Oropouche Virus: The Silent Threat of a Re-emerging Arbovirus

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Abstract

Oropouche virus is a neglected, emerging virus belongs to the *Peribunyaviridae* family that has caused significant public health concerns especially in South America. Since its discovery in 1950s, this virus has demonstrated a considerable impact on public health through its silent spread and occasional outbreaks. At least 30 major outbreaks have been reported with more than half a million cases have been documented in many countries including Brazil, Peru, Panama, Trinidad and Tobago so far. In 2024, more than 16000 confirmed cases were reported including four deaths. It is endemic to Amazon and currently spreading outside of its territory to other non-endemic countries and has been linked to human death for the first time. This has raised the major concerns about the threat of this virus to the public health. The virus is primarily transmitted through the bite of midge *Culicoides paraensis* and possibly of certain mosquitoes. Oropouche virus fever did not exhibit any specific clinical symptoms and hence it is often undiagnosed or misdiagnosed as other arboviral diseases. Currently there are no vaccines or antiviral treatment available; hence disease prevention mainly focused on vector control and personal protection measures. Understanding the comprehensive drivers influencing the emergence and spread of these diseases is vital for effective control and prevention strategies. This infection is recently emerging as one of the most important viral diseases in Latin America and likely to remain a considerable threat to global public health in the near future. Here, an overview of Oropouche virus, clinical features and its pathogenesis are presented.

Keywords: arbovirus; emerging disease; epidemiology; health threat; midge

1. Context

Arboviral diseases are a group of infections that cause significant challenges to public health globally. Arboviral diseases are mainly transmitted by vectors such as mosquitoes, ticks, and midges (1, 2). These vectors have the ability to transmit the viruses to humans and animals resulting in life-threatening diseases such as dengue, zika, chikungunya, malaria and yellow fever (3, 4). Arboviruses are distributed worldwide and the arboviral infections are often mild to severe and sometimes lead to death. Mosquitoes such as *Anopheles*, *Aedes*, and *Culex* are one of the predominant vectors that transmit several arboviruses to humans (5). There are hundreds of thousands of deaths were reported every year due to the arboviral diseases (6, 7). A large number of human disease causing arboviruses belongs to the members of *Togaviridae*, *Flaviviridae*, *Bunyaviridae* and *Reoviridae* family. These viruses are predominately circulating in tropical, and subtropical regions, largely due to the prevalence of high vector populations (5). Hence, there is a significant burden particularly in the low and middle-income countries in tropics. For instance, dengue was responsible for over 6.5 million cases and >7300 fatalities worldwide in 2023 (8). More number of dengue cases was reported in over 80 countries, where in Asia, the highest number of cases were reported in Bangladesh (321 000), Viet Nam (369 000) and Thailand (150 000) (9). Before 2015, Oropouche was the second most prevalent arboviral disease after dengue in South America. Nowadays many diseases are re-emerging in previously unreported new regions due to the complex interplay of various factors including urbanization, climate change, increased population, global trade and travel (10, 11).

The arboviral infections such as Zika, Chikungunya and dengue have a major impact on South America over the last decade (12). In addition to this, cases of Oropouche virus have been increasing recently. Oropouche virus is one of the reemerging arthropod-borne viruses responsible for Oropouche fever which is characterized by severe acute febrile disease. It is one of the neglected diseases and disease burden was often overlooked due to significant underreporting. The virus was first identified in Trinidad and Tobago in 1955 (13) and till 2000, outbreaks were reported mainly in Brazil, Panama, and Peru. In 2023, the virus was reported in new places in South America which showed the high potential for the spread of virus to other non-endemic countries (14). Here in this review, an overview of Oropouche virus, its clinical features and pathogenesis is presented.

2. Epidemiology

Oropouche virus is a spherical, enveloped virus (80 to 120 nm in diameter) belonging to *Peribunyaviridae* family¸ order *bunyavirales* and genus *Orthobunyavirus* (Simbu serogroup) (15). It is a negative-sense ribonucleic acid (RNA) virus, consists of three segments such as small (S), medium (M), and large (L). The proteins encoded by these fragments help for virus replication inside the host cells and also help to evade the host immune response (16-18).

Oropouche fever was first reported in 1955 and subsequently the virus was isolated from the blood of a symptomatic patient in a village Vega de Oropouche, Trinidad (13). Since its first identification, more than half a million human cases were reported. This virus is circulating throughout much of Central and Southern America and the Caribbean (19). Oropouche virus fever is the most frequent arboviral disease after dengue fever (20). Although the virus was identified six decades ago, much attention has been given recently due to its reemergence and outbreaks in different areas of South America in 2023-2024. The geographic range of the virus is becoming wider, where the virus is currently even reported in non-endemic areas (21, 22).

