A Case–control Study on the Role of Deer Fly in the Transmission of Hepatitis B in Kerala, South India

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Abstract

Background: The sudden increase in the number of Hepatitis B-positive cases between December 2018 and June 2019, in Pathanamthitta District of Kerala in South India, aroused fear both among the government and the people. Some earlier studies postulated that deer flies act as vectors for the transmission of Hepatitis B. Deer flies were found to be in plenty in the concerned area and their bite was also considered part and parcel of everyday life. Hence, it was considered necessary to prove whether deer flies played a role in the transmission of Hepatitis B.

Aims and Objective: The aim of this study is to investigate the role of deer fly in the transmission of Hepatitis B.

Materials and Methods: A case–control study design was adopted to test the hypothesis concerning the possible role of deerfly in disease transmission. Cases were those who were picked up by the routine surveillance system (Integrated Disease Surveillance Project) and found to be positive for Hepatitis B surface antigen (HBsAg). Controls were age- (±5 years) and gender-matched neighborhood individuals negative for HBsAg. Data was collected with the help of a pretested interview schedule.

Results: There was no significant association between bite of deer flies and acquisition of Hepatitis B.

Conclusion: This study concluded proving the deer fly hypothesis to be false.

Keywords: Deer fly, Hepatitis B, Kerala, transmission, vectors

INTRODUCTION

At the beginning of the third millennium, Hepatitis B viral infection (HBV) still remains a major public health problem. Globally, more than two billion people have been infected, and 350–400 million suffer from chronic infection.[1,2] Chronic HBV infection can progress to hepatocellular carcinoma, liver cirrhosis, and subsequently lead to death. Therefore, it is considered a life-threatening virus worldwide, leading to significant mortality.[3]

Intravenous drug use, unprotected sexual contact with multiple partners, medical procedures such as dialysis and surgery, accidental exposure to needle stick injuries, and vertical transmission from mother to child are the common routes of transmission of both HBV and Hepatitis C virus.[4-7] Despite the availability of vaccination, the number of people getting affected by Hepatitis B in the state of Kerala has risen over the years. Since 2005, there have been several reports of Hepatitis B outbreak in Kerala. Some of them have been reported in the media[8-10] and very few has been reported in the medical literature.[11] The actual number of acute cases is believed to be 6.5 times the number of reported cases in any year.[11]

In the recent years, there has been a worry that an insect (deer fly) bite could pass on viral hepatitis. However, several studies conducted by the government and private agencies failed to identify routes other than the known conventional modes of transmission. These flies are likely to transmit the virus to persons who have not taken Hepatitis B vaccination and horizontal transmission is also a possibility.[12] The virus was believed to be transferred through the bite of flies which is painful and itchy. The fly, identified as “deer fly,” belongs to the genus Chrysops. Several species of Tabanidae[13] have been described which can be pests of both livestock and humans. The role of these insects in the mechanical transmission of
equine infectious anemia virus, vesicular stomatitis virus, and bacteria such as *Bacillus anthracis*, *Francisella tularensis* have been elucidated. However, *Tabanids* have never been shown to be biological vectors of viruses so far. In a study done in a medical college in Kerala, it was suggested that deer flies could act as mechanical vectors in the transmission of Hepatitis B. The female *Chrysops* flies require blood meal for the development of eggs and typically feed on moving hosts such as humans and livestock, usually biting on the hands, shoulders, and head. They have aggressive feeding habits where the bites are painful and many a times-incomplete, due to chasing away of the flies by the host. Hence, they make frantic attempts to find another host to complete its feeding and in the process transmit HBV through its contaminated mouth parts. Even a minimal amount of blood is known to transmit this infection. Since, Hepatitis B is both highly contagious and the virus is able to survive outside the human body for at least 7 days, there is a biological plausibility of this mechanical route of transmission.

**Background of the study**

A previous study conducted in Kerala postulated that deer flies, a pest to the cattle, could be responsible for the unprecedented rise of infection. The District Medical Office of Pathanamthitta District in Kerala, raised concern over-not only the increase in the number of reported cases of Hepatitis B compared to the previous years but also pointed to a nonsexual route of transmission; after preliminary surveys. Deer fly larvae appear to be plenty in this district due to the availability of vast aquatic habitats, including marshes, ponds, streams, freshwater wetlands, and open areas within forests. The blood sucking behavior of female deer flies combined with the presence of a large number of infected patients who live in proximity with the susceptible unvaccinated individuals could facilitate the rapid transmission of the virus. The study was designed to test this hypothesis using a case–control study.

From Figure 1, it is clear that there has been a rise in the diagnosed cases of Hepatitis B with a maximum peak from April to June 2019. This led to the commencement of the discussion to evaluate if Deerflies are associated with the transmission of Hepatitis B or is it just a myth?

