THE NORTHERN HOSPITAL

WEST NILE & KUNJIN VIRUS

"The Visit of the Queen of Sheba to King Solomon" oil on canvas, Sir Edward John Poynter, Art Gallery of New South Wales.

The Queen of Sheba heard of Solomon's fame and came to test him with difficult questions.

She arrived in Jerusalem with a very large retinue, with camels laden with spices and an immense quantity of gold and precious stones. Having reached Solomon, she discussed with him everything that she had in mind, and Solomon had an answer for all her questions; not one of them was too obscure for the king to answer for her.

When the Queen of Sheba saw how very wise Solomon was, the palace which he had built, the food at his table, the accommodation for his officials, the organisation of his

staff and the way they were dressed, his cupbearers, and the burnt offerings which he presented in the Temple of Yahweh, it left her breathless, and she said to the king, "The reports I heard in my own country about your wisdom in handling your affairs was true then! Until I came and saw for myself, I did not believe the reports, but clearly I was told less than half: for wisdom and prosperity, you surpass what was reported to me". How fortunate your wives are! How fortunate these courtiers of yours, continually in attendance on you and listening to your wisdom! Blessed be Yahweh your God who has shown you his favour by setting you on the throne of Israel! ....

And she presented the king with a hundred and twenty talents of gold and great quantities of spices and precious stones; no such wealth of spices ever came again as those which the Queen of Sheba gave to King Solomon. Similarly, Hiram's fleet, which brought the gold from Ophir, also brought back great cargoes of almug timber and precious stones....

And King Solomon, in his turn, presented the Queen of Sheba with everything that she expressed a wish for, besides those presents which he gave her with a munificence worthy of King Solomon. After which, she went home to her own country, she and her servants.

1 Kings, 1 - 13

Civilization, the archaeologists tell us, arose on the back of one of the most significant social developments in the history of the Homo Sapiens species, that is the transformation from small isolated hunter-gatherer societies to that of large cooperative agricultural societies. This allowed the for production of food far in advance of that necessary purely for survival and in consequence this freed up large sections of these societies to pursue other specialized activities apart from food production. From this change arose great civilizations, and from these in turn great empires. This miraculous transformation evolved in the region we call "Mesopotamia", or the "fertile crescent" in the region of the great Tigris and Euphrates rivers. Some of the earliest allusions to the interactions of these new civilizations we read in ancient Biblical accounts. Though much of these stories are myth, many almost surely have roots in very ancient truths, transmitted and embellished by millennia of oral tradition passed down through countless generations.

In the mountainous regions of southern Arabia, (in present day Yemen), a sequence of kingdoms, reaching as far back as 1300 B.C rose and fell, until eventually culminating in the Kingdom of Sheba that emerged around the 8th century B.C and flourished until about the Third century A.D. Scholars over millennia have penned oceans of ink speculating as to the identity of the Biblical Queen of a great southern empire, who visited King Solomon in the Tenth century B.C. Christian, Islamic and Jewish traditions have it that it was the Queen of the Kingdom of Sheba, although none directly name her.

But there is an intriguing alternative possibility. Was the Queen of Sheba, actually an African Queen? The physical extent of the ancient Kingdom of Sheba is unknown. Though it undoubtedly involved southern Arabia, it may also have extended into the African mainland. Indeed, could the Kingdom have originated in Ethiopia and later extended its influence into the southern Arabian peninsula? Eurocentric assumptions have it that any evidence of ancient civilizations found on the African continent must have originated or been transplanted from the Middle East or Europe. But these assumptions are wrong, the

Kingdom of Aksum being a case in point. This kingdom arose in the First Century A.D in what is today present day Ethiopia, Eritrea and Somalia, however its human origins are of course far more ancient than the First century A.D. Christianity with strong ties to ancient Judaism is the dominant religion in Ethiopia. Ethiopian tradition has it that the Queen of Sheba was in fact a native African. Upon hearing reports of the unsurpassed wisdom of King Solomon, she decided to see the truth of these for herself, by paying the great King a personal visit. So impressed was she by the King's wisdom she bestowed upon him many priceless treasures of gold. King Solomon, much charmed and besotted, in turn showered many valuable gifts upon the Queen. Again according to Ethiopian tradition, gifts of a rather more intimate nature also appeared to have been exchanged. When the Queen returned to Ethiopia, she found she was pregnant! Her son became the king after she died, and from his line were descended the royal house of Solomon that ruled Ethiopia down to the last Emperor, Haile Selassie I, who was deposed in 1974.

