Pearls & Oyster: Typical Atypical Creutzfeld-Jakob Disease: A Case Presenting as a Rapidly Progressive Corticobasal Syndrome Without Dementia

Author(s):
Zoe Olga Marinides, MD1; Timothy R Malone, MD1; Yitao Ma, MD1; Jason Hawley, MD1

Neurology® Published Ahead of Print articles have been peer reviewed and accepted for publication. This manuscript will be published in its final form after copyediting, page composition, and review of proofs. Errors that could affect the content may be corrected during these processes.
Corresponding Author:
Zoe Olga Marinides
zmarinides@gmail.com

Affiliation Information for All Authors: 1. Department of Neurology, Walter Reed National Military Medical Center, Bethesda, MD

Contributions:
Zoe Olga Marinides: Drafting/revision of the manuscript for content, including medical writing for content; Major role in the acquisition of data; Analysis or interpretation of data
Timothy R Malone: Drafting/revision of the manuscript for content, including medical writing for content; Analysis or interpretation of data
Yitao Ma: Drafting/revision of the manuscript for content, including medical writing for content; Analysis or interpretation of data
Jason Hawley: Drafting/revision of the manuscript for content, including medical writing for content; Major role in the acquisition of data; Analysis or interpretation of data

Number of characters in title: 20
Abstract Word count: 133
Word count of main text: 1492
References: 11
Figures: 2
Tables: 0

Supplemental: Tracked changes on original draft


Study Funding: The authors report no targeted funding

Disclosures: The authors have no financial disclosures. Drs. Marinides, Malone, and Hawley are active duty medical officers in the United States military. The opinions expressed in this paper are the views of the authors alone, and do not necessarily reflect the views of the United States Department of Defense or any other Federal Government Agency.
Abstract:

Creutzfeld-Jakob Disease (CJD) is a rare disease but a common cause of rapidly progressive neurodegeneration. Although the “classic” presentation involves early dementia or behavioral changes, there are well-described atypical variants with less prominent cognitive symptoms at onset. One such variant is Corticobasal Syndrome (CBS), which may be seen with other underlying neurodegenerative processes, but when due to prion disease pathology involves much more rapid progression and certain characteristic imaging findings. This report presents a case presenting as CBS without cognitive or behavioral changes at onset, which rapidly progressed and was determined ultimately to be due to underlying CJD. This case illustrates the need for a high index of suspicion for CJD in order to drive appropriate diagnostic testing and careful review of imaging and EEG findings, which may be subtle in early disease.

Pearls:

- Corticobasal Syndrome, a phenotype with unilateral motor and secondary sensory deficits without significant cognitive impairment or dementia, is a well-described “atypical” presentation of Creutzfeld-Jakob disease.
• While CBS is most associated with neurodegenerative tauopathies, characteristic imaging findings of restricted diffusion along with rapid progression to akinetic mutism or death are strong indicators for prion disease pathology.
• MRI abnormalities in early CJD can be subtle and easily missed. Awareness of atypical phenotypes of CJD presentations can increase clinical suspicion and better interpretation of subtle neuroimaging and neurophysiological studies such as EEG.

Oy-sters:
• EEG findings in early CJD may not show the classic diagnostic features of Periodic Synchronous Discharges (PSDs), and should not be used alone to rule out the diagnosis.
• CSF 14-3-3 testing has low specificity and can be positive in other neurodegenerative diseases; results should be interpreted in context of clinical suspicion for CJD.
• While Rapidly Progressive dementia is included as a criteria for both “Probable” and “Possible” CJD diagnosis, atypical presentations of CJD without cognitive symptoms are well described. The absence of dementia should not dissuade from further targeted diagnostics.

