multifaceted approach in employing diverse diagnostic methodologies for accurate and timely identification of Nipah virus cases (Páez et al., 2017). Challenges in the availability of molecular assays in rural settings warrant urgent attention for equitable access to diagnostic facilities across regions. In recent years, the world has grappled with the emergence of various deadly viruses and diseases, significantly impacting global health (Martin et al., 2018). As the battle against COVID-19 seemed to ease, a new concern emerged: the red-eye disease, casting an ominous shadow. Adding to these worries is the looming threat of the Nipah virus, already established in South India with a mortality rate spanning from 40% to 70%, now presenting a serious and imminent danger to Pakistan (Nahar et al., 2020). The Nipah Virus Disease (NiVD) outbreak in 2018 marked a significant event characterized by a notably high case fatality rate (CFR), yet subsequent outbreaks could be categorized as minor events. The initial cases in both outbreaks likely stemmed from accidental exposure to NiV-infected bats or contaminated food sources (Latinne et al., 2020). However, in the 2018 outbreak, the spread might have been amplified by person-to-person transmission within hospital settings, involving close family and hospital contacts in subsequent cases (Mazzola et al., 2019). These incidents are believed to be isolated or localized occurrences. Furthermore, gaining a deeper understanding of reservoir bats' spatial preferences and movement could contribute to their conservation efforts and aid in preventing potential disease transmission (Singhai et al., 2021). The utilization of Remote Sensing (RS) and Geographic Information System (GIS) technologies has proven instrumental in investigating animal distribution concerning environments, human settlements, and wildlife diseases, offering insights into flying fox colonies potentially carrying NiV and their surrounding areas (Singh et al., 2019).

Conclusion

It is concluded that Effective control measures were observed in certain aspects, such as surveillance systems' ability to pinpoint clusters. Still, gaps in intersectoral collaboration and environmental involvement were evident, demanding immediate attention to fortify these strategies. The risk assessment underscored the importance of understanding transmission routes,

emphasizing the necessity of tailored preventive measures targeting occupational exposure and high-risk areas.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department Concerned.
Consent for publication
Approved
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Not applicable

Conflict of interest

The authors declared absence of conflict of interest..

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