Whether the Queen of Sheba was from Arabia or Africa is today a moot point, indeed whether she existed at all is a moot point. Ancient traditions however frequently have some small basis in fact. With the rise of civilizations, it was inevitable that these would come into contact with each other, and when they did history tells us more often than not disastrous conflict and war would follow. Perhaps however, the Biblical story of the visit of the Queen of Sheba to King Solomon, in the 10th century B.C reflects the ancient memory of a tentative and hopeful diplomatic mission between two great kingdoms that did not end in conflict and bloodshed, but rather records the very first beginnings of mutual trade, cooperation and respect between civilizations.

In the 10th century B.C trade among civilizations was rare and precarious, the tyrannies of distance, language and alien cultures being significant barriers. Today of course, the world is a very different place to the time of the Queen of Sheba. We live in a "global village" where instantaneous interaction across the Earth is possible. This brings unprecedented opportunities for mutually beneficial trade, learning and cultural understanding.

While the Queen's mission seems to have been a great success, there would have also been hidden dangers in the trade between distant empires, the nature of which would have been utterly unimagined at the time. While the global village of today has untold advantages there are also some disadvantages in particular that we share with the mission of the great Queen. We see these in the realm of the potential for global spread of infectious disease in the form of the potentially deadly emerging arboviruses, such as the West Nile and Kunjin viruses.

WEST NILE & KUNJIN VIRUS

Culex annulirostris (Photo: Stephen Doggett, Medical Entomology, Pathology West – Institute for Clinical Pathology and Medical Research - ICPMR, Westmead)

Introduction

West Nile Virus is an **arbovirus** of the **flavivirus** genus. Clinically infection can be subclinical, encephalitic or non-encephalitic.

It is known to lethally infect **horses, domestic birds** and **wild birds**, as well as **humans**.

West Nile virus was probably carried from the Middle East to the Americas (specifically) New York) in 1999, where it caused thousands of deaths in **birds** and **horses**, and **human** disease, including **fatal encephalitis**.

Kunjin virus is a closely related **sub-species** (**1b**) of the West Nile Virus (**1a**) endemic to Oceania, including Australia and Papua New Guinea. Like West Nile virus, clinical

infection can subclinical, encephalitic or non-encephalitic, though clinical illness is usually of a milder form compared to West Nile virus.

Kunjin virus is found in parts of Australia, particularly the Northern Territory and northern Western Australia.

West Nile virus has *not yet* been detected in Australia.

West Nile virus/Kunjin virus has many similarities to Murray Valley Encephalitis virus, and disease due to these two viruses can only be distinguished by specific **virological testing**. The distinction is important during periods when weather patterns and other surveillance indicators suggest that an outbreak of MVE virus may be imminent in south-east Australia. **MVE has a higher mortality rate and can be more prevalent**.

History

The **West Nile virus** was first identified in the West Nile district of Uganda in 1937 from the blood of a Ugandan patient with a mild febrile disease.

It first appeared in the Americas in 1999. It is not clear how WNv gained access into the United States in 1999. The most popular theory is that aircraft flying from a WNv-endemic area in the Middle East carried infected mosquitoes into New York.

The **Kunjin virus** was first isolated from Culex annulirostris mosquitoes in Australia in 1960. The name of Kunjin virus derives from an Aboriginal clan living on the Mitchell River close to where the virus was first isolated in Kowanyama, northern Queensland.