From 2023, there has been significant increase in Oropouche fever cases have been reported in Brazil and surrounding countries including Bolivia, Colombia, Cuba, Dominican Republic, Ecuador, Guyana and Peru. From 2015 to 2022, Brazil recorded only less number of cases (261) of Oropouche fever. However, in 2023, there was a significant surge, with confirmed cases reaching 831. In 2024, about 16,239 confirmed cases were reported in Americas region including four deaths, whereas 3,765 confirmed Oropouche cases were reported in 2025 (As of Feb 11, 2025) (23-26). The virus has been reported first time in Cuba, Ecuador and Guyana in 2024 (27, 28). The travel-associated cases have been reported in the USA, Canada, Italy, Germany and Spain, all involving the travelers who had visited Brazil or Cuba (29, 30). However, no local transmission has been reported in USA. Two deaths associated with Oropouche virus was confirmed by Brazilian Ministry of Health in the state of Bahia on July 25, 2024 and vertical transmission resulting in congenital infection, fetal death, and microcephaly in pregnant women have been reported in Brazil in August 2024 (31, 32). Brazil reported a case of encephalitis associated with this virus, 13 fetal deaths, three spontaneous miscarriages, and four cases of congenital anomalies (as of October 15, 2024) (28). This has raised the serious concerns about the threat of this virus to the public health.

3. Transmission

The virus exhibits both sylvatic and urban transmission cycles. For the sylvatic cycle, the vertebrate host is sloth (*Bradypus tridactylus*), non-human primates and birds, whereas in the urban cycle, humans are the primary host and the virus transmission occurs by the bite of infected midge *Culicoides paraensis (*genus: *Culicoides,* Order: *Diptera,* Family: *Ceratopogonidae)* (33, 34). The genus *Culicoides* includes the vectors of arboviruses (>50 viruses) of human and veterinary importance (35). The mosquitoes such as *Cx. quinquefasciatus*, *Cq. venezuelensis* and *Ae. serratus* can also act as possible vectors and transmit the disease mostly in sylvatic environment (36, 37). There is no evidence of human-to-human transmission reported so far. During the first week of illness, the virus has been detected in serum samples and not detected beyond day 5 (14). The viral RNA can be detected by real-time reverse transcription-polymerase chain reaction (RT-PCR) and virus specific neutralizing antibodies can be detected by plaque reduction neutralization tests

(PRNTs). The diagnostic or rapid tests based on antigens or immunoassays are not commercially available (14, 38).

4. Symptoms and Treatment

Most of the symptoms are usually mild and self-limited, appearing four to eight days after an infected bite and can last for up to seven days. The incubation period is variable and typically ranges from three to ten days (39). The symptoms are similar like other mosquito-borne infections (dengue, chikungunya, Zika) making it difficult to distinguish between them (40, 41). In some cases, Oropouche virus fever goes undiagnosed due to mild symptoms or misdiagnosed due to similar clinical characteristics like other arboviral diseases (20). It presents a sudden onset of fever (38-40°C), chills, headache, extreme weakness, joint pain, muscle aches, nausea, and vomiting (29, 42). Other symptoms including diarrhea, bleeding, abdominal pain, retro-orbital pain, photophobia, dizziness, conjunctival injection have also been reported. The infection typically resolves within two to three weeks. In some cases, severe complications including meningitis or encephalitis were reported (39). Some affected individuals reported recurrent symptoms after resolution of their initial illness (29). Though fatal outcomes are rare, mortality has been reported in Brazil (22, 43). Treatment is primarily supportive which includes rest, hydration, use of analgesics, antipyretics to alleviate the symptoms and hospitalization might be required in case the patient is experiencing severe symptoms or complications. The vaccine development efforts such as chemically inactivated, DNA-vectored, live attenuated, and protein-subunit approaches are currently in progress to control the Oropouche infection (14, 44, 45).

5. Prevention

Arboviral diseases are challenging to manage due to their complex transmission dynamics, unpredictable outbreaks and limited treatment options (46). The research on vector competence studies, transmission and viral pathogenesis is essential. Due to the unpredictable nature of viral diseases, it is essential for all countries to be prepared for the unexpected. The local and national health authorities should focus on preventing small, localized viral outbreaks from escalating into epidemics or pandemics by implementing integrated surveillance systems, emergency response protocols and community-based prevention strategies. As Oropouche virus is spreading in new territories, the epidemiological and entomological surveillance is critical to reinforce the prevention measures. Early detection and differential diagnosis is essential for good patient management and to prevent the possible virus transmission. Currently, there are no licensed vaccines or specific antiviral therapies available to treat Oropouche virus disease. The plant system can be utilized for the expression of immunogenic proteins of Oropouche virus for vaccine development (47). The genetic diversity of the virus makes the vaccine development a challenging task (48). Therefore, the vector control and personal protection strategies appear to be the best prevention and control measures right now (20). The monitoring of vector is crucial, as they play an important role in the transmission of the disease. The risk of getting an infection can be reduced by reducing midge populations by controlling their breeding sites around at-risk communities, minimizing the vector bites by using mosquito nets, using insect repellants and insecticides (38, 49, 50). Further educating at risk communities in endemic regions about the potential health threats due to midge bites along with personal protection options can also significantly prevent the Oropouche virus.

6. Conclusion

Oropouche virus is a neglected arbovirus that has recently become a major public health threat causing major outbreaks in South America. Like other arboviral diseases, Oropouche virus fever was considered as a neglected disease for the last six decades. Now, this virus is reemerging and becomes one of the most important viral diseases in Latin America and likely to remain a considerable threat to global public health in the future. Hence, further research is essential to assess the disease burden and there is urgency to develop effective vaccines in order to effectively respond to future outbreaks.

Author contributions

Conceptualization - BS., literature review - BS, KS., writing—original draft preparation BS., writing—review and editing - BS, KS.

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Ethics approval and consent to participate

Not applicable.

Conflict of Interest

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Availability of data and material

The data sharing is not applicable to this article as no new datasets were generated or analyzed during the current study.

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