Lessons from practice

West Nile virus Kunjin subtype in rural NSW

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Clinical record

The patient was a 41-year-old man from the New England area in regional New South Wales (NSW). The patient lived with his family on a 100-acre property about 35 minutes from the nearest township. The family farmed cattle and owned a horse. He had no significant medical history and took no regular medications.

On 11 January 2025, the patient and his family left for a camping holiday through central Queensland. On the evening of 11 January, he experienced headache, anorexia, body aches, and confusion; however, the family continued travelling. Due to worsening symptoms, he presented to hospital in the Central Highlands area of Queensland on 13 January 2025, where he was diagnosed with viral illness and discharged from the emergency department.

The patient's symptoms persisted, and he presented to another hospital in Central West Queensland on 14 January 2025 where he was discharged from the emergency department with empiric antibiotics. On 15 January 2025, he presented to another hospital with markedly worsened symptoms and was transferred to the tertiary referral hospital for north Queensland for ongoing care.

The patient was tested for encephalitis. Based on the computed tomography (CT) scan of the brain, herpes simplex viral encephalitis was considered (Box 1). The remainder of his septic screen (including blood and urine cultures, and respiratory viral nasopharyngeal swab), syphilis, and a bloodborne virus screen were negative. Serology demonstrated previous herpes simplex virus 2 (HSV2) infection (Box 2).

The patient was diagnosed with acute encephalitis, and treated with ceftriaxone, acyclovir and dexamethasone. His last recorded fever was on 16 January 2025, the same day as admission to the tertiary referral hospital. The patient was discharged on 22 January 2025, with advice to visit an emergency department with any further concerns, and for convalescent flavivirus serology to be performed in two weeks. At discharge, neurological symptoms were reported to have resolved; however, at time of interview (24 February 2025), memory remained impacted.

Acute and convalescent blood samples were referred to the Institute of Clinical Pathology and Medical Research (ICPMR) in NSW for parallel testing, which demonstrated reactivity to the flavivirus group, Japanese encephalitis virus (JEV) total antibody, Murray Valley encephalitis virus (MVEV) total antibody, and West Nile virus Kunjin subtype total antibody. There was a fourfold rise in West Nile virus Kunjin subtype antibody and total flavivirus antibody levels on convalescent serology, indicating acute West Nile virus Kunjin subtype infection.[1,2] Stable JEV and MVEV total antibody titres with negative IgM suggested past infection with both JEV and MVEV. There was no history of JEV vaccination.

The patient's case was notified to the Hunter New England Public Health Unit by the Darling Downs Public Health Unit on 30 January 2025 via pathology results and a referral from the Townsville Public Health Unit. During the follow-up investigation, the Hunter New England Public Health Unit requested that blood collected during the admission to the tertiary referral hospital be sent to ICPMR for flavivirus differentiation. Using a sample collected on 16 January 2025, testing was able to determine that the causative organism was West Nile virus Kunjin subtype, making this the first locally acquired NSW case since 2011. The findings also demonstrated past JEV and MVEV infections with static titres of 1:160 in the absence of IgM antibody.

Discussion

This case represents the first locally acquired human case of West Nile virus Kunjin subtype in NSW since 2011.[1,2] The patient experienced acute encephalitis and was admitted to the tertiary referral hospital in north Queensland for six days in January 2025. Exposure likely occurred during December 2024 or early January 2025 in NSW, although the exact location is difficult to determine given the patient's travel history (see Supporting Information for interview details). After discharge, although acute neurological symptoms had improved, the patient continued to experience fatigue, memory loss, and a negative impact on activities of daily living. Ongoing neurological follow-up was advised.

