

## Absence of Serological Evidence of West Nile Virus in Blood Donors in South Western Nigeria

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### ABSTRACT

**Background:** West Nile virus (WNV) is a mosquito-borne virus that circulates among avians, but can also affect other species, particularly humans and horses. The virus is transmissible via blood transfusion.

**Objectives:** To determine the prevalence of the West Nile virus among blood donors in Nigeria.

**Materials and Methods:** Serum samples from 185 blood donors who donated blood at blood bank units of Obafemi Awolowo University Teaching hospitals and Ladoke Akintola University Teaching Hospital, Nigeria were screened for WNV IgM antibody.

**Results:** Out of the 185 donors recruited for the study, 175 (94.6%) were males. The age of the participant ranges from 18 – 65 years with the mean age (SD± 20.3). One hundred and sixty five (89.1%) donors are urban dwellers while twenty (10.8%) donors are rural dwellers. Twenty seven donors (15.4%), out of the urban group regularly use insecticides treated or mosquito repellent nets whereas none of the rural dwellers use insecticides or mosquito net. All the 185 donors screened were negative for West Nile virus-specific IgM antibody.

**Conclusion:** This study reveals that there is no serological evidence of WNV infection in Osun state Nigeria. Although this is only a preliminary report, there would be the need for a more elaborate study cutting across different seasons of the year on the prevalence of WNV in Nigeria.

**Keywords:** West Nile virus, blood donors, serological evidence, IgM antibody, Nigeria.

West Nile virus (WNV) is a mosquito-borne zoonotic arbovirus belonging to the Flaviviridae family in the genus flavivirus<sup>1</sup>. The virus belongs to the Japanese encephalitis virus complex or serogroup. This flavivirus is found in temperate and tropical regions of the world. It was first isolated in 1937 in Northern Uganda in a region close to a tributary of the river Nile, is widely distributed in Africa, Asia, the Middle East and Europe<sup>2</sup>. West Nile Virus disease occurred only sporadically and was considered a minor risk for humans, until an outbreak in Algeria in 1994, with cases of WNV-caused encephalitis and the first large outbreak in Romania in 1996, with a high number of cases with neuroinvasive disease. The WNV was isolated from patients, birds and mosquitoes in 1950 in Egypt<sup>3</sup>. In a survey

for WNV haemagglutination-inhibition (HI) antibody carried out in Nigeria fourteen years ago prevalence of WNV haemagglutination-inhibition (HI) antibody of 40% was reported<sup>4</sup>. In a more recent study in suspected febrile malaria and typhoid patients a prevalence of 25% for WNV neutralizing antibody was reported<sup>5</sup>.

The main mode of West Nile (WNV) transmission is through mosquito bites. *Aedes aegypti* and various species of mosquitoes, are the prime vectors of the virus with the birds being the most commonly affected animal and serving as the prime reservoir host. Only female mosquitoes feed on blood and different species are involved to take a blood meal on preferred types of vertebrate hosts.

Infections have been documented in ticks in Asia, Europe and the Middle East, and soft (argasid) ticks have been shown to transmit WNV in the laboratory. Hippoboscids flies might be able to transmit this virus in North America and infected lice (*Philoaterus* spp.)<sup>6</sup>. Transmissions through blood transfusion, organ transplantation, and breast-feeding have also been reported<sup>7</sup>. Human illness by WNV can be classified into two forms: West Nile

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fever, which is relatively mild and flu-like, and West Nile neuroinvasive disease, which encompasses all cases with neurological signs. Many WNV infections are asymptomatic<sup>7</sup>.

West Nile fever is the most common form of the disease. Most uncomplicated infections resolve in 2 to 6 days, but in some severe cases, persistent fatigue can last for a month or more<sup>8</sup>.

A few patients with West Nile fever develop West Nile neuroinvasive disease. This form can be severe, and in some cases, it is life-threatening<sup>9</sup>. Three syndromes - encephalitis, meningitis, and acute flaccid paralysis – are seen. Symptoms of more than one syndrome often occur in the same patient. West Nile meningitis is characterized by fever, headache, a stiff neck and photophobia<sup>10</sup>.

Patients with West Nile encephalitis have changes in consciousness, disorientation and, or focal neurological signs, which may include ataxia, incoordination, tremors, involuntary movements, and signs that resemble Parkinson's disease (rigidity, postural instability and bradykinesia). Concurrent signs of meningitis are common, and seizures or coma may also occur. Some patients who recover have persistent neurological dysfunction.<sup>11</sup>

Acute flaccid paralysis (sometimes called West Nile poliomyelitis) is seen in some patients. The paralysis, which resembles polio, appears suddenly and progresses rapidly, usually reaching a plateau within hours. It is typically asymmetrical and can affect one or more limbs, often the legs. The weakened limbs become darker than normal at the peak of the paralysis. This syndrome may be accompanied by muscle aches in the lower back and or abnormalities in bladder and bowel function. Some patients develop respiratory distress, which may require mechanical ventilation. Sensory functions are usually normal or minimally affected. Some patients with flaccid paralysis have prodromal signs of West Nile fever, sometimes with signs of meningitis or encephalitis; however, many patients are asymptomatic before the onset of paralysis. Late in the illness, the

muscles may become atrophied. Recovery is highly variable: some patients recover completely within weeks, while others remain paralyzed<sup>12</sup>.

