Diagnosis of Creutzfeldt-Jacob Disease on Diffusion Weighted MR Imaging Manifesting With Typical Pulvinar or Hockey Stick Sign

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Received: 02 Mar. 2022; Accepted: 21 Mar. 2023

Abstract- Creutzfeldt-Jacob disease (CJD) is a rapidly progressing fatal neurodegenerative disease and can manifest with a rapidly progressive cognitive decline, ataxia, behavioral changes, visual disturbances and myoclonus. In our case report, we described a 68-year-old woman presented with rapid cognitive decline, gait disturbance, and cerebellar symptoms. Her laboratory and CSF examinations were found within normal limits. EEG examination revealed generalized periodic sharp and slow wave complexes. She underwent MRI examination including DWI. On DWI, restricted diffusion was detected at bilateral fronto-parietal and temporo-occipital lobes involving cingulate gyrus and bilateral basal ganglia and thalamic regions. The typical bilateral restricted diffusion areas in the medial pulvinar nuclei of the medial called as pulvinar sign or hockey stick sign were also found. DWI plays a crucial role in the diagnosis of CJD, because restricted diffusion abnormalities could be detected within a couple of weeks after the onset of disease symptoms and even before the manifestation of periodic triphasic waves on EEG. Hence, in this case report, we would like to emphasize the invaluable role of DWI in the early diagnosis of CJD cases.

Acta Med Iran 2023;61(4):254-256.

Keywords: Creutzfeldt-jacob disease; Diffusion-weighted imaging; Prionic disease; Rapidly progressing dementia

Introduction

Creutzfeldt-Jacob disease (CJD) is a rare neurodegenerative, prion disease and mostly seen as sporadic form (90%) followed by familial and acquired forms (1). The triad of myoclonus, ataxia and dementia is the most common encountered presentation of the disease. In the early stages of the disease making a prompt diagnosis might be very challenging, because unusual clinical manifestations can occur. Definitive diagnosis can only be achieved by histopathological study. A wide spectrum of diseases including infectious or granulomatous disorders, tumors, vasculitis, paraneoplastic syndromes, Hashimoto thyroiditis and Alzheimer disease can present with similar symptoms and therefore may mimic CJD. Diffusion weighted imaging (DWI) increases the diagnostic accuracy in CJD and can reveal the related striking abnormalities. In this disease, neuropathologic examination displays cortical spongiform change and hence, the term "spongiform encephalopathy" is widely used (2).

Case Report

A 68-year-old woman was admitted to hospital with rapid cognitive decline and gait disturbance over the one-month period. She was also complaining of difficulty during swallowing for two days. She had also cerebellar symptoms including ataxia and dysdiadochokinesia. Following neurological examination, the patient was evaluated as a dementia case. She had neither a family history nor a medical disease. Her laboratory examination was within normal limits. Cerebrospinal fluid (CSF) evaluation had normal cell counts with no remarkable findings. Electroencephalography (EEG) examination revealed generalized periodic sharp and slow wave complexes. The patient was referred to magnetic resonance imaging (MRI) examination. DWI revealed

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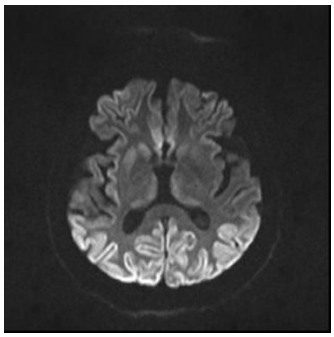
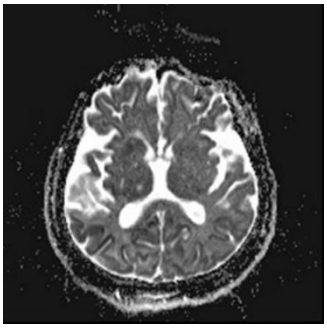
bilateral fronto-parietal and temporo-occipital extensive cortical hyperintensities also involving cingulate gyrus, bilateral basal ganglia and thalamia. On ADC map images a restricted diffusion was detected in the related brain regions. Posterior fossa structures were preserved. The typical bilateral restricted diffusion areas in the medial pulvinar nuclei of the medial thalamia are compatible with pulvinar sign or hockey stick sign were found (Figure1a and b). Based on the clinical, EEG and MRI findings, a diagnosis of CJD was considered.



1a



1b

Figure 1. a. Diffusion weighted image shows bilateral fronto-parietal and temporo-occipital extensive cortical hyperintense areas also involving cingulate gyrus, bilateral basal ganglia and thalamia. The typical bilateral restricted diffusion areas in the medial pulvinar nuclei of the medial thalamia are seen (pulvinar sign or hockey stick sign).b. On ADC map image, restricted diffusion is detected in the corresponding brain regions

Discussion

CJD is an infrequently seen, but rapidly progressing fatal neurodegenerative disease and currently an effective treatment for the disease is not available. It can manifest with a rapidly progressive cognitive decline, ataxia, behavioral changes, visual disturbances and myoclonus. CJD is an extremely rare entity and although some cases are familial, majority of them are sporadic carrying a prion protein mutation which causes death within one year period (3). The diagnosis of sporadic CJD which accounts for majority of cases, is based on clinical symptoms together with laboratory findings including EEG, CSF and serum analysis for some specific proteins such as 14-3-3 protein and also imaging and pathology (4). On T2 weighted and FLAIR images, hyperintensity involving cortex and the head of caudate nucleus and putamen and accompanying progressive cerebral atrophy are typical findings, however, as in our case, sometimes these hyperintense signal intensity changes may be subtle and therefore can be overlooked in early phases of the disease. Other structures including thalamus, globus pallidus, cerebellar cortex and white matter can also show abnormal signal intensity changes (5). DWI has a crucial role in supporting the diagnosis of CJD. On these images, restricted diffusion abnormalities could be detected within a couple of weeks after the onset of disease symptoms and even before the manifestation of periodic triphasic waves on EEG. The typical bilateral lesions in the pulvinar nuclei of the thalamus can be seen which is called as pulvinar sign or hockey stick sign. In Kandiah *et al.*, study, restricted diffusion seen in these patients was attributed to spongiform neuronal degeneration and they showed that DWI had a higher sensitivity (92%) than FLAIR sequence (41-59%), T2WI (36-50%), EEG (50-78%), CSF protein 14-3-3 (84%) or neuron-specific enolase (73%) in the detection of CJD (6). The combination of DWI with FLAIR sequence has been proven to have a sensitivity, specificity and accuracy of over 90 % in discriminating of CJD from other dementia disorders (7). Variant type CJD manifests with bovine spongiform encephalopathy and the typical bilateral lesions in the pulvinar nuclei of the thalamus can be seen which is called as pulvinar sign or hockey stick sign (8). DWI could provide effective diagnostic accuracy for the diagnosis and if high signal intensity changes can be detected in at least two cortical regions or both caudate nuclei and putamen, CJD should be a highly suspected diagnosis (9). Signal intensity changes involving basal ganglia are a consisting finding seen in CJD and therefore can be used as a noninvasive biomarker for the disease (10).

In conclusion, we would like to emphasize the role of DWI in the early diagnosis of CJD and described some characteristic imaging features for clinicians and radiologists in order to be familiar with this dreadful disease. Patients presenting with progressive dementia should be evaluated with DWI to rule out this disease in the differential diagnosis.

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