

Meningoencephalitis Caused by a Novel Paramyxovirus: An Advanced MRI Case Report in an Emerging Disease

C C T Lim, Y Y Sitoh, K E Lee, A Kurup, F Hui

ABSTRACT

Eleven abattoir workers in Singapore were infected in March 1999 by an outbreak caused by the Nipah virus. This newly discovered, Hendra-like paramyxovirus causes acute infection of the CNS. We present the magnetic resonance imaging (MRI) and proton magnetic resonance spectroscopy (MRS) findings in a patient suffering from acute meningoencephalitis. Multiple small white matter lesions were detected on diffusion-weighted imaging (DWI) and T2-weighted images. There were no abnormalities detected on MRS. We believe this to be the first reported MRI findings in this novel zoonotic viral disease.

Keywords: magnetic resonance imaging, echo planar imaging, encephalitis, viruses, paramyxovirus

INTRODUCTION

An epidemic of viral encephalitis occurred in Malaysia in 1998-99, causing many fatalities⁽¹⁾. The causative agent isolated from cerebrospinal fluid was found to be a paramyxovirus, which was similar, but not identical, to the Hendra virus. The previously unknown virus, now named the Nipah virus, is believed to infect pigs and humans. Although information on routes of transmission is still emerging, it appears that contact with pigs is necessary for infection. Eleven infected Singaporean abattoir workers, who had been in close contact with live pigs imported from Malaysia, were affected by the outbreak.

CASE REPORT

A 42-year-old Indian man was admitted to hospital seriously ill with fever, headache and neck stiffness. He worked at a local abattoir as a truck driver transporting live pigs from Malaysia. On admission, he was drowsy and had a Glasgow Coma Scale (GCS) of 8. Examination of the CSF revealed marked pleiocytosis and elevated protein. His GCS rapidly deteriorated to 3, and he required intubation and ventilatory support. Chest radiograph revealed widespread granular infiltrates. Emergent MRI, including a diffusion-weighted sequence (DWI) at $b = 1000 \text{ s/mm}^2$ was successfully performed on the

fifth day of his illness. Single voxel proton MRS (SV-PROBE, GE Medical Systems, Milwaukee, Wis) using a point-resolved spectroscopy (PRESS) sequence at TR/TE 1500/136 was also performed over the largest lesion.

Multiple small foci of T2 prolongation (Fig 1) and restricted diffusion were detected in the deep white matter. The splenium of the corpus callosum was affected. Many of these lesions were subtle on conventional T2-weighted images (Fig 2b). Widespread leptomeningeal enhancement was seen after intravenous Gadolinium DTPA (Fig 3), but none of the parenchymal lesions showed contrast enhancement. MRS revealed normal metabolite peaks of N-Acetylaspartate (NAA), creatine (Cr), and choline (Cho). The NAA/Cr ratio was 1.85, and Cho/Cr ratio was 1.42. Abnormal lactate was not detected (Fig 4).

The patient's serum tested positive to a test kit developed by the Centers for Disease Control and Prevention (CDC, Atlanta), using capture-IgM ELISA with the prototype Hendra virus antigens⁽¹⁾. The patient improved gradually with supportive treatment and an empirical course of acyclovir. He was discharged with mild residual dysmetria after 16 days in hospital.

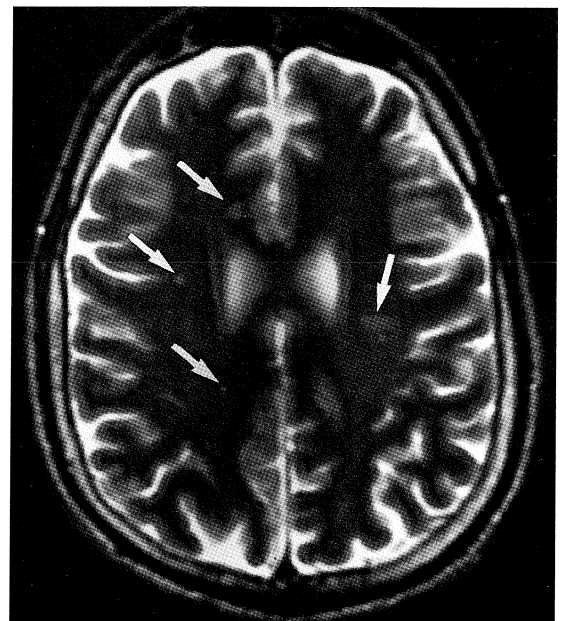


Fig 1 - Axial T2-weighted MR images showing multiple, bilateral punctate lesions (arrows).

