 DOI: 10.18231/2394-6776.2016.0010

An outbreak of Kyasanur Forest Disease in Kerala: A clinico epidemiological study

Priya Chandran[1,*], Jayakrishnan Thavody[2], Lilabi MP[3], Thomas Bina[4], Suthanthira Kanan[5]

[1,2,3]Associate Professor, [4]Professor, [5]Junior Resident, Dept. of Community Medicine, Govt. Medical College, Kozhikode

***Corresponding Author:**
Email: drpriyamcc@gmail.com

Abstract

Kyasanur Forest disease virus (KFDV) was first identified in 1957, when it was isolated from a sick monkey from the Kyasanur Forest in Karnataka State, India. Since then it has been reported to be enzootic in five districts of Karnataka State. Despite the availability of a vaccine against the disease, reports of human infections are on the rise. Isolated cases and antibody against KFDV have been reported from new areas from the states of Tamil Nadu, Maharashtra and Kerala in India. Here, we report the features of the first outbreak of Kyasanur Forest disease (KFD) from Kerala involving 184 cases and 9 deaths.

Keywords: Kyasanur forest disease, Virus, Ticks, Monkeys

Introduction

Kyasanur Forest Disease (KFD) also known as "Monkey fever" is a tick borne disease caused by the KFD virus belonging to *Flaviviridae* family. Since its identification in 1957 from Shimoga district of Karnataka in India, it has spread to other neighbouring districts (North Kanada, Udipi, Chikmangalur, South Kanada, Chamarajanagar).[1] Aggressive vaccination efforts by the Karnataka government resulted in an initial decrease in the number of cases but the detection of antibodies against KFD virus in human serum from areas in Goa, Tamil Nadu, Kerala, Maharashtra indicate that the disease might be persisting silently in other regions of India.[2]

In Kerala the first reported human case was in 2013 from the district of Wayanad.[3] In 2014 a new focus of virus activity was reported from tribal area of Nilambur in Malappuram district of Kerala.[4] Antibodies against KFD virus have been demonstrated in human serum from the districts of Malappuram, Palakkad and Wayanad.[2,3] But the recent outbreak - the largest in Kerala detailed in the present article occurred in 2015 in Wayanad district with 184 cases and nine deaths being reported.

KFD is a zoonotic disease and many tick species especially Hymaphysalis spinegera act as vectors for the disease. A number of small mammals act as reservoirs for the disease - the most important being two species of monkeys (Black faced langurs and red faced bonnet monkeys). The monkeys get infected after bites from infected ticks. Death of the infected monkeys is followed by the ticks dropping off from their bodies and seeking new hosts, further spreading the disease.[5,6,7] Several species of rodents have been implicated as maintenance hosts. Man is a dead end host and person to person transmission has not been demonstrated so far.

In humans, after an incubation period of about 2 to 7 days following the bite from an infected tick, KFD begins suddenly with chills, severe frontal headache, high grade fever lasting for 5–12 days. Diarrhoea and vomiting occur by the third or fourth day of illness. Haemorrhagic symptoms like bleeding from the nose, gums and intestines may begin by the third day, but the majority of cases run a full course without any haemorrhagic symptoms. Haematemesis, fresh blood in the stools and haemoptysis may also be seen. The convalescent phase is prolonged. KFD runs a biphasic course with the second phase occurring after an afebrile period of 1 to 2 weeks. During the second phase the fever lasts from 2 to 12 days and is associated with headache and abnormalities of the central nervous system. Neck stiffness, mental disturbance, coarse tremors, giddiness, and abnormality of reflexes are seen.[8,9]

The outbreak which occurred in Wayanad district of Kerala is the largest outbreak ever reported from Kerala. Wayanad district shares its border and forest range with Karnataka and Tamil Nadu. Earlier KFD was restricted to a few districts of Karnataka but recent evidences point to its spread to Kerala and probably to Tamil Nadu and Maharashtra.[2,3] We describe here clinico epidemiological details of the recent outbreak which occurred in Wayanad district.

Methodology

Our institution serves as the nearest tertiary care government institution for referred cases from Wayanad district. The index case of KFD was admitted and diagnosed here. Both active and passive surveillance was initiated following confirmation of KFD. All cases were reported to the IDSP (Integrated disease surveillance program) unit in Wayanad which in turn was linked to the IDSP unit in our Institution. Field visits were conducted by the authors in the month of January, February and March 2015 in the effected panchayaths. Case details were collected from the hospitals where the cases were admitted. Blood samples of the suspected cases were sent via cold chain to Manipal Centre for virus research for KFDV detection using RT - PCR. Entomological study was carried at the forest range to identify the vector. Interactions with the District Medical

Office Wayanad and the District Surveillance Officer to collect details of the outbreak and active surveillance in the effected areas continued till the end of July 2015.

