

MURRAY VALLEY ENCEPHALITIS



“The Purple Noon’s Transparent Might”, oil on canvas, 1896, Arthur Streeton, National Gallery of Victoria.

“The glory of the river and plain spread before me... Far below were the tops of river-oaks, and water like the blue of a black opal.

The brightness of noon, the power of deep blue, the flies, and the temperature now 108 degrees, wrought me to a pitch of excitement... the atmosphere 10 degrees higher than my own temperature crept round my face like a flame; and it seemed like working in a fiery trance.

I paused and found that in two hours two thirds of my canvas was covered with paint, I had stamped my big impression upon it, I had made my picture”.

Arthur Streeton, (1867-1943).

*The sun is warm, the sky is clear,
The waves are dancing fast and bright,
Blue isles and snowy mountains wear
The purple noon's transparent might,
The breath of the moist earth is light,
Around its unexpanded buds;
Like many a voice of one delight,
The winds, the birds, the ocean floods,
The City's voice itself, is soft like Solitude's.*

*I see the Deep's untrampled floor
With green and purple seaweeds strown;
I see the waves upon the shore,
Like light dissolved in star-showers, thrown:
I sit upon the sands alone, -
The lightning of the noontide ocean
Is flashing round me, and a tone
Arises from its measured motion,
How sweet! did any heart now share in my emotion.*

*Alas! I have nor hope nor health,
Nor peace within nor calm around,
Nor that content surpassing wealth
The sage in meditation found,
And walked with inward glory crowned-
Nor fame, nor power, nor love, nor leisure.
Others I see whom these surround -
Smiling they live, and call life pleasure;
To me that cup has been dealt in another measure.*

*Yet now despair itself is mild,
Even as the winds and waters are;
I could lie down like a tired child,
And weep away the life of care
Which I have borne and yet must bear,*

*Till death like sleep might steal on me,
And I might feel in the warm air
My cheek grow cold, and hear the sea
Breathe o'er my dying brain its last monotony.*

*Some might lament that I were cold,
As I, when this sweet day is gone,
Which my lost heart, too soon grown old,
Insults with this untimely moan;
They might lament - for I am one
Whom men love not, and yet regret,
Unlike this day, which, when the sun
Shall on its stainless glory set,
Will linger, though enjoyed, like joy in memory yet.*

*Percy Bysshe Shelley,
"Stanzas Written In Dejection, Near Naples", 1818.
Published posthumously, by Mary Shelly, 1824*

Arthur Streeton's haunting images of the endless purple blue haze of Australia's sun-drenched outback struck a nationalistic chord during the lead-up to Federation.

In 1896 Streeton had travelled to the upper reaches of the Hawkesbury River. He was so inspired by the raw and savage untamed nature of the Australian bush, he began to record the images he was seeing in paint, despite a fierce heat of over 100 degrees Fahrenheit. His works struck a universal chord among the great grandchildren of the Australian pioneering age at a time when the new citizens-to-be were searching for an national identity and a unifying culture with the original inhabitants.

Streeton's most famous work of this period, "The Purple Noon's Transparent Might" takes its name from Percy Bysshe Shelley's "Stanzas Written In Dejection, Near Naples", 1818, a work that celebrated raw and untamed nature. Shelly was a poet that Streeton much admired. He painted one of Australia's most iconic images, he later explained, in a fevered state of "artistic intoxication with thoughts of Shelley in my mind".

MURRAY VALLEY ENCEPHALITIS



Culex annulirostris, commonly known as the **common banded mosquito**, is native to Australia, Fiji, Micronesia, the Philippines and Indonesia. This species represents a serious health threat as it is an efficient vector of a range of arboviruses including Murray Valley encephalitis, Kunjin, Barmah Forest and Ross River virus. As global warming progresses over the next century, the natural habitat of the banded mosquito is likely to significantly expand. (Photograph, Richard C. Russel).

Introduction

Murray Valley Encephalitis, (MVE) is a potentially fatal arbovirus, endemic to **Northern Australia, Papua New Guinea** and **Irian Jaya**, but may also cause occasional outbreaks across **south-eastern Australia**.

It is caused by a flavivirus, **Murray Valley encephalitis virus (MVEV)**, and has the capacity to cause severe human disease, with encephalitis being the most serious clinical manifestation.

