



Correspondence

Mayaro, Oropouche and Venezuelan Equine Encephalitis viruses: Following in the footsteps of Zika?



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Dear Editor

We have read with interest the paper by Ginier et al. [1], Zika (ZIKV) without symptoms in returning travelers. As witnessed in the recent epidemic throughout the Americas, many cases indeed remain asymptomatic through the course of infection, and when symptomatic, could also be easily missed or misdiagnosed under the umbrella of dengue (DENV) fever symptoms. Thus, a detailed list of differential diagnoses should be considered at the time of workup, including most importantly those emerging and reemerging arboviruses present in Latin America. In these lines, we would like to discuss about the potential spread of other arboviruses native to the region, in addition to DENV, chikungunya (CHIKV), ZIKV, and West Nile virus (WNV); such as the case of Venezuelan Equine Encephalitis virus (VEEV), Oropouche virus (OROV) and particularly Mayaro virus (MAYV). Although the Zika epidemic has slowly started to recede in some areas, an inevitable question revolving in the mind of public health authorities, physicians, virologists and infectious diseases researchers, is what's coming for us next and which of the arboviruses will be responsible for the next outbreak in the Americas? Within the past decade, a number of arboviral diseases have seriously stricken South and Central America, as well as the Caribbean. Initially CHIKV arrived in 2013, followed later on by Zika in 2015, with other viruses such as DENV, OROV, VEEV and MAYV exhibiting both isolated and periodical endo-epidemic cycles around the region. Then, what should we expect for 2017?

From an epidemiological standpoint, multiple scenarios can be envisaged. Nevertheless, the obvious and closest possibility would rely on an insider, as would be the case, specially, of MAYV. This arbovirus of the *Togaviridae* family and the genus *Alphavirus* (part of the Semliki Forest complex, which includes CHIKV) was originally isolated in Trinidad island in 1954 from the serum of febrile patients [2,3]. With a sylvan transmission cycle similar to

the yellow fever virus (YFV) and CHIKV, outbreaks of MAYV have been increasingly reported in the Americas, constituting a monumental diagnostic challenge on patients living in endemic areas [3,4] or returning from them to non-endemic places, as has been recently highlighted in cases of MAYV infection imported from French Guiana to Lyon, France [5], and in the past in returning travelers to the USA and Netherlands. MAYV infection classically includes a constellation of symptoms such as fever, headache, myalgias, rash arthralgia of large joints and arthritis. These symptoms overlap and can easily be confused with those of CHIKV, ZIKV and DENV infections with a high chance of misdiagnosing such cases especially during early clinical stages, thus posing a significant diagnostic challenge amongst these arboviral-like illnesses [4]. This prompts to consider not only MAYV, but also other arboviruses such as CHIKV, DENV, ZIKA, VEEV and OROV as a group in the differential diagnosis of look-alike arboviral infections (eg. ChikDenMaZika, ChikDenMaZikO or ChikDenMaZikVO, as mnemonic tool, as used it with STORCH agents) [4].

MAYV infections have been reported in Trinidad and Tobago, French Guiana, Brazil, Venezuela, Peru, Bolivia, Surinam, Costa Rica, Guatemala, Panama, Mexico, and sporadically in Colombia [3]. Nevertheless, more research is needed as there are many questions, which remain to be addressed regarding MAYV infection [6]. For example, if atypical and severe expressions of the disease are prone to occur (e.g. as in the case of ZIKV and Guillain-Barre Syndrome), chronic complications such as those presenting in post-CHIKV infection (e.g. chronic inflammatory rheumatism, CIR) or the possibility of an efficient transmission by *Aedes aegypti* in urban areas (and secondarily with *A. albopictus*). This, certainly will require studies to address the relevance of post-MAYV CIR. As the ZIKV infection outbreak in Latin America starts to retreat with the number of cases per week decreasing rapidly; studies start to reveal that cross-protective immunity between these antigenically related flaviviral infections (DENV and ZIKV) does not confer partial or complete protection as initially presumed. The question remains on whether these findings would also apply between heterologous groups of viruses as with the alphaviruses. Although cross-reactive immunity among different alphaviruses has been reported, more evidence needs to be gathered to draw definite conclusions. On the other hand, if antibody dependent enhancement of infection would occur between CHIKV and MAYV, the results in terms of associated increased disease severity in the region would be devastating.

The recent reports of circulation of MAYV in the Caribbean along with the sporadic endo-epidemic cycles naturally occurring in the

Amazon region underscore the role of MAYV as the next potential emerging pathogen representing a novel threat for an epidemic outbreak in the region.

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Conflict of interest

None of the authors report conflict of interests.

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