Ethical concerns: Although this was an outbreak investigation, the institutional human ethics committee was informed. The identity of cases was kept confidential.

Results

An outbreak of viral haemorrhagic fever confirmed to be Kyasanur Forest disease occurred in the district of Wayanad in Kerala - a southern state in India. The outbreak started in January 2015 and continued till June 2015. During this period a total of 184 cases of KFD were reported from the district.

The index case was a 28 year old male forest guard who gave a history of handling a dead monkey in the Kurichad forest range in Wayanad during fire line work in the forest in December 2014. He was admitted in our institution on 31st December 2014 with high grade fever, vomiting, diarrhoea, malaise and hypotension. Investigations showed leucopaenia, thrombocytopaenia, elevated liver enzymes in the absence of jaundice, pus cells and albumin in urine. Laboratory confirmation of KFD was done by detection of KFDV viral RNA by Real time PCR (Polymerase chain reaction) from Manipal centre for virus research.

Following this 18 cases with similar symptoms were reported by the end of January 2015. All of the cases gave a history of being involved in fire line work in Chikenji in Kurichiad forest 7 -10 days prior to the onset of symptoms. Of these 14 cases were positive for KFD by PCR. All the cases were being managed in Taluq Hospital Sulthan Bathery a secondary level hospital at Wayanad.

Following the field visit by the authors and confirmation of outbreak of KFD at Wayanad district active surveillance was initiated for detecting fresh cases. An operational Case definition of KFD was established referring to previous literature on the subject.[1](Table 1)

Table 1: Operational case definition for KFD

Clinical Case	A patient of any age presenting with acute fever, headache and myalgia, and a history of exposure to ticks or dead monkeys and/or a visit to a forest area where the presence of KFD has already been confirmed.
Confirmed Case	A confirmed case of KFD is defined as a case that fulfils the criteria for a probable KFD case and, in addition, it should cover any of the following:
	1) Detection of KFDV-specific genetic sequence by reverse transcription-polymerase chain reaction (RTPCR) or real- time RT-PCR from blood or tissues 2) Serology suggestive of KFD

Following the above case definition from the period January 2015 to July 2015 total of 184 cases of KFD were reported in Wayanad district with 9 deaths (Case fatality rate = 4.9%). The mean age of the cases was 38yrs (Median 40 yrs), (Range 3yrs to 74 yrs). Majority (55%) were females. The outbreak peaked during the months of February and March and declined by April to June (Fig. 1).

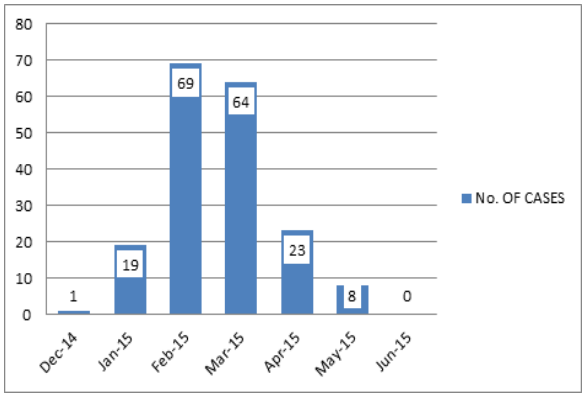

Fig. 1: Monthwise KFD cases

Cases were reported mainly from 4 panchayaths of the district - Mullankoly, Chethalayam, Pulpally & Poothady Panchayats (Table 2) (Fig. 2). Majority of the cases were from tribal colonies in these panchayaths - Kappipadi, Madapalli, Vandikadavu, Puthenkuzhiyil, Devargada & Parakadavu. Clinically most cases were of moderate severity with only 10% having haemorrhagic or neurological manifestation.