A diagnosis of MVE virus encephalitis should be considered in any patient who presents with encephalitis and who has been in an endemic region within the incubation period of the disease.

There is no vaccine currently available. There is no specific treatment.

History

Murray Valley encephalitis virus was first isolated from patients who died from encephalitis in the Murray Valley region in Victoria and South Australia in 1951.

Major outbreaks of MVE have occurred in Australia in 1951, 1956 and 1974. In the most recent outbreak in 1974, 58 cases of encephalitis were identified.

MVEV may have been the cause earlier outbreaks of Australian “X” disease in 1917-18, 1922 and 1925.

Most recently MVEV was detected along the Murray River in February of 2011 through widespread seroconversion among sentinel chicken flocks after heavy rainfall and regional flooding. High numbers of mosquitoes were also observed, with *C. annulirostris* predominating.

In 2011, there were increased numbers of cases of MVEV in humans across Australia, including nine cases (one death) from Western Australia, four cases (one death) from the Northern Territory, two cases (one death) from South Australia, one case from New South Wales, and one suspected but unproven case from Victoria

Epidemiology

MVEV is thought to be maintained in enzootic foci in the north of Western Australia and the Top End of the Northern Territory in a cycle involving waterbirds and mosquitoes, primarily the species ***Culex annulirostris***.

Most cases in humans since 1974 have occurred in these areas.

Activity outside the enzootic areas is believed to follow the migration of infected waterbirds into flood-affected areas.

MVEV also infects a wide range of native and non-native animals, but the role of these species in maintenance and transmission of the virus is unclear.

MVEV is also endemic to **Papua New Guinea** and **Irian Jaya**.

The sporadic nature of MVEV infection in south-eastern Australia has led to the development of several models attempting to predict epidemics. These include the hypotheses of Forbes and Nicholls, which are based on patterns of rainfall and other climatic conditions. The predictive value of these models has been difficult to ascertain because of the infrequency of MVEV activity in south-eastern Australia, but it is likely that factors other than just flooding are required for epidemics.

Challenges in prevention and control of MVEV also include difficulties in controlling mosquito numbers during periods of extensive flooding, and a lack of other prophylactic or treatment measures for MVEV.

Pathology

Organism

Murray Valley encephalitis virus is an arbovirus of the **flavivirus** genus and **Flaviviridae** family.

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

See also Appendix 2 below for a classification of the arboviruses

Epidemiology

MVE virus is endemic in northern Australia and Papua New Guinea where sporadic cases or small outbreaks of MVE virus encephalitis occur every few years usually at the end of the wet season.

Seven outbreaks of MVE virus encephalitis have occurred at irregular intervals in southeastern Australia since 1917. The last of these was in 1974.

During these times there was heavy rainfall leading to widespread flooding which promoted large increases in water bird and vector mosquito populations. The MVE virus numbers were amplified in the bird-mosquito-bird cycle and humans became infected when bitten by mosquitoes carrying the virus.

MVE virus encephalitis seems to occur in people who receive large numbers of mosquito bites during a single exposure.

There are two theories as to how the MVE virus appears and causes outbreaks of MVE virus encephalitis in **southeastern Australia** and both may be correct.

The first one postulates that the virus is carried from northern parts of Australia by birds migrating south in search of food after heavy rainfall down the southeastern parts of the continent. This occurs in repeated mosquito-bird-mosquito amplification cycles.

The other suggests that the virus persists during inter-epidemic periods in cryptic foci along the **Murray River** (hence the name) and the MVE virus only amplifies and becomes evident when weather conditions are conducive to massive local mosquito and bird multiplication.

Transmission

- Arboviruses are spread by the bite of arthropods, particularly mosquitoes. The primary mosquito vector during epidemics of Murray Valley encephalitis is **Culex annulirostris**.

Mosquitoes become infected when they feed on people or animals that are infected with the MVE virus.

- Other mosquitoes such as *Culex australicus* and some *Aedes* and *Ochlerotatus* species may be involved in other aspects of MVE virus ecology.

Incubation Period

- The incubation period is around 7-28 days.

Reservoir

The primary hosts in Victoria of MVE virus during years of high virus activity are water birds.

The most commonly infected species include:

- Ardeiformes (herons), particularly the Rufous night-heron
- Pelicaniformes (cormorants/ darters)

Period of Communicability

- There is no evidence of person to person transmission of MVE virus.