Department of Diagnostic Imaging
Tan Tock Seng Hospital
Moulmein Road
Singapore 308433

C C T Lim, FRCP (UK),
MMed (Diag Radiol)
Senior Registrar

Y Y Sitoh, FRCP (UK)
Senior Registrar

F Hui, FRCP (UK)
Consultant

Department of Neurology
Tan Tock Seng Hospital

K E Lee, MRCP (UK)
Registrar

Department of Infectious Diseases, Communicable Disease Centre
Tan Tock Seng Hospital

A Kurup, MRCP (UK)
Registrar

Correspondence to:
Dr C C T Lim

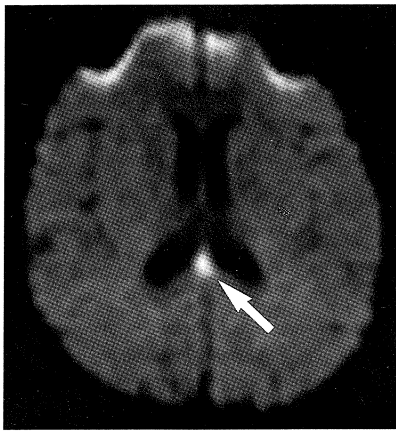


Fig 2a



Fig 2b

Fig 2a & b – Diffusion-weighted image (a) showing a hyperintense lesion (arrow) in the splenium of the corpus callosum. The lesion (arrow) is less clearly visualised on the corresponding T2-weighted image (b). Note the other punctate lesions (arrowheads) not seen on DWI.

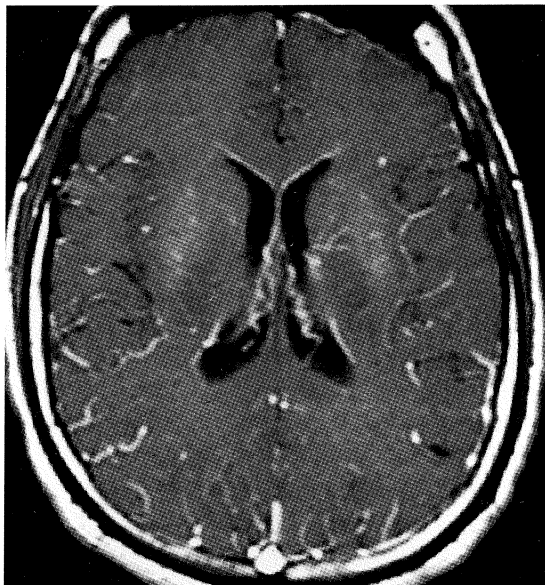


Fig 3 – Post-gadolinium T1-weighted axial image showing widespread and florid leptomeningeal enhancement.

DISCUSSION

The Nipah virus is an emerging zoonotic pathogen that can cause disease in humans. This patient suffered serious meningoencephalitis complicated by respiratory failure. Although he was very ill, and was suffering from an infective agent of unknown virulence, emergent MRI utilising advanced MRI techniques was successfully completed.

In this patient, the abnormalities on DWI improved lesion conspicuity, thus leading to better lesion detection. Attention was drawn to very vague and subtle foci of T2 prolongation (Fig 2b), which might have been overlooked. Imaging of diffusing water molecules is a functional MRI technique that provides additional information totally independent from T1 and T2 relaxation in conventional MRI. Restricted diffusion, seen as increased signal on DWI, is thought to represent cytotoxic oedema⁽²⁾, and DWI has been successfully applied to the study of hyperacute stroke. In CNS infection, brain abscesses have been reported to show restricted diffusion^(3,4), and a search of the literature revealed one report of herpes encephalitis that displayed diffusion abnormality⁽⁵⁾. We are unable to ascertain if the findings of restricted diffusion are due to cytotoxic oedema arising from viral infection or from ischemia. As more data is gathered on this new disease, we hope this question can be answered.

MRS is the study of metabolic spectra and has been applied to the study of stroke, tumours and other conditions⁽⁶⁾. Proton spectroscopy has also proven useful in infectious conditions such as AIDS⁽⁷⁾. In our patient, there was preservation of the normal metabolite peaks, and no evidence of abnormal lactate to indicate acute ischemia. Interpretation of these findings is hampered by the small size of the lesion and partial volume effects as a result of contamination of the voxel by normal tissue. Voxel size remains a limiting factor in SV-PROBE⁽⁸⁾.

