Zoonosis unfurling: A public health challenge

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Abstract

Nipah viral infection (NiV) is an emanating zoonotic disease caused by highly virulent paramyxovirus naturally found in fruit bats of the genus *Pteropus*, also propagates in intermediate amplifying hosts like pigs and other domestic animals further facilitating spread in human beings. Neighbouring countries experienced many outbreaks concluding in high fatality and severe socio-economic loss. Being flying creatures, bats can spread NiV over long stretch of land making approximately 2 billion people at risk in SE Asian region. Recent outbreak emerged in Kozhikode, India in May 2018 with consequential 10 fatalities prompted to review and revisit data on NiV and suggest recommendations in Indian context.

In absence of vaccine and therapeutic, this disease needs to be prevented at community setting by restraining certain social habitude and animal farming practices including food habits so that bat-pig-human cycle is severed preventing spread of disease. Awareness intensification through information and communication among at-risk population and health-care workers is imperative among control measures. Outbreak preparedness and season specific surveillance for acute encephalitis syndrome (AES) and acute lower respiratory infection (ALRI) cases of unknown aetiology are obligatory by formation of multisectoral team with holistic approach to mitigate impending surge. Available clinical services need to be geared up in terms of assignment of surveillance clinicians, laboratory services for basic tests like ELISA and RT-PCR, commissioning of isolation wards, positioning of personal protective equipment for barrier nursing along with safety education of health-workers. Preventive measures so organised can defend the at-risk community undeniably in the face of a challenging zoonotic spate.

Keywords: NiV, Nipah, AES, ALRI.

Introduction

Nipah viral infection (NiV) is an emerging zoonotic disease that is caused by a highly pathogenic paramyxovirus naturally hosted by fruit bats also capable of propagating in intermediate host like pigs and other domestic animals. NiV diseases appeared in recent past and recurrent outbreaks have been reported in some countries since 1998. Apart from being a serious public health problem for having multiple hosts and multifarious modes of transmission, NiV outbreaks caused devastating socio-economic effects in neighbouring countries with high fatality rate, therefore merits attention. Recently an outbreak surfaced in Kozhikode (Kerala), India, initially involving 03 subjects of a family slowly transgressing in to other contacts increasing the death toll to 10.[1] The index case contracted infection apparently from resting bats while cleaning up an unused bat infested well in a rural area. This endeavour tries to appraise the epidemiological significance and basic preventive measures that ardour the essence of prevention of this critical and complex viral infection in Indian context.

Epidemiological Review

NiV infection was first recognized in a large outbreak with 40% fatality in peninsular Malaysia among 265 subjects in '98-'99.[2] Patients were affected with acute encephalitis after contracting NiV from infected pigs. The outbreak had clinical similarity with Japanese encephalitis; however, the causative agent was pinned down as NiV ultimately. This episode caused widespread public panic in Malaysia leading to social disruption and economic loss due to mass culling of millions of pigs. Evidence suggested that climatic and anthropogenic driven ecological changes coupled with location of piggeries in orchard and the design of pigsties allowed spill-over of NiV from its reservoir host into domestic pigs and ultimately to humans. In early 1999, 11 pig slaughterers in Singapore developed NiV infection following close contact with imported Malaysian swine as fallout of mother-outbreak in Malaysia resulting in prohibition of import of pigs from Malaysia causing economic blockade between the countries.[3] However, recurrence of such outbreaks has not been reported from these countries since May 1999.

Bangladesh and India experienced spate of NiV infection since 2001. Bangladesh outbreaks in winters of 2001, 2003 and 2004 affected smaller number of subjects with high fatality rates reportedly higher (75%) than the initial outbreak in Malaysia and Singapore.[2-5] Consumption of raw date palm juice contaminated by fruit bats was the primary source of human NiV infection in Bangladesh outbreak.[4,5] Human-to-human transmission had definite secondary role however, the role of pigs or other domestic animals in disease transmission in Bangladesh could not be established.[5] Strong evidence indicative of human-to-human transmission of NiV was found in West Bengal, India in 2001 as most of the cases pivoted around 2-3 hospitals; affected were either related to or among the contacts of hospital in-patients.[4] Factors like proximity of Siliguri, West Bengal to areas of north-western districts of

Bangladesh that experienced NiV outbreaks in 2001, 2003, 2004 and distribution of locally abundant *P. giganteus*, the apparent natural reservoir of NiV in this area, could have been responsible for outbreak of NiV in North Bengal.[4] Bangladesh experiences NiV outbreaks every year in the north-western provinces and the last foray reported in Apr-May of 2013.[6]

Infective Epidemiology

Outbreaks of NiV shows seasonal pattern (winter-spring) associated with breeding season of bats, increased viral shedding and date palm sap harvesting attracting young bats to fly away in search of food due to local shortage leaving natural habitat yielding spill out of NiV to other animals.[7]

Fruit bats (flying foxes) of the genus *Pteropus*, family Pteropidae, have been identified as a natural reservoir host of NiV.[8] NiV was isolated from urine of free-living colony of fruit bats in Malaysia.[9] These bats are migratory and known to travel over considerable distances within the Asia-Pacific Region.

Infected bats shed the virus in urine, faeces, saliva, genital secretions but remain asymptomatic carriers as reservoir host. NiV is highly contagious among pigs and is spread by infected salivary droplets. Pigs act as an intermediate amplifying host after contact with infected bats or their secretions.