Initial evaluation of encephalitis in adults should be systematic,[3] with consideration given to geographically appropriate flavivirus testing. Routine studies should include cerebrospinal fluid (CSF) where indicated, serum (to be held and tested in parallel with a convalescent serum collected 10–14 days later), imaging (neuroimaging and chest imaging), neurophysiology (electroencephalogram) and other tissues/fluids where appropriate.[3] Following transfer to the tertiary referral hospital, the patient was diagnosed with acute encephalitis and appropriate management commenced. However, this followed repeated presentations to smaller inland regional hospitals where encephalitis was not considered or investigated, noting that the areas considered endemic for flaviviruses, particularly JEV, are expanding.[4] This highlights the need to promote a systematic approach to diagnosing cases of potential encephalitis in areas where flavivirus infections may occur.[3,5]

Cross reactivity within the Japanese encephalitis serocomplex complicates laboratory diagnosis, particularly in localities where there are multiple flaviviruses co-circulating, confusing the epidemiological picture.[6] As there were no detections

1 Diagnostic test results

Test	Date and result
Contrast-enhanced CT scan of brain	16/1/2025: Findings suggestive of encephalitis affecting right anterior lobe region of ill-defined, subtle low density within the right anterior temporal lobe with a degree of sulcal effacement noted. No acute intracranial haemorrhage. No cerebral abscess.
Magnetic resonance imaging scan with contrast of the brain	17/1/2025: No acute intracranial pathology. Incidental right frontal developmental venous anomaly, considered unrelated to the presentation. Constellation findings of partial empty sella, tortuous optic nerves and distended optic nerve sheaths may represent idiopathic intracranial hypertension, clinical correlation advised and if appropriate check opening pressure if planning to perform lumbar puncture. Incidental mild sinus mucosal thickening in ethmoids, sphenoid and maxillary sinus.
Contrast-enhanced CT scan of abdomen and pelvis	16/1/2025: No CT scan evidence of acute intra-abdominal pathology
Chest x-ray	16/1/2025: Unremarkable
Cerebrospinal fluid	18/1/2025: • Volume: 12 mL, clear, colourless • Cell count: white blood cell count, 250 × 10^6/L (reference interval [RI], 0–5 × 10^6/L); red blood cell count, 1 × 10^6/L (RI, 0–25 × 10^6/L); differential (polymorphs 0%, mononuclear 100%, eosinophils 0%, others 0%) • Chemistry: protein, 980 mg/L (RI, 150–500 mg/L); glucose, 3.4 mmol/L (RI, 2.2–3.9 mmol/L) • Gram stain: no organisms seen • Culture: no growth after 5 days incubation • India ink test: negative • Cryptococcus antigen: non-reactive • Polymerase chain reaction: lymphocytic choriomeningitis virus RNA not detected, enterovirus RNA not detected, *Neisseria meningitidis* DNA not detected, HSV1 DNA not detected, HSV2 DNA not detected • Arbovirus: Flavivirus (serotype) IgM microsphere immunoassay detected, Japanese encephalitis RNA not detected
Blood tests (initial test unless otherwise specified)	16/1/2025: • Full blood count: haemoglobin, 140 g/L (RI, 135–180 g/L); white blood cell count, 9.3 × 10^9/L (RI, 4.0–11.0 × 10^9/L); platelets, 266 × 10^9/L (RI, 140–400 × 10^9/L); monocytes, 1.15 × 10^9/L (RI, 0.10–1.00 × 10^9/L) • Urea, electrolytes and creatinine: within normal range • Liver function tests: within normal range • Coagulation profile: within normal range • Inflammatory markers: C-reactive protein, 8.4 mg/L (RI, < 5.0 mg/L); erythrocyte sedimentation rate, 11 mm/hour (RI, < 10 mm/hour) • Lactate dehydrogenase: within normal range • Lipase, amylase: within normal range • Blood culture: no growth after 5 days incubation 17/1/2025: • HIV serology: non-reactive • Hepatitis B and C serology: evidence of hepatitis B immunity • Herpes serology: herpes simplex virus 1 IgG non-reactive, herpes simplex virus 2 reactive • Syphilis: total EIA antibody non-reactive • Immunoglobulin (IgG, IgA, IgM) levels: within normal range
Urine	16/1/2025: • White blood cell count: 10 × 10^6/L (RI, < 10 × 10^6/L) • Red blood cell count: < 10 × 10^6/L (RI, < 10 × 10^6/L) • Epithelial cells: < 10 × 10^6/L
Nasopharyngeal swab	17/1/2025: • SARS-CoV-2, influenza A, influenza B and respiratory syncytial virus not detected