Susceptibility and Resistance

- Infection with MVE virus confers lifelong immunity.

Clinical Features

A diagnosis of MVEV encephalitis should be considered in any patient who presents with encephalitis and who has been in an endemic region within the incubation period of the disease.

The disease may also be acquired at any time in northern parts of Australia or Papua New Guinea.

Infection with Murray Valley encephalitis virus may manifest clinically as:

- Asymptomatic disease
- Non-encephalitic illness
- Encephalitic illness

[Asymptomatic disease:](#)

Subclinical infection is common.

Serological studies show that only one person in about every 800 of those infected with MVE virus will develop clinical disease.

Non-encephalitic illness:

It may cause a mild influenza type illness with non-specific “constitutional” symptoms such as:

1. Fever
2. Lethargy/ malaise
3. Headache
4. Nausea and vomiting.
5. Myalgias
6. A non-specific rash may be seen

Encephalitic illness:

In a *small percentage* of all people who are infected, mild disease may be a prodrome to disease progression and involvement of the central nervous system.

This can result in:

1. Meningitis of variable severity.
2. Encephalitis of variable severity.
 - Clinical signs of brain dysfunction such as drowsiness, confusion, fitting, weakness or ataxia indicate the onset of encephalitis.

Of those presenting with encephalitis in Victoria in the 1974 epidemic, approximately:

- One third died
- One third were left with residual brain damage
- One third recovered completely.

Investigations

Infection is confirmed by:

1. Serology:

- IgG:
 - ♥ For a significant rise (i.e fourfold or greater) in titre over 7 - 10 days.
- IgM:
 - ♥ MVEV-specific (from blood or CSF)

Note, however that cross-reaction of antibodies to other flaviviruses is possible.

Definitive diagnosis is by testing

2. PCR testing:

Suitable samples include:

- Blood
- CSF

3. Isolation of the virus.

EEG

This may show abnormalities typical of encephalitis

MRI / MRA scan ²

This may show abnormalities suggestive of **encephalitis**.

MRI makes a critical contribution to an early diagnosis of MVEV infection, often providing supportive information before serological results are available and helping to exclude alternative diagnoses.

MRI is the most sensitive and specific type of imaging, and may show positive findings within a week of symptom onset.

Typical features include bilateral hyperintensity of the deep grey matter, especially the thalami, on fluid attenuation inversion recovery or T2-weighted images (see Appendix 2 below).

These changes may also involve the temporal lobes, red nucleus and cervical spinal cord, and, in some cases, they may resemble those seen in HSV encephalitis.

Findings may be similar for other flaviviruses, especially JEV and WNV, and thus MRI does not allow discrimination between these infections.

Future studies are planned to determine if MRI can be used to predict patient outcomes.

Unfortunately, MRI is not available in many rural areas and computed tomography (CT), which is more widely available, lacks the sensitivity to detect mild changes.

In *severe* disease, CT may detect hydrocephalus, reduced attenuation from the thalami to the brainstem, cerebral atrophy or cerebral infarcts.

Management

Prevention:

Vaccine:

There is no preventative vaccine available.

Control and avoidance of mosquitoes:

MVE infection can be prevented by:

- Mosquito control measures
- Personal protection measures, such as wearing long sleeves
- Using personal insect repellents containing diethyl toluamide (DEET) or picaridin
- Avoiding mosquito-prone areas and vector biting times at dusk and dawn.

Treatment:

There is no specific treatment for Murray Valley encephalitis virus.

No antiviral drugs have been trialled in the treatment of humans with MVEV and there are few in-vitro or animal model data.

Management therefore is supportive.

1. IV fluid rehydration
2. Correction of electrolyte disturbances
3. Analgesia:
 - IV paracetamol is a useful option.

4. Mechanical ventilation and other intensive supportive measures for severe cases of encephalitis may be required.
5. Acyclovir:
 - In the first instance a definitive diagnosis of MVE will not be possible.
 - Acyclovir should be given empirically for presumed encephalitis to cover the possibility of herpes simplex virus infection.

Notification

MVE is an urgent notifiable condition and must be notified by medical practitioners and pathology services immediately by telephone upon initial diagnosis (presumptive or confirmed).

Pathology services must follow up with written notification within 5 days.

This is a Victorian statutory requirement.