**Materials and Methods**

This is a community-based case–control study conducted in Pathanamthitta District, involving four Panchayats-Pramadom, Vallikodu, Konni, and Pandalam-Thekkekara, from where most of the cases were reported. Pathanamthitta, is a district in the southern part of Kerala in India. The district stretches through the Western Ghats, where the hills are tall and covered with thick forests with three important rivers (Pampa, Achencovil River, and Manimala River) flowing through the district. Cases were those who were picked up by the routine surveillance system between December 2018 to June 2019 and found to be positive for Hepatitis B surface antigen (HBsAg) on laboratory-based enzyme immunoassay. Controls were age- (±5 years) and gender-matched neighborhood individuals negative for HBsAg. Any control found HBsAg positive was excluded from the study. People with known mental disorders and adults previously vaccinated against Hepatitis B were excluded from the study.

Data was collected by interviewing both cases and controls, by home visits using a structured questionnaire. The questionnaire was designed based on literature review, expert opinion and frequent discussions with the health workers of the area. The questionnaire was pilot tested before use. The interview technique was standardized by prior training of the Junior Public Health Nurses (JPHN) and Junior Health Inspectors (JHIs). Females were interviewed by JPHNs and males by JHIs. Care was taken to provide privacy and confidentiality during the interview. The blood investigations of cases (*n* = 54) and controls (*n* = 108) were arranged by home visits to the concerned area. The total study population was 162.

The Chi-square test was used to find the association between the categorical variables. A *p* < 0.05 was considered to be statistically significant.

**Results**

Majority of the study population were unskilled laborers, unemployed persons and skilled workers. From Table 1, we see that in spite of more cases being reported to be bitten by deer flies compared to the controls, the association of deer fly bite with transmission of Hepatitis B is not statistically significant. Although the presence of cattle shed and proximity to forests favored breeding of deer flies, it did not have any relevance with contracting Hepatitis B. This study proves that deer fly bites do not have any significant role in the transmission of Hepatitis B in Pathanamthitta district.

**Discussion**

Deer fly, as a vector in the transmission of Hepatitis B is proved wrong. Deer flies may not be vectors of transmission-be it mechanical or biological. The reason for high number of Hepatitis B positive cases in the study area may be due to other factors and needs to be investigated. Hence, a thorough
study about various other factors involved in the spread is the need of the hour.

Awareness about HBV infection is dismally low in India, and this problem is compounded by the absence of symptoms (until late stage of disease) in a large majority of cases. Drug adherence is poor, which decreases the cure rate and increases the spread of infection. Education about HBV infection is crucial for curbing its spread. Published guidelines recommend proper counseling of patients on the prevention of transmission, advice on lifestyle (i.e. avoiding high-risk sex, diet, alcohol use, and other predisposing factors such as unsafe injection practices and tattooing) and importance of continuous adherence to long-term treatment regimens. Health education of the community, particularly the high-risk population and health care workers is needed.

Following universal precautions in health care settings, such as-care to prevent needle-stick injuries and implementing postexposure prophylaxis, can reduce transmission of HBV infection. The unnecessary use of blood transfusions without clear indication should be curbed as well. Most high-risk groups have a significant prevalence of occult infection, which needs more vigilant screening.

The most effective strategy to curb the spread of Hepatitis B is prevention of HBV infection by vaccination. A universal immunization program (containing vaccination against Hepatitis B) was introduced in India in 1985 and became part of the Child Survival and Safe Motherhood program in 1992. A cost efficacy study\(^{[19]}\) showed that the inclusion of Hepatitis B vaccine in India’s national immunization program would lead to a reduction in HBV carrier rate from 4.0% to 1.15%. Vaccination against Hepatitis B was piloted in 2002–03 and subsequently integrated into the National Rural Health Mission in 2005. Initially it was introduced in some districts and its success was followed by the commencement of Hepatitis B vaccination in ten states by 2008. Full country coverage started in 2011.\(^{[19]}\)

**Conclusion**

Deer flies may not have any significant role in the transmission of Hepatitis B. The role of deer fly as a vector in the transmission of Hepatitis B could not be established in our study. The study ruled out the deer fly Hypothesis as the reason for the increase in the number of hepatitis B cases in Kerala. Majority of the study population were unskilled laborers, unemployed persons and skilled workers, pointing towards the fact that these people could have lacked proper education. Their ignorance of the disease and its preventive measures may have favored the increase in the number of cases. Thus, strong attempts have to be made for better awareness of Hepatitis B among the people. At the same time, utmost urgency to identify the root reason for transmission needs attention and must be studied in depth.

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**Conflicts of interest**

There are no conflicts of interest.

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