Table 2: Area wise distribution of KFD cases

Area	KFD Cases		Deaths
	Clinical	Confirmed*	
Pulpally	22	10	1
Chethalayam	35	19	4
Mullankolly	20	8	
Poothadi	92	37	4
Nool puzha	15	10	
Total	184	84	9

*Confirmation by RT- PCR

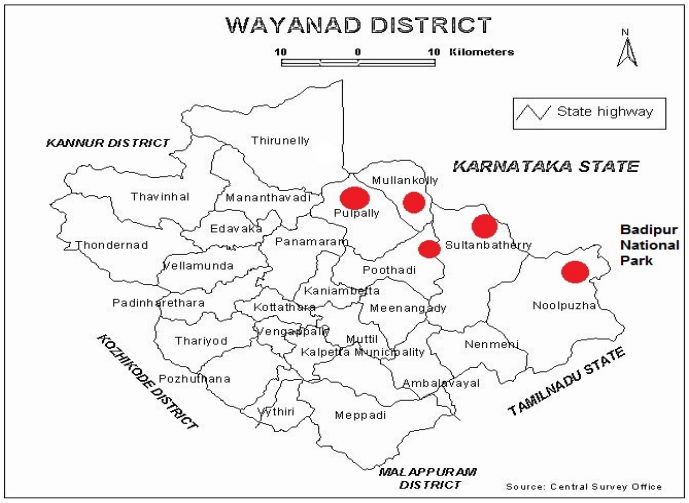

Fig. 2: Spot map of Wayanad District showing the affected areas

Of the 9 cases which died, five were admitted in our institution and the rest in a private medical college in Wayanad. All of them were tribals living in close proximity to the forest. Haemorrhagic manifestations were the cause of death in six patients and neurological complications in three patients.

Samples of 147 cases were sent for RT PCR and of this 84 (57%) tested positive for KFDV. Samples of 37 cases could not be obtained due to feasibility issues and unwillingness on the part of the subjects.

Eighteen Monkey deaths were reported in the area indicating an ongoing epizootic within the forest. Monkey death was reported at Chikenji area by the index case and another death in domestic areas near Vandikadavu in Kurichiad range where the monkey had wandered after it became ill. Abundant tick samples were obtained by "flag drag" method by the state entomologist from the forest floor near the fire lines indicating that these areas were hot spots for tick habitation. The species were identified as Hymophysalis spinegera. Necropsy done at the veterinary college on five monkeys was positive for KFD virus.

Despite continued surveillance in the district no further cases of KFD have been reported as of August 2016.

Discussion

Wayanad district in Kerala is an area of thick rainforest with diverse wildlife sharing borders with Karnataka and Tamil Nadu. People dwelling and working in forest such as fireline workers, farmers, forest officers, hunters constitute the high risk population for KFD infection on contact with infected ticks. Wayanad is also home to several tribal groups residing in colonies in or around the forest range who are dependent on the forest for their livelihood.

The first large outbreak of KFD which occurred in Wayanad in 2015 involved 184 cases with a case fatality rate of 4.6%. Following this outbreak, control measures were initiated by the health department Wayanad in consultation with the Department of Community Medicine Kozhikode Medical College. Work at the fire lines was stopped immediately. A dedicated ward in the Taluk Hospital Sulthan Bathery was set up for managing KFD cases, severe cases were referred to Govt. Medical College Kozhikode. Taluk hospital Sulthan Bathery also served as a surveillance centre for reporting KFD cases from other Primary Health Centres and private hospitals in the district. Due to unavailability of the KFD vaccine in Kerala it was procured from the Karnataka government and vaccination of the high risk population (forest guards and forest workers and population living within 5 km of the designated hot spots) was carried out. House to house survey for fever cases was done in the affected areas. Malathion dusting around 50 metres of the monkey deaths was done to destroy the ticks. A guideline for case management of KFD was developed in consultation with experts from the Department of General Medicine, Infectious disease, Nero-medicine, Gynaecology, Paediatrics and Community Medicine from our institution. The guidelines were disseminated to all medical officers of the district of Wayanad and Kozhikode.

The outbreak began in the last week of December 2014, peaked in January, February and declined after that. This was in line with data available from previous outbreaks seen in Karnataka where the epidemic period begins in November or December and peaks from January to April, then declines by May and June.[10] The case fatality rate of 4.9% is similar to the case fatality seen in other outbreaks estimated to be about 2-10%.[1,11] 80% of the cases were tribals who resided in or near the forest range. Collection of firewood and grazing animals in the forest range were the main high risk activities which may have made them easily susceptible for infection. A case control study by Padda et al on the same population (unpublished data) [12] showed that grazing of animals, recent visit to forest, exposure to monkey deaths and collection of leaves were significantly associated with developing KFD.

Moreover the female preponderance seen in the current outbreak points to the fact that that females engage in activities which brings them close to forest range thus exposing them to the infection. Haemorrahagic manifestations was the main cause of deaths among the cases followed by encephalopathy. Similar findings were noted by other authors also.[13,14]

In earlier years, the geographic area affected was small and the number of cases relatively low, in recent years the number of cases has gone up with the increase in the number of foci. Changes in the ecobiology, including large scale deforestation and increased human activities in the forests and timber harvesting, might be the reason for the spread of this disease to newer localities.[1,15] Forest fires leading to migration of the animals to newer areas might be another reason for spread of the disease to newer areas. KFD has also been reported from the nearby Bandipur area in Chamaraja district Karnataka in 2013,[16] which is adjoining Wayanad district.