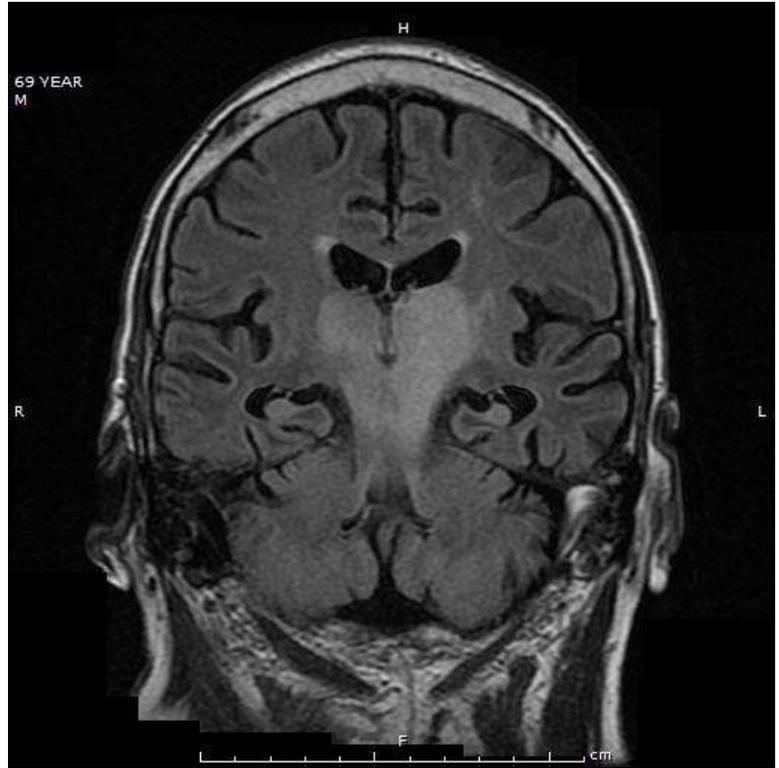
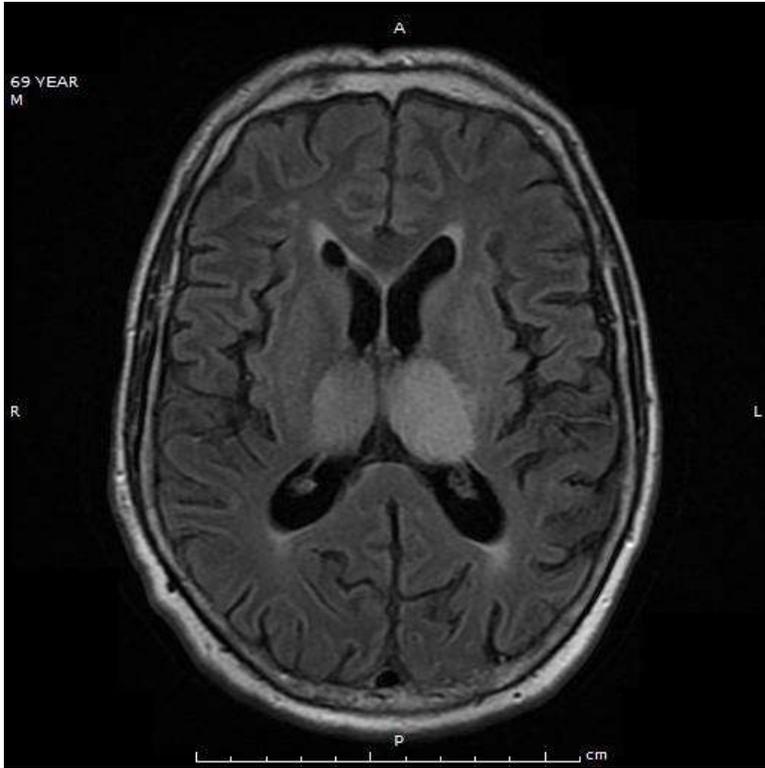
Following Victorian notification of a seroconversion to MVE virus or information of human notification:

- An emergency meeting of the Victorian Arbovirus Task Force (VATF) will be convened by the department
- The presence of MVE virus in the area will be notified to relevant regional offices and local government health personnel
- Suitable media releases will be made available
- Appropriate VATF members will visit the area to consult and advise local councils, health and tourism authorities
- Depending on the actual or potential severity of the epidemic, meetings of relevant personnel will be arranged in the affected area to consider control measures.

