Nipah virus

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Nipah virus emerged in 1999 in Peninsula Malaysia, where it caused a severe respiratory disease in pigs, some of which also displayed encephalitic symptoms. Humans became infected following contact with infected pigs and suffered a severe encephalitic disease. There were a total of 276 human infections in Malaysia and Singapore, with 106 deaths, a case fatality rate of 38.4% [1]. The outbreak was finally contained by culling just over one million pigs at significant cost to the Malaysian economy.

Although the virus was clearly transmitted effectively between pigs, there was no recognised human-to-human transmission. The wildlife reservoir was subsequently found to be fruit bats [2], as had been demonstrated earlier for the closely-related Hendra virus. How the bats infected the pigs remains to be determined, but it probably occurred through pigs coming into contact with urine from infected bats, pigs eating fruit contaminated by bat saliva, or from masticated spats falling into pig pens. Nipah virus was also shown to infect cats, dogs and horses during the outbreak in Malaysia.

Nipah virus is the second member of the genus *Henipavirus* in the family Paramyxoviridae; Hendra virus being the other closely related member of the genus. Serological studies of fruit bats have found evidence of Nipah and/or Hendra-like viruses in bats sampled in Australia, Cambodia, Thailand, Indonesia, Papua New Guinea, India, Timor Leste, Madagascar and China and recently in West Africa [3-5]. Thus these viruses are widespread in fruit bat populations, especially in *Pteropus* sp.

In 2001, further outbreaks of Nipah virus infection were reported from Bangladesh and West Bengal, India. Subsequently, nine further outbreaks were reported, with a total of 207 cases and 152 deaths, a case fatality rate of 73.4%. Infection appears to be related to the ingestion of date palm juice, which had been contaminated by bat secretions [6]. Bats have been observed feeding on date palms at the sites where juice is being collected. In the regions where disease occurs, date palm juice is consumed without pasteurisation. Nosocomial infections were reported from Silguri in West Bengal, but the mode of transmission remains unknown, although the virus is known to be present in respiratory secretions and urine and a number of the patients had naso-gastric tubes inserted or had been intubated [7].

Of great concern is the strong evidence of human-to-human transmission in some of these outbreaks [8]. In one outbreak, there were up to six cycles of human-to-human transmission [9]. It is likely that this transmission occurs following close contact between infected and uninfected people. Notably, there was no need for an intermediate host (pigs).

These viruses clearly demonstrate the emergence of novel, previously unrecognised viruses from wildlife to infect other animals and humans. They also provide strong evidence for the impact of ecological changes on the emergence of these viruses. In the case of Nipah virus, deforestation affects bat habitats through loss of normal food sources. The bats then seek food from orchards and ornamental trees around human habitation and sites of animal production.

The recent outbreaks in Bangladesh and India also demonstrate how these viruses change with time, being now transmitted from human-to-human and with an increased case fatality rate of 74%, compared to the rate of 38% in Malaysia. The change in transmissibility is of particular concern, as a further mutation resulting in increased human-to-human transmission by the aerosol route could potentially lead to a severe disease outbreak.

Nipah virus reservoirs are close to Australia, being found in bats from Indonesia and Timor Leste and there is regular movement of these bats between countries [3]. Thus increased surveillance for these viruses in northern Australia is essential, as are joint research programs between Australian and regional scientists to better understand the movement, pathology and ecology of these viruses.

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