Even though work at the fire line has been stopped, infected tick habitats can be expected to remain. Transovarian transmission of the KFD virus among the ticks may sustain the infection in the forest area. Hence surveillance for cases among population in the high risk groups should be continued. The disease appears enzootic in forest areas in Wayanad since 2013 and there is a potential risk for further outbreaks in the coming years.

A sound vaccination policy covering the high risk population in and around the forest area is essential to prevent outbreaks in the future in newer foci. Animal Surveillance & Containment, and surveillance for deaths or illness among sentinel animals like monkeys will help detect hot spots for disease transmission.

Acknowledgement

RT – PCR of blood samples was done at the Manipal Centre of virus research as a part of a Surveillance Programme on Acute febrile illnesses in the Western Ghat. We acknowledge the help rendered by the District Medical officer and the District Surveillance Officer - Wayanad and the faculty of Veterinary College Wayanad for their valuable comments.

Conflict of Interest: None declared

References

1. Pritam Roy, Dipshikha Maiti, Manish Kr Goel, SK Rasania Kyasanur Forest Disease: An emerging tropical disease in India.
2. Journal of Research in Medical and Dental Science | Vol. 2 | Issue 2 | April – June 2014.
3. D. T. Mourya, P. D. Yadav Recent Scenario of Emergence of Kyasanur Forest Disease in India and Public Health Importance. Current Tropical Medicine Reports March 2016, Volume 3, issue1 pp 7–13.
4. Murhekar, M.V., et al., On the transmission pattern of Kyasanur Forest disease (KFD) in India. Infect Dis Poverty, 2015;4:37.
5. Tandale BV, Balakrishnan A, Yadav PD, Marja N, Mourya DT. New focus of Kyasanur Forest disease virus activity in a tribal area in Kerala, India, 2014 Infect Dis Poverty. 2015;4:13. doi: 10.1186/s40249-015-0044-2.
6. Work TH. Russian spring-summer virus in India: Kyasanur Forest disease. Prog Med Virol. 1958;1:248-79.
7. Varma MG, Webb HE, Pavri KM. Studies on the transmission of Kyasanur Forest disease virus by Haemaphysalisspinigera Newman. Trans R Soc Trop Med Hyg. 1960;54:509-16.
8. Work TH, Rodireguez FR, Bhatt PN. Virological epidemiology of the 1958 epidemic of Kyasanur Forest disease. Am J Public Health Nations Health 1959;49(7):869-74.
9. Banerjee K. Kyasanur Forest disease. In: Monath TP. Editor. Arboviruses: epidemiology and ecology. Boca Raton (FL): CRC Press,1990. pp. 93–116.
10. Pattnaik P. Kyasanur forest disease: an epidemiological view in India. Rev. Med. Virol. 2006;16:151–65.
11. Kasabi GS, Murhekar MV, Yadav PD, Raghunandan R, Kiran SK, Sandhya VK, et al. Kyasanur Forest disease, India, 2011–2012. Emerg. Infect. Dis. 2013;19:278–82.
12. Holbrook MR. Kyasanur Forest Disease. Antiviral Res 2012;96(3):353–62.
13. P Padda, A srivasthava, S Sodha, KR Vidhya, Outbreak of KFD in Wayanad district Kerala India. Poster presentation at 17th International congress of infectious diseases / International journal of infectious diseases 455 (2016);1–477.
14. Adhikari Prabha MR, Prabhu MG, Raghuveer CV, Bai M, Mala MA. Clinical study of 100 cases of Kyasanur Forest disease with clinicopathological correlation. Indian J Med Sci 1993;47(5):124-3.
15. Pavri K. Clinical, clinicopathological, and hematologic features of Kyasanur Forest disease. Rev Infect Dis 1989;11 Suppl 4:S854-9.
16. Devendra T Mourya, Pragya D Yadav, Deepak Y Patil Highly infectious tick-borne viral diseases: Kyasanur forest disease and Crimean–Congo haemorrhagic fever in India.
17. WHO South-East Asia Journal of Public Health | January-March 2014 | 3(1).
18. Mourya DT, Yadav PD, Sandhya VK, Reddy S. Spread of Kyasanur Forest disease, Bandipur Tiger Reserve, India, 2012–2013 [letter]. Emerg Infect Dis [Internet]. 2013 Sep.