Case Report

A 58-year-old right hand dominant man presented to Neurology clinic with a four month history of episodic left sided weakness and lateral pulsion lasting several hours. Five
months after initial presentation, he developed progressive, continuous left sided symptoms including pain, unsteady gait, and myoclonic jerks of his left arm and leg. He also reported “restricted” movement and abnormal tactile sensations; for example, he had difficulty setting his left foot down with certainty and reported that objects held in his left hand felt foreign to him. He had no cognitive complaints, and his wife confirmed no changes in his behavior or personality. Examination showed preserved cognitive functions as tested using the Montreal Cognitive Assessment (MoCA) with a score of 26/30. Strength and primary sensory modalities were normal. He had continuous myoclonic jerks throughout his left upper and lower extremity, mild apraxia in the left upper extremity, and an upward drift of his left hand (parietal lift). Testing of secondary sensory modalities showed agraphesthesia bilaterally (worse on the left) and left sided extinction. His deep tendon reflexes were +2 throughout, however he had an exaggerated startle response. His gait was wide, with uncoordinated movements on the left with abnormal posturing of his left arm while walking. A Brain MRI demonstrated diffusion restriction in the right temporal, parietal, and occipital cortices (figure 1) with ADC correlate, but no significant T2 FLAIR changes. Retrospective review of his previous brain MRIs done during the episodic phase of his disease showed subtle diffusion restriction on DWI in the same regions, not appreciated in the original neuroradiology review. An EEG showed lateralized complex delta slowing of the background over the right hemisphere. A second EEG 12 days later showed worsening asymmetric right hemispheric and left fronto-central complex delta with right hemispheric periodic discharges with triphasic morphology (figure 2). A PET scan showed hypometabolism in the entire right cerebral hemisphere to include (to a lesser
degree) the right basal ganglia and thalamus (figure, B). Cerebrospinal Fluid studies showed normal white blood cell count and protein, and a rapid PCR meningitis/encephalitis panel was negative. CSF Paraneoplastic and Autoimmune Dementia panels were negative. CSF Neuron-Specific Enolase was elevated (45 ng/mL, normal 0-30 ng/mL), as was total tau protein (4853 pg/mL, normal < 0-1149 pg/mL). CSF 14-3-3 and RT-QuIC both returned positive. Myoclonus was symptomatically treated with levetiracetam. He continued to decline rapidly, eventually developing akinetic mutism. He passed away one month after his CSF results returned and four months after development of persistent motor symptoms. Given lack of family history or exposures to iatrogenic or dietary sources of prion disease, he was presumed to have sporadic CJD, which was later confirmed by autopsy. Results showed positive Western Blot and immunohistochemical analyses for abnormal prion protein, without evidence of a deleterious gene mutation in the PRNP gene.

Discussion

Patients with Creutzfeldt-Jakob Disease (CJD) show a variable combination of clinical symptoms resulting in heterogeneous phenotypes of presentation. While CJD is the most common cause of rapidly progressive dementia, misdiagnosis or delays of diagnosis can occur with atypical presentations especially when cognitive deficits that are mild or absent, or when the presentation mimics another neurodegenerative disease.¹ ²
For example, Corticobasal Syndrome is an asymmetric movement disorder with lateralized higher cortical features. Motor signs show some combination of apraxia, rigidity, bradykinesia, myoclonus, dystonia, or alien limb. Cortical sensory features of neglect and agraphesthesia can accompany the motor signs. The underlying disease causing CBS can vary, and it is commonly associated with the tauopathies of Corticobasal Degeneration (CBD), Progressive Supranuclear Palsy (PSP) and Frontotemporal Dementia (FTD). However, CBS can also present as an atypical manifestation of CJD, which should be considered in all cases presenting with CBS. Cases of CBS misattributed to tauopathies have been described previously in the literature. One reported case was initially pathologically attributed to Corticobasal Degeneration (CBD), and only on post-mortem testing was confirmed as due to underlying sporadic CJD (sCJD). A review of 19 cases of CBS due to confirmed CJD showed that rapidity of progression and DWI abnormalities (such as cortical ribboning) were key discriminators —clues—that aid in the differentiation of sCJD-CBS and CBD-CBS. Length of disease course from diagnosis to death was a median of 5 months on average for sCJD versus 48-68 months in CBD-CBS. This was similar in our patient, and along with imaging findings, his rapid decline helped prompt the appropriate diagnostic work up.

Atypical presentations of sCJD can also be missed because published criteria of the diagnosis of sCJD are incomplete and may not account for less common phenotypes. Although the definitive diagnosis of CJD is made histopathologically, several organizations have published criteria aimed at making the diagnosis less invasively. The World Health Organization (WHO) created the original diagnostic criteria for CJD in
1998. Updates in 2007 by the University of California San Francisco (UCSF) group and again in 2009 by the MRI-CJD Consortium (MCC) improved diagnostic accuracy.\(^8\) The Centers for Disease Control (CDC) have their own criteria adopted from the WHO criteria in 2018.\(^9\) All of the aforementioned criteria depend on clinical presentation supported by a combination of radiographic, electrographic, and laboratory findings. However, there are several diagnostic pitfalls in these criteria, and the current diagnostic schemes may miss atypical presentations of the disease resulting in either a false-negative diagnosis, or a truncated work up.

