

Case Report:

First Report of Detection of Dengue Virus in River Nile State, Shendi City, Sudan

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Abstract:

Dengue virus (DENV) is a *flavivirus* spread by vectors that affects around 390 million people annually, of whom 2.5 billion are at risk. Early diagnosis of dengue is required to identify an epidemic and implement effective vector control measures. Over the past 20 years, dengue outbreaks have occurred often in Sudan. Outbreaks of dengue hemorrhagic fever were reported in an outbreak in Port Sudan in 2005, with a 3.8% mortality. Recently, the detection of nonstructural protein 1 (NS1) antigen during the acute phase of disease in patients having primary and secondary infections has been studied in various laboratories across the world. NS1 is a highly conserved glycoprotein for all the serotypes and is produced in both cell membrane-associated and secreted forms. Dengue and malaria are two widespread mosquito-borne illnesses that have a high morbidity and mortality rate worldwide. The number of cases of both diseases is currently rising in Sudan and is associated with climate and environmental changes. The single NS1-positive Dengue case found in this study was a 30-year-old man from Shendi City, one of the biggest cities in the state of the Nile River; the participant had traveled and hadn't been sick for two months before the study. Shendi is about 100 miles northeast of Khartoum on the eastern bank of the Nile River; there hasn't been any history of arboviral outbreaks in Shendi, but neighboring provinces, Merawi and Karima, for example, saw an outbreak of yellow fever in 1989, and during the 2007 outbreak, they verified instances of Rift Valley disease. Fever, headaches, lethargy, and malaise are typical asymptomatic or non-specific symptoms of dengue and malaria infections. There is little data on co-infections between dengue and malaria, as well as how severe the two illnesses are in febrile patients in eastern Sudan. The preparedness and response to the

outbreak especially at the community and decision-making (state) levels need further description and consideration due to the absence of previous assessment studies.

Keywords: NS1, Dengue fever, Malaria, *Aedes aegypti*.

INTRODUCTION

One of the four closely related dengue virus serotypes (DENV1-4) of the genus *Flavivirus* and family *Flaviviridae* causes dengue. *Aedes aegypti* is the primary mosquito responsible for transmission, while other *Aedes* species may also be implicated [1,2]. Dengue infection has different clinical presentations ranging from a self-limiting flu-like illness to the fatal severe form of dengue hemorrhagic fever or dengue shock syndrome [1,3]. Dengue is a rapidly expanding arboviral infection currently present in at least 128 countries with an estimated 390 million dengue infections annually and 3.97 billion people at risk of infection [4-6]. Some typical infection signs are a high fever running around 104°F, aches behind the eyes, severe headache, muscle/joint pain, vomiting, inflamed glands, and rash. These symptoms usually start to show up 4–10 days after the person is bitten by a mosquito and can last up to 7 days. However, severe dengue fever (DF) can be potentially life-threatening in part due to plasma leaking, fluid accumulation, ascites, pleural effusions, severe bleeding, low

platelets, and/or organ impairment [7]. Nevertheless, patients infected with DENV-2 & DENV-4 show acute illness due to dengue hemorrhagic fever (DHF), but infection due to DENV-1 & DENV-3 is mild, sometimes inapparent [8]. DHF can be staged in four grades according to the guidelines of the World Health Organization (WHO): Grade I- only mild bruising, grade II- spontaneous blood loss into the skin and in another place, grade III- a symptom of shock, and grade IV- acute shock [9,10]. Currently, there is no gold standard antiviral treatment for DF/DHF; however, the maintenance of a patient's body fluids plays a crucial role in the treatment [11]. Kassala state is facing an increasing occurrence of dengue and emphasizes the need for developing appropriate interventions to address the identified risk factors and place control programs into action. The establishment of routine dengue epidemiological and entomological surveillance and climate warning systems will contribute to early warning and timely detection and response to emerging outbreaks [12]. The number of cases

of both diseases is currently rising in Sudan and is associated with climate and environmental changes. Limited information is available on malaria and dengue co-infections and the severity of the two diseases among febrile patients in eastern Sudan [13]. Shendi is located on the eastern bank of the Nile River, approximately 100 miles northeast of Khartoum [14]. Shendi has no reported history of arboviral outbreaks, but neighboring provinces, such as Merawi and Karima, witnessed a YF outbreak in 1989 and

confirmed cases of Rift Valley fever during the 2007 outbreak [15–17]. The Nile River state has excessive population movement with all the other parts of the country and recently witnessed a huge influx of workers attracted by traditional gold mining activities [18]. To date, only one vaccine (Dengvaxia, Sanofi Pasteur, Marcy-l'Étoile, France) has been licensed for use in several countries but can only be administered to people with a previous infection [19].

