

Supplementary Material

ChatGPT's Inconsistency in the Diagnosis of Alzheimer's Disease

The Accuracy and Reproducibility Crises: ChatGPT's Inconsistency in the Diagnosis of Alzheimer's Disease

The prompts represented under the "Authors" for all the four cases were exactly copied from the transcripts provided by Haj ME et al. [1] and were pasted in ChatGPT 3.5 by Dr ArunSundar M at 10:00 AM IST in Chennai, India and the responses were obtained as given below:

CASE 1
❖ According to the ChatGPT's response from Haj et al. [1], Case-1 was classified as "Mild AD"
❖ However, when ArunSundar M attempted with the exact prompt, Case-1 was classified as "early to moderate stage of AD"
Authors: Hi ChatGPT, we are working on patients' data and trying to understand their medical condition, can you assist us with the diagnosis?
❖ ChatGPT: Of course, I'd be happy to assist you with understanding the medical conditions of your patients. However, I must clarify that I'm not a doctor, and I cannot provide medical diagnoses. However, I can help you understand general medical information, suggest possible conditions based on symptoms, or provide guidance on where to seek further medical advice.
Could you please provide me with the symptoms or any specific information about the patients you're concerned about? The more details you provide, the better I can assist you.
❖ Authors: Name: J S, Age: 75, Gender: Male, Education: College graduate, Occupation: Retired accountant, Medical History: Hypertension, Type 2 Diabetes, Family History: Father had late onset Alzheimer's Disease. Presenting Complaint: J's wife brought him to the clinic, expressing concerns about his recent memory problems. She noticed that he frequently forgets names, appointments, and is becoming disoriented even in familiar places. He's experiencing difficulties to plan daily activities, such as preparing meals or organizing a schedule. Changes in mood are also observed. J is experiencing some mood swings, anxiety, and become sometimes frustrated. His condition has been progressively worsening over the past eight months. 1. Physical examination: J appears well-nourished, and has lost 10% of his weight since 6 month. Vital signs are within normal range. No neurological deficits or focal motor deficits are observed. 2. Neuropsychological assessment: Mini-Mental State Examination: Score of 24/30. Detailed neuropsychological testing reveals deficits in the following areas: short-term memory impairment, poor recall of recent events, difficulty with complex tasks, impaired judgment and problem-solving abilities. 3. Blood Tests: Complete Blood Count: Within normal limits, Comprehensive Metabolic Panel: Within normal limits, Thyroid Function Tests: Normal, Vitamin B12: Normal, Folate: Normal. HbA1c: Slightly elevated at 6.8%.

4. Neuroimaging: Magnetic Resonance Imaging of the brain shows significant atrophy in the temporal and parietal lobes, especially in the hippocampus, no evidence of acute infarcts or mass lesions, mild white matter hyperintensities.

5. Cerebrospinal Fluid analysis: elevated tau protein, elevated phospho-tau protein, and decreased amyloid-beta levels.

❖ **ChatGPT:** Based on the information provided, it seems that J.S is presenting symptoms consistent with a neurodegenerative disorder, most likely Alzheimer's Disease. Here's a breakdown of the findings supporting this diagnosis:

Memory Problems: J.S is experiencing significant memory problems, including forgetting names, appointments, and becoming disoriented in familiar places. These are hallmark symptoms of Alzheimer's Disease.

Changes in Mood and Behavior: Mood swings, anxiety, frustration, and changes in behavior are commonly observed in Alzheimer's patients.

Neuropsychological Assessment: The Mini-Mental State Examination score of 24/30 suggests cognitive impairment. Detailed neuropsychological testing reveals deficits in short-term memory, recall of recent events, complex tasks, judgment, and problem-solving abilities, which are all consistent with Alzheimer's Disease.

Brain Imaging: The MRI showing significant atrophy in the temporal and parietal lobes, especially in the hippocampus, is indicative of Alzheimer's Disease. These regions are typically affected in Alzheimer's patients.

Cerebrospinal Fluid Analysis: Elevated tau protein, elevated phospho-tau protein, and decreased amyloid-beta levels are consistent with Alzheimer's Disease pathology.

Given J.S's age, symptoms, medical history, and family history of late-onset Alzheimer's Disease, along with the findings from the assessments and tests, Alzheimer's Disease appears to be the most likely diagnosis. However, it's essential to consult with a neurologist or a specialist in neurodegenerative disorders for a comprehensive evaluation and confirmation of the diagnosis. They can also provide guidance on treatment options and management strategies.

❖ **Authors:** can you specify the stage of Alzheimer's Disease for this patient?

❖ **ChatGPT:** Based on the provided information, J.S appears to be in the **early to moderate stage of Alzheimer's Disease**. Here's why:

Memory Impairment: J.S is experiencing significant memory problems, including difficulty with short-term memory, recall of recent events, and complex tasks. These symptoms typically manifest in the early stages of Alzheimer's Disease.

Functional Impairment: J.S is having difficulty planning daily activities, such as preparing meals or organizing a schedule. Impaired judgment and problem-solving abilities are also noted. These functional impairments suggest that the disease has progressed beyond the very early stages.

Neuropsychological Assessment: While his Mini-Mental State Examination score of 24/30 indicates cognitive impairment, it also suggests that J.S is still functioning relatively independently. However, deficits in multiple cognitive domains indicate a moderate level of impairment.