For example, only the MCC criteria do not require rapidly progressive dementia or neuropsychiatric symptoms as a feature of the patient presentation. This may have led to a missed diagnosis in our patient as he did not display any cognitive symptoms at onset. Along with sCJD-CBS, other known atypical variants present with prominent non-cognitive symptoms, such as gait ataxia (Oppenheimer-Brownell) or purely visuospatial deficits (Heidenhaim).\(^2\) There are other cases described in the literature with patients presenting initially with motor symptoms but without prominent dementia, although even cases presenting atypically eventually progress to dementia at the time of death.\(^10\)

Neuroimaging, neurophysiological studies, and lab studies are important diagnostic tools for evaluating CJD and recent advances have improved diagnostic specificity. The later updates to the WHO criteria added MRI changes as a means of diagnosis. Brain MRI may have sensitivity and specificity of 90% for probable CJD and may be more accurate than CSF studies in diagnosis.\(^1,6\) However, these findings can be subtle or mistaken for artifact; in our patient, cortical ribboning was present on imaging before the
development of motor symptoms but only identified on retrospective review. This illustrates well that Neurologists should carefully review the imaging themselves if CJD is suspected. All of the criteria include epileptiform discharges or more specifically periodic sharp wave complexes as diagnostic EEG findings. However, there are multiple reports showing initial EEGs may show non-specific background slowing or frontal intermittent rhythmic delta activity.\(^1,^8,^10\) Lastly, most criteria rely on 14-3-3 protein detected in the CSF, which by some reports varies in both specificity and sensitivity within a range of 80-90% and can be positive in other neurodegenerative diseases.\(^6\) Given imperfect specificity, 14-3-3 is more helpful as supportive in cases with high suspicion for CJD rather than independently diagnostic. The more recently developed real-time quaking-induced conversion (RT-QuIC) test demonstrates a similar sensitivity (90.3%) with much better specificity (98.5%).\(^1,^6,^11\) However, only the CDC criteria are recent enough to include this test at this point.\(^9\)

Neurologists should be familiar with atypical presentations, such as Corticobasal Syndrome, that do not appear to meet all current clinical criteria, especially as findings such as MRI and EEG changes may evolve as the disease progresses. Although CJD is a rare disease, it is a common cause of rapidly progressive neurodegeneration and a high clinical suspicion is required to make the diagnosis. Use of the CSF real-time quaking-induced conversion (RT-QuIC) diagnostic test has important clinical implications as a non-invasive test with both good sensitivity and specificity for the disease process.\(^11\)
References


Figure 1. Imaging findings of Creutzfeldt-Jakob Disease

(A) Diffusion-weighted MRI showing cortical ribboning predominantly in the right hemisphere. (B) Brain PET scan showing hypometabolism in the right hemisphere with some involvement of the deep structures (basal ganglia and thalamus).

Figure 2. EEG findings of Creutzfeldt-Jakob Disease

EEG using a 10-20 system in longitudinal bipolar montage ("double banana") demonstrating frequent unilateral right hemispheric 1 - 1.5 Hz periodic discharges with triphasic morphology (red arrow), and asymmetric complex delta slowing over the right hemisphere and left fronto-central regions (orange arrows).
Pearls & Oy-sters: Typical Atypical Creutzfeld-Jakob Disease: A Case Presenting as a Rapidly Progressive Corticobasal Syndrome Without Dementia
Zoe Olga Marinides, Timothy R Malone, Yitao Ma, et al.
Neurology published online August 10, 2021
DOI 10.1212/WNL.0000000000012613

This information is current as of August 10, 2021

<table>
<thead>
<tr>
<th>Updated Information &amp; Services</th>
<th>including high resolution figures, can be found at:</th>
<th><a href="http://n.neurology.org/content/early/2021/08/10/WNL.0000000000012613.full">http://n.neurology.org/content/early/2021/08/10/WNL.0000000000012613.full</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>Subspecialty Collections</td>
<td>This article, along with others on similar topics, appears in the following collection(s):</td>
<td>Corticobasal degeneration</td>
</tr>
<tr>
<td></td>
<td>Myoclonus</td>
<td><a href="http://n.neurology.org/cgi/collection/myoclonus">http://n.neurology.org/cgi/collection/myoclonus</a></td>
</tr>
<tr>
<td></td>
<td>EEG</td>
<td><a href="http://n.neurology.org/cgi/collection/eeg">http://n.neurology.org/cgi/collection/eeg</a>_</td>
</tr>
<tr>
<td></td>
<td>Prion</td>
<td><a href="http://n.neurology.org/cgi/collection/prion">http://n.neurology.org/cgi/collection/prion</a></td>
</tr>
<tr>
<td></td>
<td>Prion disease; see Infections/prion</td>
<td><a href="http://n.neurology.org/cgi/collection/prion_disease">http://n.neurology.org/cgi/collection/prion_disease</a></td>
</tr>
<tr>
<td>Permissions &amp; Licensing</td>
<td>Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at:</td>
<td><a href="http://www.neurology.org/about/about_the_journal#permissions">http://www.neurology.org/about/about_the_journal#permissions</a></td>
</tr>
<tr>
<td>Reprints</td>
<td>Information about ordering reprints can be found online:</td>
<td><a href="http://n.neurology.org/subscribers/advertise">http://n.neurology.org/subscribers/advertise</a></td>
</tr>
</tbody>
</table>