

West Nile virus: is there a message for Australia?

The US strain of West Nile virus could enter Australia, but we may be protected by the already present Kunjin virus

AUSTRALIA NEEDS TO consider the implications of the recent emergence and spread of West Nile virus in the United States, including the possibility of its spread to Australia. This development also raises questions about Kunjin virus, a subtype of West Nile virus, which already occurs widely in Australia.

West Nile virus, a mosquito-borne flavivirus, was known to have a wide geographic range, extending from Africa through the Middle East to southern and eastern Europe and western Asia. The initial outbreak in New York city and adjacent counties in August 1999 resulted in 62 human infections and seven deaths of elderly patients.^{1,2} Genetic evidence suggests that the virus came from the Middle East. Over the next three years, it spread rapidly in the US, first in the north-east and then more widely, causing disease and deaths in humans, horses and birds.³ Birds, especially crows, were found to be responsible for both spread and maintenance of the virus in a natural cycle with culicine mosquitoes.^{3,4} By late November 2002, the virus had been detected in 43 states spanning the mainland US, with 3735 reported clinical cases and 215 deaths, almost all among the elderly.⁵ The virus had also spread to five provinces in Canada, with around 140 cases and two deaths. The speed of its spread was undoubtedly due to the presence of competent mosquito species and a large number of susceptible birds, and especially to a greatly increased propensity to spread in a virgin ecosystem.

Before 1996, West Nile virus was known to cause high fever, chills, malaise, headache, backache, arthralgia, myalgia and retro-orbital pain, and, in about 50% of cases, a maculopapular rash,⁶ but neurological symptoms were uncommon. Since then, severe neurological illness, including encephalitis and meningitis, has been reported more frequently,^{6,7} together with an acute flaccid paralysis syndrome.^{6,8} Fatalities have generally been in the elderly. Although human acquisition is nearly always through the bite of an infected mosquito, unusual modes of transmission via organ transplantation,⁹ blood transfusion^{9,10} and possibly breastfeeding¹¹ have recently been described in the US.

West Nile virus is closely related antigenically and genetically to other members of the Japanese encephalitis serological group of flaviviruses, including Japanese encephalitis, Murray Valley encephalitis (MVE), and St Louis encephalitis viruses, and is almost identical genetically and immunologically to Kunjin virus.¹²

Kunjin virus, reclassified as a subtype of West Nile virus in 2000, is the most common flavivirus in Australia, occurring widely across northern Australia. Most infections with this virus are asymptomatic, but it causes occasional, mild febrile illness, similar to that traditionally described for West

Nile virus, and rare cases of non-fatal encephalitis.¹³ It is closely related genetically to the West Nile strain in North America,^{1,2} both being members of West Nile lineage 1. However, unlike Kunjin virus, some recently isolated members of West Nile lineage 1 are known to cause fatal encephalitis in elderly patients,^{3,6,7} fatal disease in wild birds (in North America)^{3,14} and domestic geese (in Israel),¹⁵ and severe epizootics in horses, with significant mortality.^{7,13,14} In addition, recent experimental evidence has shown that the New York strain of West Nile virus is considerably more neuroinvasive than Kunjin virus.¹⁶

Could Kunjin virus mutate to be as virulent as recent West Nile strains seen in Europe and the US? Kunjin virus has been in our ecological system for many years without any apparent increase in virulence. Several mutations may be required to increase virulence substantially, and there seems little pressure to select for such mutations.

Alternatively, could a more pathogenic strain of West Nile virus spread to Australia and, if it did, would it be able to establish itself in competition with Kunjin virus?

West Nile virus has been isolated in Sarawak, Malaysia, and is endemic in western India; thus, it could conceivably spread slowly through the region. The virus is believed to have reached New York through carriage on an aircraft of an infected mosquito or an infected traveller with sufficient viraemia to infect a mosquito on arrival in the US. Similar mechanisms could allow its importation into Australia from the US, Europe or Africa. Although current disinsection procedures for aircraft are believed to minimise the first possibility, there is concern that an infected human traveller arriving in Australia might have sufficient viraemia to infect Australian mosquitoes. More information is urgently needed on viraemia levels during infection so that this risk can be properly assessed.

Other routes of entry seem less likely. Although a horse infected with West Nile virus was recently imported into Australia from North America, viraemia levels in horses are believed to be insufficient to infect mosquitoes. Introduction of virus through migratory birds is doubtful because of the route and length of migration. Even if West Nile virus is introduced into Australia, it would have to compete with Kunjin virus for vertebrate hosts and vectors. Experience with other members of the Japanese encephalitis serogroup of flaviviruses suggests that they do not interfere with each other's ability to spread,¹² despite the induction of cross-reacting antibodies. Thus, West Nile and Japanese encephalitis viruses coexist in western India, and MVE and Kunjin viruses coexist in Australia, while West Nile and St Louis encephalitis viruses appear to coexist in North America, and Japanese encephalitis and MVE viruses appear to coexist in

...there is concern that an infected human traveller arriving in Australia might have sufficient viraemia to infect Australian mosquitoes.
