Magnetic Resonance Imaging Features in Japanese Encephalitis: two cases report

WEN-PIN CHEN  JOSEPH-HUANG LEUNG  YU-BUN NG  CHUN-LIN HUANG

Department of Medical Imaging, Chia-Yi Christian Hospital

The prevalence of Japanese encephalitis (JE) is not uncommon in Taiwan. It tends to occur in the summer and early autumn. The definite diagnosis of JE was according to the results of serological examination and clinical presentation. We report the magnetic resonance (MR) imaging findings of two patients with serologically proved JE. The MR imaging demonstrated bilateral thalamic involvement with abnormal high signal intensities on T2-weighted images (T2WI), fluid-attenuated inversion recovery images (FLAIR) and diffusion-weighted images (DWI). The lesions showed no obvious contrast enhancement. Recognition of such typical MR imaging features associated with appropriate clinical setting will aid in early correct diagnosis and render proper treatment.

Key words: Encephalitis; Japanese encephalitis; Magnetic resonance (MR)

Japanese encephalitis (JE) is the common endemic encephalitis in southeastern Asia, including Japan, Korea, Thailand, Burma, India and Taiwan. The diagnosis of JE was established on the basis of the results of serologic examination. There is often a delay of at least one week before the diagnosis can be confirmed[1].

We report and demonstrate the characteristic magnetic resonance (MR) imaging findings of two patients with serologically proved JE, and hope to aid in early diagnosis.

CASE REPORT

Two patients (27-year-old male and 35-year-old female respectively) presented with a several-day history of fever, headache and impaired consciousness. The mental status had progressively deteriorated with confusion, disorientation, stupor, dysarthria as well as intermittent aphasia. The remainder of examination revealed no focal neurologic signs. Cerebrospinal fluid (CSF) study showed clear colorless appearance, a prominent lymphocytic pleocytosis and an elevated protein concentration. The concentration of glucose was normal. The diagnosis of viral meningoencephalitis was made by CSF study and clinical presentation. Empiric antiviral therapy and antibiotics were given.

Initial brain computed tomography (CT) revealed no significant findings. Brain MR imaging (1.5T, Signa® Horizon LX system; GE) demonstrated striking bilateral thalamic hyperintensities on T2-weighted images (T2WI), fluid-attenuated inversion recovery images (FLAIR) and diffusion-weighted images (DWI), with similar involvement of the midbrain and basal ganglia (Fig. 1, 2). The corresponding apparent diffusion coefficient (ADC) maps show hypointensities. They showed hypointensities on T1-weighted images (T1WI) and no apparent gadolinium enhancement. There were no micro-organisms seen or isolated from the serum and CSF stain or culture for ordinary bacteria, fungus, acid-fast bacilli, cryptococcus and

Reprint requests to: Dr. Wen-Pin Chen
Department of Radiology, Chia-Yi Christian Hospital.
No. 539, Chung Hsiao Road, Chiayi 600, Taiwan, R.O.C.
enterovirus. Serologic tests for a variety of pathogens including herpes simplex virus, cytomegalovirus, Epstein-Barr virus, human immunodeficiency virus and mycoplasma were also negative.

Serologic test subsequently secured the diagnosis of JE virus with detection of immunoglobulin (Ig) M antibody in the serum using the enzyme-linked immunosorbent assay (ELISA).

DISCUSSION

Japanese encephalitis (JE) is an acute viral encephalitis which is caused by JE virus. It belongs to the Flaviviridae family, which also includes St. Louis encephalitis virus, Murray Valley encephalitis virus, Tick-borne encephalitis virus, Russian spring-summer encephalitis virus and numerous other related examples. The vector of JE virus is the Culex tritaeniorhynchus mosquito and the amplifying hosts are pigs and birds.

JE is a serious public health problem in many countries in southeastern Asia, due to specific climatic and seasonal conditions. JE tends to present in the summer and early autumn [2]. The age distribution and incidence depend on the target population for vaccination, the amount and distribution of the vector, the vaccination availability for the amplifying host, and the social and financial lifestyle and preventive healthcare changes.