West Nile virus can also be transmitted by transfusion through infected blood components. In the United States (US), WNV transmission to humans was detected in 1999 during an outbreak of encephalitis in New York City and it was first detected among blood donors in 2002<sup>13</sup>. As a result, WNV nucleic acid testing (NAT) among blood donors began in 2003 at the blood transfusion unit<sup>14</sup>.

In Africa particularly Nigeria, there is scarcity of information about the prevalence of the virus among blood donors. This study was therefore undertaken to investigate the seroprevalence of WNV in a population of healthy blood donors living in southwestern Nigeria in order to determine whether this emerging infection is a possible risk for the blood supply in Nigeria.

## **MATERIALS AND METHODS:**

### **Study population:**

Healthy blood donors attending the Ladoké Akintola University Teaching hospital blood bank in Ogbomosho and Obafemi Awolowo University Teaching Ile Ife, southwestern Nigeria between May and October 2013 were recruited into this study. Informed consent was sought from the donors and only those who consented were included in the study.

Questionnaires were used to obtain demographic information as well as information on the use of insecticide net, records of immunization, knowledge on West Nile virus infection and educational status.

### **Serological Test**

Five milliliters of venous blood was collected from the antecubital vein of each donor. The blood was allowed to retract and then centrifuged at 1500 rpm. The sera were stored at -20°C until tested. HBsAg and HCV antibody were detected in each serum sample by means of an immuno-chromatographic mini strip (HBsAg DiaSpot One Step and HCV DiaSpot One Step, USA) and HIV antibody were detected by means of an

immuno-chromatographic test strip (Alere Determine HIV1/2 Matsuhidal, Japan). West Nile IgM antibody was detected by enzyme linked immunoassay method (ELISA) (Wkea Med. Supp., Changchun, Chenguang Garden, Qianjin, China)

### RESULTS:

A total of one hundred and eighty five (185) donors were recruited for the study of which 175 (94.6%) were males. The age of the participants ranges from 18 to 65 with a mean age of 41.5.

Out of the 185 donors, 2 (1.08%) tested positive for HIV-1 and HIV-2. Eleven (5.9%) were positive for Hepatitis B virus, and only 1(0.5%) was positive for HCV antibody. However none of the 185 donors was positive for the WNV IgM antibody.

From the questionnaire survey and the interviews, only 90 (48.6%) have a record of immunization with yellow fever virus out of which 87 (97%) were males. None of the respondent had a previous knowledge of West Nile virus infection.

Twenty (10.8%) were rural dwellers (i.e. those who have no access to tertiary health facilities and basic amenities such as electricity good roads e.tc) while One hundred and sixty five (89.1%) were urban dwellers. Only 27(15.4%) out of the urban group regularly use insecticides or mosquito repellent net whereas none of the rural dwellers use insecticides or mosquito repellent net. Only 5% out of the urban dwellers group use insecticides and mosquito repellent.

### DISCUSSION:

West Nile virus is a known cause of flu-like illness and neuroinvasive diseases (such as meningitis, acute flaccid paralysis etc). Due to the outbreak of the virus in 1999 from cases of encephalitis in United States <sup>14</sup> and established evidence of its transmission in blood transfusion, screening of blood donors for WNV was instituted in July, 2005 <sup>15</sup>.

The pattern of transmission of WNV and incidence of cases reported among the infected subject vary due to temperatures,

rainfall, regional seasonal differences and bird migratory form <sup>16</sup>. These stated factors are determined by a climatic change and also influence the outbreak of infection, with higher arbovirus infection in the rainy season<sup>17</sup>. The findings of this study are similar to a previous study in Nigeria where the investigators reported a low endemicity of WNV during the dry season<sup>18</sup>. The result of this study might not be not unrelated to the weather situation at the period during which the study was conducted as the study was conducted in the dry season, supporting the report of Baba et al<sup>16</sup>.

Out of 185 serum samples collected for this study, none was positive for IgM anti-WNV antibodies; this indicates that there was no recent exposure to the virus among the blood donors in the southwestern part of Nigeria. However, we had a limitation in this study of accessing the WNV IgG antibody in the donors screened, as this would have given a picture of their previous exposure to the virus. Although, oftentimes the specificity of the IgG antibodies is always low because it cross react with other members of the Flaviviruses such as Dengue virus, Yellow virus. Though a good number of the respondents did not use insecticide treated nets this however seems not to affect the prevalence of the WNV IgM antibodies in them.

West Nile virus is an emerging disease with still a low prevalence among blood donors. Similar to the findings of this study is a study in Iranian which equally showed absence of WNV IgM in blood donors <sup>19</sup>. In a study in 2004, the presence of WNV RNA in Dutch blood donor samples was investigated but WNV infection was not observed among these Dutch blood donors <sup>20</sup>.

### CONCLUSION:

There is no serological evidence of acute WNV infection observed among the blood donors in this study. The West Nile infection can be said to have faded into obscurity in southwestern Nigeria, however due to the complexity in the transmission of WNV and increase in re-emergence rate of previously neglected diseases, it is very important that

blood banks and transfusion unit should give serious attention to any manifestation of symptoms associated with WNV in the donors. Proper questioning, screening and correct examination of the blood donors is very necessary to ensure safe blood transfusion. Also, effective preventive measure to avoid contact with the vector (mainly the specific mosquitoes) should be encouraged through the use of insecticide treated nets and history of travel to endemic areas is highly important to minimize the risk of WNV transmission. However, in order to increase the safety of blood donation, it is essential to maintain a sustained surveillance for this re-emerging infection in order to protect the blood supply in the future.

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