Routes of transmission are multifarious like infected pig to human among pig farmers and abattoir workers in Malaysia,[10] human-to-human transmission among health workers and hospital visitors in the outbreak of Siliguri,[4] bat to human transmission among date palm sap farmers in Bangladesh[3] and even through contaminated palm sap or bat-bitten fruits like date and mango facilitate infection. Aerosolisation of infective droplets originating from urine, saliva and respiratory secretion of patients, bats and pigs can play havoc.

Incubation period is 4-18 days; however the period of communicability is not defined. NiV causes severe, rapidly progressive encephalitis culminating into high mortality with clinical features suggestive of involvement of the brain stem.

Surveillance

A system of seasonal surveillance of NiV infection in humans should be initiated in countries having experienced outbreak in the past or evidence of infection in bats or animal hosts. The process needs to be linked to necessary investigation, response and ability to control and resolve the outbreak. Distinctive characteristics for such surveillance include sensitivity of detection, timely reporting of cases, basic clinical/hospital services and dissemination of awareness in community. Laboratory support including both serological and molecular techniques like ELISA and RT-PCR are mandatory for confirmatory diagnosis. Quality control for laboratory tests should be verified by national reference laboratories. Baseline test like detection of IgM antibody by ELISA should be available across the counter.

Event-based surveillance encompasses cases of NiV infection in the community members; identifying clusters of subjects having acute encephalitis syndrome (AES) or acute lower respiratory infection (ALRI) cases of unknown aetiology helping in early detection of NiV outbreaks among at-risk population. The definitions of AES/ARLI cases and cluster are to be ascertained according to standard scientific classification.[11]

Hospital-based surveillance embodies AES/ALRI monitoring in district and sub-divisional hospitals with basic laboratory capacity. Surveillance clinicians need to be designated and trained in case detection, cluster identification and reporting.

Awareness Intensification

Awareness strengthening in hospitals and communities incorporate training of health-care workers to follow standard infection control precautions like personal hygiene, barrier-nursing, use of personal protective equipment (PPE) while dealing AES/ALRI cases. Communities need to be communicated through multimedia, hand-outs and public address system encouraging people to stop consumption of raw date palm sap, avoid bat-bitten/fallen fruits, cover mouth and nose while caring unconscious patients, wash hands with soap-water before and after feeding/taking care of patients, avoid going to or accepting guests from known NiV afflicted region.

Bio-Security Animal Farm and Food Products

Bio-security of animal farms like removal of fruit orchards from immediate vicinity, wire-mesh screening of pig sheds, draining roof run-off away from pig pens to avoid contact with bat's excreta and droppings can help prevent likely spill-over. Protection of palm sap drain-point from bats by using polythene skirts, jute-fringe or bamboo-sarong covering sap-yield areas, even pasteurisation of sap are options to reduce spread of infection.[12]

Vaccine

Probability of success of a vaccine development against NiV is expected to be very high. In addition, various candidate vaccines demonstrated feasibility of using one or both of NiV glycoprotein (G) and fusion protein (F) as antigens to stimulate a protective immune response in various preclinical animal models including pigs. Little or no clinical signs of disease were observed in vaccinated animals after NiV challenge and protection against mortality often reached 100%.[13] Comprehensive trials are needed in human platforms to prove the vaccine kinetics; however ethical, biological and miscellaneous issues stood obstacle in vaccine development.

Outbreak Preparedness

Preparedness in terms of technical and logistical management of a NiV outbreak is essential in countries with history of recurrent outbreaks. The best response to a NiV outbreak is being able to detect cases as early as possible and prevent spread of infections. Surveillance should be intensified during NiV season from January to May, when most NiV outbreaks occurred in past. This will increase possibility of identifying NiV infection and understanding characteristics of the virus. Training of health-care personnel on aseptic collection of blood, CSF, urine and throat swabs from suspected patients and submission to laboratories for required tests need be stressed upon.

Being a zoonosis, NiV outbreaks may be associated with multiple extraneous factors such as animal reservoirs, socio-cultural practices, local food habits and possible human-to-human transmission; therefore a multidisciplinary team is needed including community representatives and groundwork should be done for pre-outbreak, outbreak and post-outbreak phases.

A multi-sectoral team should be built at national and local levels for monitoring, evaluation and response to unusual acute public health events involving the surveillance clinicians, microbiologist, epidemiologist, lab technicians, health-care workers and local leaders. Holistic, multi-disciplinary approach fostering a focussed public health target should be the perspective to prevent impending outbreaks and mitigate its disastrous effect.

This work congregates available data pertaining to NiV epidemiology, vaccines, therapeutics and modals for prevention and control. NiV is one of eleven diseases considered as in urgent need of research attention in the revised priority list issued by WHO in 2017. NiV is a zoonotic disease with case fatality up to 100%; its reservoir, the Pteropus bat, has a flying range that can cover huge areas enhancing risk of further spread to around 2 billion population.[13] Vaccine and other therapeutic platforms still need exploration. Therefore, an essential strategy for controlling NiV should focus on preventing virus transmission from bats to humans. Controlling virus in its wild reservoir does not seem a feasible approach. However, establishing or reinforcing surveillance system is of utmost importance to ensure that NiV outbreaks can be detected quickly and appropriate control measures initiated without delay. Also essential are the efforts on behaviour change communication interventions, so as to increase awareness on the risks associated with this virus.

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