The clinical symptoms include high fever,

![Figure 1. MR images from the case of a 27-year-old male with serologically proved JE. a. Axial spin-echo T1WI (450/9 [TR/TE]) shows symmetric hypointensity of bilateral thalami and caudate nuclei. b. Axial fast spin-echo T2WI (4000/88.2) shows symmetric hyperintensity of bilateral thalami and caudate nuclei. c, d. Axial FLAIR image (9002/138; inversion time, 2200ms) reveals symmetric marked hyperintensities in bilateral thalami, caudate nuclei and midbrain. e. Single-shot spin-echo echo-planar axial DWI with diffusion sensitivity of b=1000 s/mm2 (9999/97.5) demonstrates marked high signal intensity in bilateral thalami. f. Gadolinium-enhanced axial T1WI (450/9) shows subtle enhancement within the thalami.](image-url)
headache, impaired consciousness and seizure. JE also presents with extrapyramidal symptoms similar to parkinsonism, with an incidence of up to 30% [3].

The best diagnosis of JE is accomplished with three diagnostic studies: by isolating the JE virus from CSF, detecting JE virus antigen, and detecting JE virus RNA by polymerase chain reaction (PCR). The serologic diagnosis has been well established by demonstrating a four-fold or greater rise in either the complement fixation (CF) test or the hemagglutination inhibition (HI) test for JE virus in paired sera. Also, the diagnosis is confirmed by detection IgM antibody using ELISA [4].

The JE virus and most of the flavi viruses have special predilection to affect subcortical gray matter such as thalamus, basal ganglion and substantia nigra. Less frequent involvement includes cerebellum, pons, cerebral white matter and cortex. The pathological changes in the lesions of JE reveal edema, congestion, small hemorrhages, perivascular cuffing and necrotic foci, loss of neurons and proliferation of glial cells [5]. The bilateral thalamic involvement in JE is the most frequent and characteristic finding and was present in almost all patients on MRI scan [1, 4, 6, 7].

Classically MR imaging demonstrates hyperintense lesions on the T2WI and FLAIR image and hypointense lesions on the T1WI. Hemorrhagic transformations in the lesions of JE are not uncommon, with corresponding expected T1 and T2 changes [1, 7, 8]. No or minimal effect of enhancement was noticed on contrast-enhanced study.

DWI is being increasingly used in various diseases of the brain. It can detect more and early lesions in various viral and bacterial encephalitis [9]. There was a significant direct correlation of DWI and ADC values with the disease duration of JE. In acute stage, perivascular cuffing and congestion leading to ischemia and cytotoxic edema results in restricted diffusion and low ADC values. In subacute stage, the proportion of diffusion restriction decreases and ADC starts rising. In chronic phase, necrosis and demyelination are responsible for hypointensity on DWI with higher ADC values [10].

Bilateral thalamic lesions may occur in a large
number of conditions. Tumors, such as glioma or germ cell tumor may be excluded on the basis of the clinical presentation. Thalamic infarcts occur in occlusion of the basilar artery, deep cerebral vein thrombosis or neonatal asphyxia. Hypoxic-ischemic encephalopathy, osmotic myelinolysis and post-viral or autoimmune demyelination (such as multiple sclerosis or acute disseminated encephalomyelitis) should be included in the differential diagnosis. A number of degenerative and metabolic disease such as Wernicke’s encephalopathy, Wilson’s disease, Sandhoff’s disease and early childhood hepatocerebral degeneration should be considered also [1, 7].

The treatment for JE is primarily conservative and supportive since there is no specific antiviral therapy. The prognosis depends on the extent of involvement at primary presentation, and on the autoimmune mechanisms of this disease with the sequelae of complete cure, permanent disability or death. The corresponding MR imaging may reveal decreasing in the size of lesions, with small encephalomalacic cysts or extensive diffuse white matter changes with continuous progression of gray matter lesions [4].

In the appropriate clinical setting and in the endemic area, bilateral abnormal signal intensities in the thalamus, including midbrain and/or basal ganglion on MR images are suggestive of JE.

REFERENCE

日本腦炎之磁振造影影像：二病例報告

陳文彬  梁 恆  吳汝濱  黃駿麟
嘉義基督醫院 影像醫學科

日本腦炎的流行在台灣並非不常見，它好發於夏天及早秋季節。日本腦炎的確定診斷是根據血清學檢查及臨床表徵。本文報告二例確定日本腦炎病例之磁振造影影像，結果顯示在T2加權影像，FLAIR影像及擴散加權影像，兩側丘腦均有不正常高訊號強度，病灶並無明顯顯影劑增強現象。配合適當之臨床表現及典型之磁振造影特徵將有助於日本腦炎的早期診斷。

關鍵詞：腦炎；日本腦炎；磁振造影