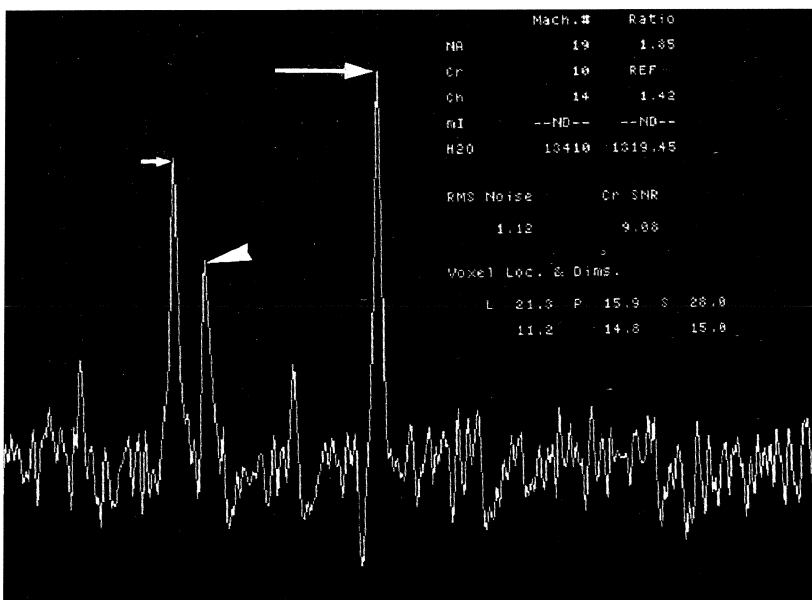


Fig 4a

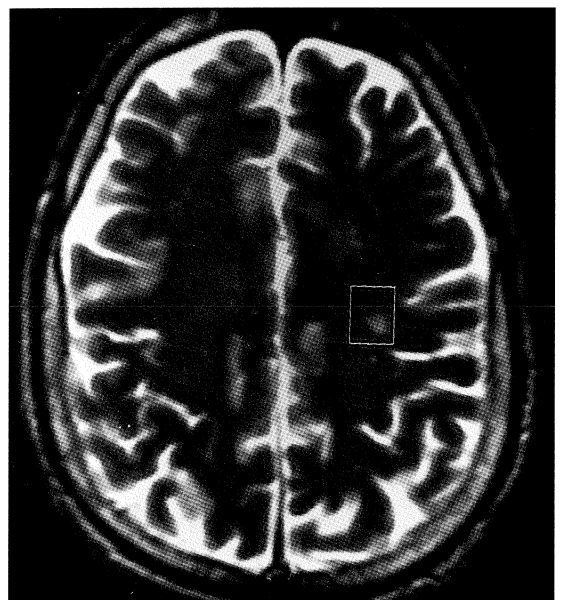


Fig 4b

Fig 4a & b – Single voxel proton spectroscopy (a) showing normal peaks of NAA at 2.02 ppm (long arrow), creatine at 3.04 ppm (arrowhead) and choline at 3.21 ppm (short arrow). There is no abnormal lactate peak at 1.32 ppm. The spectra were obtained from the voxel placed over the lesion on T2-weighted image (b). Note the small size of lesion compared to the normal-appearing brain parenchyma.

Currently, software for DWI is available on many clinical 1.5T magnets, as is single voxel MRS. These advanced MRI techniques can be added onto a conventional examination like an extra pulse sequence. The time penalty for single voxel proton MRS is in the order of 10 to 15 minutes, and the DWI sequence requires only one more minute of scan time. This case illustrates the clinical utility of DWI for better lesion detection and increased diagnostic confidence. However, in this patient with sub-centimeter lesions, single voxel proton MRS appears to contribute little information.

We believe this to be the first report of the MRI findings of encephalitis caused by the newly discovered Nipah virus. In our patient, the lesions were located exclusively in the white matter, without involvement of the cortex, brainstem or deep nuclei. It remains to be seen in a larger series if this disease gives rise to a pattern of white matter disease, and whether the lesions remain static or progress with time. Further information should also be forthcoming regarding pathological correlation of the lesions seen on advanced MRI.

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