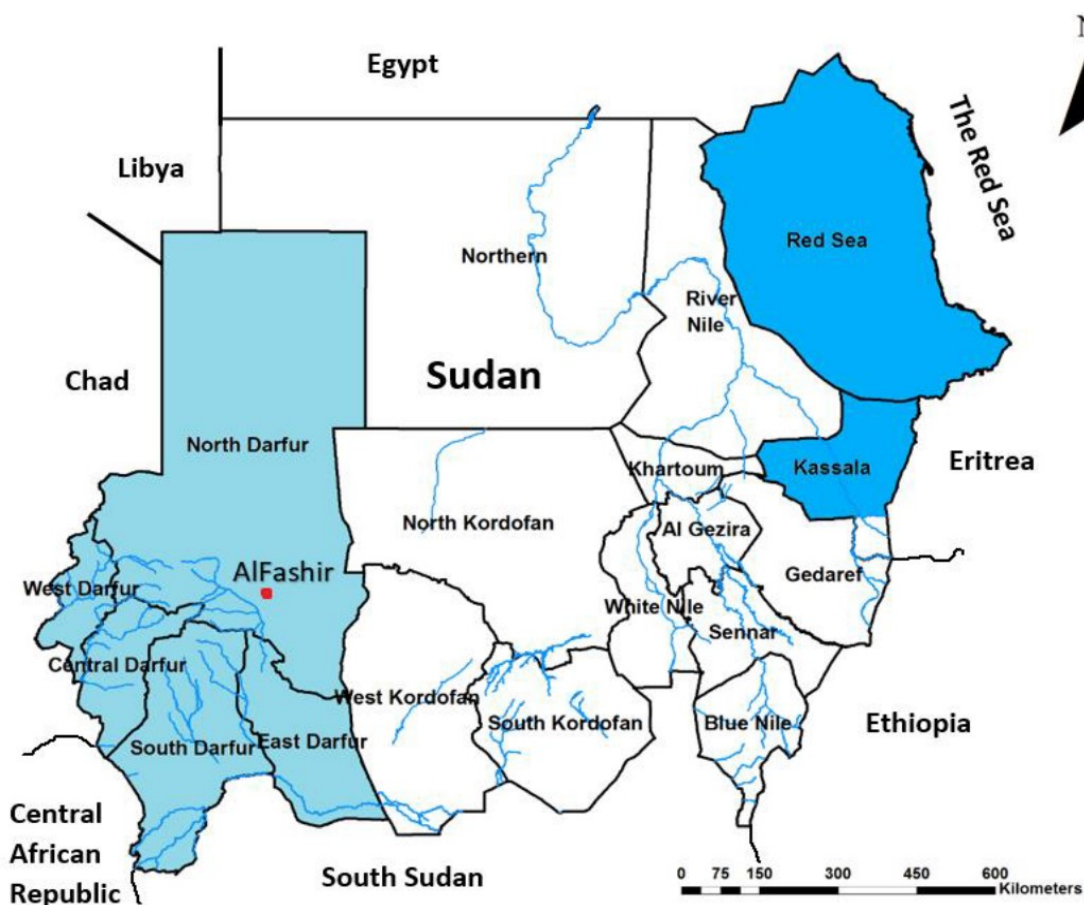


Figure 1. Map of Sudan showing the dengue fever endemic areas in Sudan (the darker blue) [20].

Case Presentation

A thirty-year-old male attended the Emergency, Shendi Teaching Hospital Coming from Port Sudan, Port Sudan a city and port on the Red Sea in eastern Sudan, with reduced levels of consciousness, headache, retro-orbital pain, arthralgia, myalgia, bone pain, backache, or rash and anorexia.

Laboratory Investigations

NS1-based antigen testing is positive, a positive NS1 test result is indicative of a dengue virus infection.

Blood film for malaria: *Plasmodium falciparum* was detected with double and single chromatin dots.

Hematological parameters: Leukopenia (white blood cell count $< 4.0 \times 10^9/L$).

Treatment

There is no specific treatment for dengue. The focus is on treating pain symptoms. Medications can be used at home to treat dengue fever in the majority of patients. To manage pain, acetaminophen (paracetamol) is frequently utilized. Aspirin and ibuprofen are examples of non-steroidal anti-inflammatory medications that should be avoided since they raise the risk of bleeding. The fatality rate from DHF/DSS remains high, and there are currently no effective treatments or vaccines to prevent dengue sickness. There is currently no approved therapeutic medication available, and the majority of the treatment has been supportive. DENV non-structural protein 1 (NS1) has been the main diagnostic for dengue virus diagnosis for some years. NS1 may be released in the patient's serum. A most recent study outlines the pathogenic effects of NS1 in

dengue-induced hemorrhage and vascular leakage as well as the potential use of NS1 as a therapeutic target and vaccine competitor. Misdiagnosis of febrile co-infections with shared clinical similarities is unavoidable in areas with overlapping endemicity. Although estimates of mono- and co-infections with malaria and dengue among febrile patients could be useful to clinicians, these are yet to be fully elucidated in Sudan. Understanding the epidemiology of dengue and malaria as mono- or co-infections is crucial for evidence-based approaches to effective control measures at the public health level. A most recent study outlines the pathogenic effects of NS1 in dengue-induced hemorrhage and vascular leakage as well as the potential use of NS1 as a therapeutic target and vaccine competitor.

Conclusion

Although estimates of mono- and co-infections with malaria and dengue among febrile patients could be useful to clinicians, these are yet to be fully elucidated in Sudan. At the public health level, understanding the epidemiology of malaria and dengue, as mono- or co-infection, is essential for evidence-based approaches to appropriate control interventions. Clinical features cannot easily distinguish malaria patients from dengue-infected or co-infected ones, reinforcing the necessity of proper laboratory diagnosis and avoidance of treating febrile patients as presumed malaria cases in such a setting.

Recommendation

1. A clear understanding of the epidemiology of malaria and dengue co-infections is essential

to inform decision-makers to institute an appropriate control strategy for both diseases.

2. More research on malaria and dengue co-infections is needed in other endemic areas of Sudan.

3. More vector studies are required for a better understanding of their role in the transmission of malaria and dengue in the country as a whole.

4. Health education via various media should be mandated to increase community awareness and dispel misconceptions about DF.

5. Further entomological, molecular, and phylogenetic investigations are urgently needed to improve our understanding of the risk factors influencing the emergence and outbreaks of dengue fever in the area.

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