Epidemiology

West Nile Virus:

West Nile Virus has been detected over a wide global area including:

1. Africa
    - It is highly endemic in Egypt.
2. Eastern Europe
3. Western Asia
4. The Americas; from Canada to Venezuela .

West Nile virus has not yet been detected in Australia.

Kunjin Virus:

Kunjin virus is found in parts of Australia, particularly the Northern Territory and northern Western Australia.

Kunjin virus has been detected in **Victoria** on several occasions since 1974, most recently in 2001. There have been three confirmed cases in Victoria since 2001. There have been 15 cases of Kunjin virus reported in Australia.

Pathology

Organism

Arboviruses are viruses that are spread by the bite of **arthropods**, particularly **mosquitoes**. In areas known to harbour infected mosquitoes, it is estimated that less than 1 per cent of the mosquitoes carry the West Nile virus.

West Nile Virus is an arbovirus of the **flavivirus** genus

Kunjin Virus is an arbovirus that is very closely related sub-species of the **West Nile virus.** It is positive-sense single stranded RNA virus

There are at least 7 genetic lineages of West Nile virus.

Kunjin virus is a small but genetically distinct **sub-lineage**, designated as **1b**.

The epidemics of **severe** disease in humans and animals during the past decade have been due to West Nile virus **sub-lineage 1a**, which has *not* to date been found in Australia.

Kunjin virus is **less virulent** than the current United States strain of West Nile virus

See also Appendix 1 below for a classification of the arboviruses

Reservoir

Mammals (mainly humans and horses) become infected with West Nile or Kunjin virus when bitten by an infected mosquito, but there is no evidence that they cause *further* spread of the virus. Mammals are considered to be "dead end" vectors because low virus amplification in their blood and a short viraemia provide little opportunity for a biting mosquito to become infected.

West Nile Virus:

Bird species appear to be the natural reservoir for the West Nile virus.

Infection in over 100 bird species has been detected.

Infected birds such as chickens commonly survive, but infection is more severe in species

belonging to the family Corvidae, such as crows and jays, which may become ill and often die.

A large number of mosquito species have tested positive for WNv in the United States.

The most common mosquito to be involved in the bird - mosquito transmission cycle has been **Culex pipiens** (also widely distributed in Australia). This mosquito, which seems to prefer to bite birds, breeds in standing water, particularly if the water is polluted with organic material.

The spread of WNv through the United States has been attributed to the migration of infected birds and the contiguous spread from area to area by new bird - mosquito cycles.

Kunjin Virus:

Kunjin virus is endemic in the tropical north of Australia and Sarawak (Malaysia), where it has cycles of infection between birds and mosquitoes in enzootic foci.

Very few epidemiological studies have been carried out to determine the exact life cycle, nature and frequency of Kunjin virus infection in Australia.

Kunjin virus is essentially a virus of birds. Various water bird species are thought to be infected with the virus, although other animals such as horses can also become infected. Mosquitoes become infected by feeding on infected birds and possibly other animals. An infected mosquito can then bite a human and transmit the infection.

Transmission

West Nile virus:

- Transmission occurs via mosquitoes.
- There is no evidence of direct person-to-person transmission.

Kunjin virus:

- Transmission occurs via mosquitoes.

  In Australia, the most common carrier of Kunjin virus is the freshwater mosquito **Culex annulirostris**.

  This mosquito breeds in fresh water and tends to be found in spring, summer and autumn around natural wetlands and irrigation waters.

  It is especially common around the Murray Darling River basin areas in NSW during summer and into autumn.

  It tends to be most active after sunset and around dawn.

- There is no evidence of direct person-to-person transmission.

Incubation Period

West Nile virus:

The incubation period is usually 2 - 14 days.

Kunjin Virus:

The incubation period is usually 7 - 28 days, (similar to MVE virus).

Period of communicability

There is no evidence of direct person to person transmission for West Nile or Kunjin virus.

Susceptibility & resistance

Kunjin virus infection confers lifelong immunity.