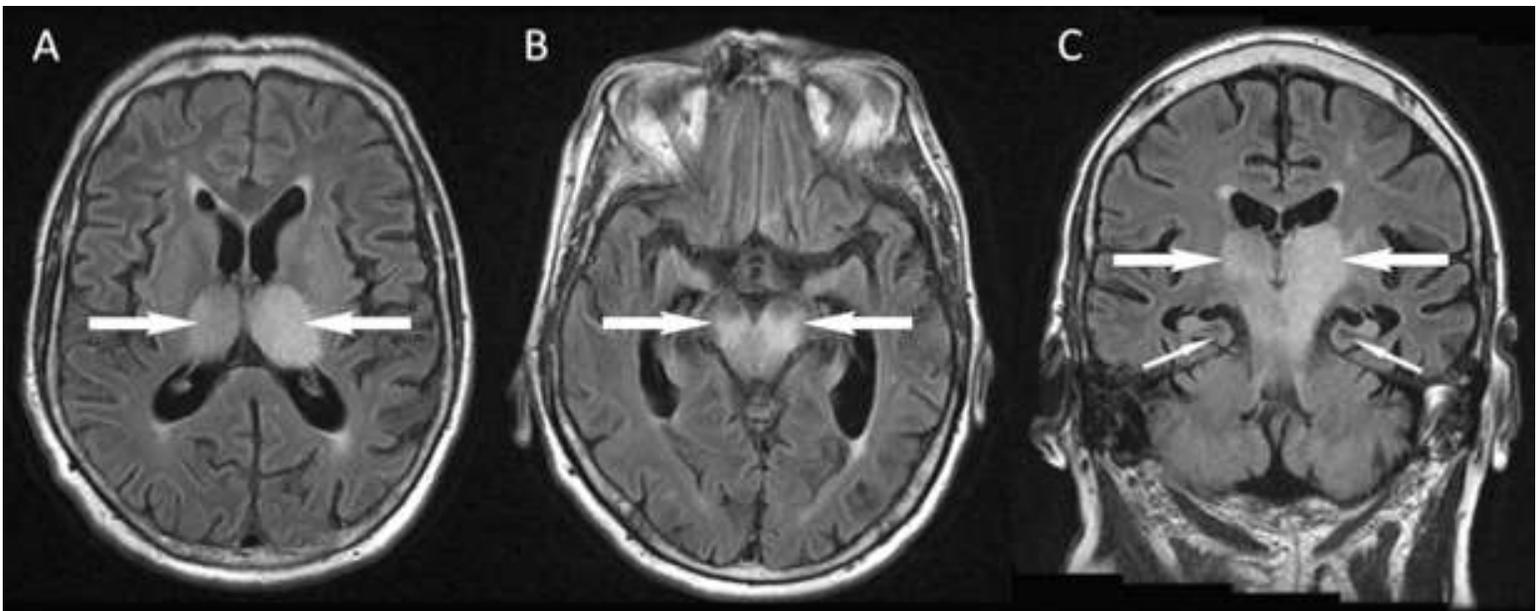
School exclusion

School exclusion is not necessary

Appendix 1



MRI T2 Cerebral Flare views of a 69 year old male who died from Murray Valley Encephalitis. The axial view shows typical features of an encephalitis with bright bilateral thalamic enhancement. The coronal view shows the bilateral enhancement extending into the brainstem. These changes are highly characteristic of an encephalitis, (but are not specifically diagnostic of Murray Valley Encephalitis).



Labelled images of the above case:

Axial images (A and B) show diffuse high signal bilaterally in the thalami, cerebral peduncles and midbrain (bold arrows).

The coronal image (C) shows confluent high signal changes extending from the thalami to the midbrain and pons (bold arrows).

The small hippocampi noted bilaterally were consistent with early Alzheimer disease (small arrows).

Appendix 2

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 Australian Heron, Lithograph, John Gould, The Birds of Australia, 1840-1848.

The Australian Heron is a beautiful bird, but unfortunately it can occasionally carry the MVE virus

References

1. Murray Valley Encephalitis in, The Blue Book Website, 31 August 2018.
2. James Knox et al. Murray Valley encephalitis: a review of clinical features, diagnosis and treatment. MJA 196 (5) 19 March 2012.

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