CT = computed tomography; HSV = herpes simplex virus; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2. ◆

in mosquito or sentinel chicken surveillance preceding this case,[7] this type of surveillance might be an inefficient means of detecting West Nile virus Kunjin subtype where incidence is likely low. West Nile virus Kunjin subtype detection in horses might be a better indicator of virus circulation, noting that horses frequently move around the state and may not indicate local transmission. The Department of Primary

2 Arboviral test results

Arboviral test	Date	Result
Ross River virus serology	16/1/2025	IgM non-reactive
Barmah Forest virus serology	16/1/2025	IgM non-reactive
Flavivirus serology	16/1/025	IgM reactive, IgG reactive
Dengue serology	16/1/2025	IgM equivocal, IgG reactive, NS1 antigen negative
Murray Valley encephalitis virus RNA (blood)	17/1/2025	Not detected
Japanese encephalitis virus RNA (blood)	16/1/2025, 17/1/2025, 18/1/2025, 20/1/2025	Not detected
Flavivirus polymerase chain reaction (CSF)	18/1/2025	Negative JEV RNA
Flavivirus IgM (CSF)	18/1/2025	Reactive

CSF = cerebrospinal fluid; JEV = Japanese encephalitis virus; NS1 = non-structural protein 1. ◆

Industry and Regional Development NSW had received serological confirmation of West Nile virus Kunjin subtype in four horses since December 2024, when this case was likely exposed (personal communication, Jane Bennett, Manager - Animal and Aquatic Biosecurity Policy, Department of Primary Industries and Regional Development, October 2025). These horse detections were reported from across the state, including from the nearby Hunter Region but not New England.

Infection with the West Nile virus Kunjin subtype is a challenge to diagnose due to non-systematic clinical evaluation of encephalitic presentations, an epidemiological picture complicated by an expanding geographic range,[4,8] extreme weather events,[8,9] and current virological and serological diagnostic methods.[10,11]

For many clinically relevant flavivirus infections, polymerase chain reaction on serum, plasma or CSF is of limited use, as viraemia is low-level and short lived.[9] Due to the challenges of detecting West Nile virus virologically, serology (such as enzyme-linked immunosorbent assays or immunofluorescence tests) may be a more appropriate means of diagnosis, particularly when an acute sample is tested in parallel with convalescent serology. Immunoglobulin M (IgM) is generally detectable at 7.5 days after the mosquito bite, and immunoglobulin G (IgG) at 10 days after the mosquito bite.[11] CSF antibodies should be ordered for suspected encephalitic flaviviruses.

Although the current focus in clinical and public health practice is on JEV and MVEV, this notification serves as a timely reminder to clinicians and public health practitioners to consider West Nile virus Kunjin subtype during the mosquito season, in patients presenting with a clinically compatible illness who live, work, or have travelled to an at-risk area.

Lessons from practice

- There are challenges to accurate diagnosis of infection with the West Nile virus Kunjin subtype. Clinicians working in high-risk areas should consider testing for flaviviruses.
- Preference should be given to serological testing methods over virological methods.
- Robust West Nile virus Kunjin subtype surveillance systems and data sharing agreements are required. Currently mosquito, chicken, horse and human surveillance data are collected by human health and animal health agencies. We recommend formalising a combination of existing surveillance systems from relevant agencies.

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Supporting Information

Additional Supporting Information is included with the online version of this article.