People with antibodies to Kunjin virus may also be immune to infection with West Nile virus

Clinical Features

Infection from either virus subtypes can result in:

1. Asymptomatic disease
2. Non-encephalitic disease
3. Encephalitic disease

West Nile virus:

Clinical features can include:

1. Asymptomatic disease (up to 80%)
2. Non-specific constitutional symptoms:
    - Fever
    - Headache
    - Lethargy/ malaise

- Anorexia
- Myalgias

3. GIT upset:
    - Nausea / vomiting
4. Rash
5. Lymphadenopathy
6. Encephalitic disease (rarely)

Kunjin virus:

Fatalities are **rare** (or absent) with Kunjin virus infection.

As for West Nile virus, clinical features can include:

1. Asymptomatic disease:
    - Serological surveys for Kunjin virus indicate that subclinical infection is **common**.
2. Non-specific constitutional symptoms:
    - Fever
    - Headache
    - Lethargy/ malaise
    - Anorexia
    - Myalgias
3. GIT upset:
    - Nausea / vomiting
4. Rash
5. Lymphadenopathy
6. Encephalitic disease (rarely)

Investigations

West Nile virus:

1. Serology:

   IgM:

   - West Nile virus specific IgM detected in serum or CSF in the absence of IgM to MVE, Japanese encephalitis or dengue viruses.

   IgG:

   - A fourfold serum rise in titre of West Nile virus over 7 - 10 days.

2. PCR testing:

   - A nucleic acid test is available for West Nile virus.

3. Viral culture

Kunjin virus:

1. Serology:

   IgM:

   - Kunjin virus specific IgM detected in serum or CSF in the absence of IgM to MVE, Japanese encephalitis or dengue viruses.

   IgG:

   - A fourfold serum rise in titre of Kunjin virus over 7 - 10 days.

2. PCR testing:

   - A nucleic acid test is available for Kunjin virus.

3. Viral culture

Note that confirmation of laboratory results by a second arbovirus reference laboratory is required if the case occurs in areas of Australia not known to have established enzootic, endemic or regular epidemic activity.

Neuroimaging:

Cerebral **CT scan** or **MRI** may show abnormalities in cases of encephalitis.

EEG:

EEG may show abnormalities in cases of encephalitis.

Management

Prevention:

West Nile virus / Kunjin virus infection can be prevented by:

Mosquito control measures:

- Personal protection measures, such as long sleeves
- Using personal repellents containing diethyltoluamide (DEET) or picaridin
- Avoidance of mosquito-prone areas and vector biting times at dusk and dawn.

Vaccination:

- A killed virus vaccine is available for the prevention of West Nile virus infection in horses, but a human vaccine has still not been developed.
- Similarly there is no vaccine currently available for Kunjin virus.

Treatment:

There is no specific treatment available for West Nile or Kunjin virus infection.

Treatment therefore is symptomatic and supportive for both

Notification:

West Nile virus and Kunjin virus infection are Group B notifiable diseases.

West Nile and Kunjin virus infection require notification within 5 days of diagnosis.

This is a Victorian statutory requirement.

School exclusion:

Exclusion is not required for primary school and children's services centers for West Nile virus and Kunjin virus disease

Appendix 1

Classification of the Arboviruses:

Arboviruses are viruses that are spread by the bite of arthropods, particularly mosquitoes.

They are divided into:

1. Alphaviruses:

   Infective alphaviruses include:

   - Ross River virus
   - Barmah Forest virus
   - Sindbis virus
   - Chikungunya virus.
   - O'Nyong Nyong virus

2. Flaviviruses.

   Infective flaviviruses include:

   - Murray Valley encephalitis virus
   - Dengue virus
   - **West Nile & Kunjin Virus**
   - Japanese Encephalitis virus
   - Yellow Fever Virus
   - Zika Virus

"The Visit of the Queen of Sheba to King Solomon" (Detail) oil on canvas,
Sir Edward John Poynter, Art Gallery of New South Wales.

References

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