Brain Imaging: The MRI showing significant atrophy in the temporal and parietal lobes, especially in the hippocampus, indicates structural changes consistent with moderate-stage Alzheimer's Disease. These changes typically become more pronounced as the disease progresses.

Cerebrospinal Fluid Analysis: Elevated tau protein and phospho-tau protein levels further support the diagnosis of moderate-stage Alzheimer's Disease. These biomarkers are associated with the progression of the disease.

Overall, based on the combination of cognitive symptoms, functional impairments, and imaging and biomarker findings, it's likely that J.S is in the early to moderate stage of Alzheimer's Disease. However, a comprehensive evaluation by a neurologist or specialist is necessary to confirm the stage of the disease and develop an appropriate management plan.

CASE-2

According to the ChatGPT's response from Haj et al. [1], Case-2 was classified as "Moderate AD"

However, when ArunSundar M attempted with the exact prompt, Case-2 was classified as "moderate to severe stage of AD"

Authors: Name: HT, Age: 78, Gender: Female, Education: High school graduate, Occupation: Retired nurse, Medical History: Hypertension, Type 2 Diabetes Presenting Complaint: HT is brought to the clinic by her daughter. She frequently forgets names, has trouble recognizing her family, and is unable to perform basic and functional daily activities independently. Her condition has worsened over the last three years.

1. Physical Examination: General physical health is good. Vital signs are within normal range. No neurological deficits or focal motor deficits are observed.
2. Neuropsychological assessment: Mini-Mental State Examination: Score of 19/30. Deficits are observed on working memory tests and long-term memory tests, as well as on tests of language and executive function.
3. Blood Tests: Complete Blood Count: Within normal limits. Comprehensive Metabolic Panel: Within normal limits. Thyroid Function Tests: Normal. Elevated HbA1c (8.2%).
4. Neuroimaging: Magnetic Resonance Imaging (MRI) of the brain shows noticeable atrophy in the temporal and parietal lobes, including the hippocampus. This atrophy is consistent with structural changes seen in Alzheimer's Disease.
5. CSF Analysis: Elevated tau and phospho-tau and decreased amyloid-beta levels, consistent with biological Alzheimer's Disease.

ChatGPT: Based on the provided information, HT appears to be in the **moderate to severe stage of Alzheimer's Disease**. Here's a breakdown of the findings supporting this diagnosis:

Memory Impairment: HT is experiencing significant memory problems, including difficulty remembering names, recognizing family members, and performing basic daily activities independently. These symptoms suggest moderate to severe cognitive impairment, which is characteristic of later stages of Alzheimer's Disease.

Neuropsychological Assessment: HT's Mini-Mental State Examination score of 19/30 indicates a substantial cognitive decline. Deficits are observed in working memory, long-term memory, language, and executive function, which are consistent with advanced stages of Alzheimer's Disease.

Functional Impairment: HT's inability to perform basic and functional daily activities independently indicates a significant decline in functional abilities. This level of impairment is often seen in the later stages of Alzheimer's Disease.

Brain Imaging: The MRI showing noticeable atrophy in the temporal and parietal lobes, including the hippocampus, is consistent with structural changes seen in moderate to severe Alzheimer's Disease. These regions are typically affected as the disease progresses.

Cerebrospinal Fluid Analysis: Elevated tau and phospho-tau levels and decreased amyloid-beta levels further support the diagnosis of Alzheimer's Disease. These biomarkers are associated with the pathological changes seen in advanced stages of the disease.

Overall, based on the combination of cognitive symptoms, functional impairments, and imaging and biomarker findings, it's likely that HT is in the moderate to severe stage of Alzheimer's Disease. However, a comprehensive evaluation by a neurologist or specialist is necessary to confirm the stage of the disease and develop an appropriate management plan.

CASE-3

According to the ChatGPT's response from Haj et al. [1], Case-3 was classified as "Advanced AD"

Similarly, when ArunSundar M attempted with the exact prompt, Case-3 was classified as "Advanced stage of AD"

Authors: Name: WP, Age: 85, Gender: Male, Education: High school graduate, Occupation: Retired firefighter, Medical History: Hypertension, Coronary Artery Disease.

Presenting Complaint: WP resides in a long-term care facility and is non-verbal. He is bedridden, unable to recognize family members, and at high risk for aspiration pneumonia due to difficulty swallowing.

- 1. Physical Examination:** General physical health is frail, WP is malnourished. Vital signs are stable. Severe muscle atrophy is noted.
- 2. Neuropsychological assessment:** WP cannot complete cognitive assessments due to his difficulties to communicate.
- 3. Blood Tests:** Complete Blood Count: Within normal limits. Comprehensive Metabolic Panel: Within normal limits. Thyroid Function Tests: Normal.

4. Neuroimaging: Magnetic Resonance Imaging of the brain shows significant atrophy in the temporal and parietal lobes, including the hippocampus. Ventricular enlargement is evident. Severe white matter hyperintensities are observed.

5. CSF Analysis: CSF analysis is not performed, as the diagnosis is evident based on clinical presentation and neuroimaging.

ChatGPT: Based on the provided information, WP appears to be in the advanced stage of Alzheimer's Disease. Here's an analysis based on the given data:

Clinical Presentation: WP is non-verbal, bedridden, and unable to recognize family members. These symptoms suggest severe cognitive and functional impairment, characteristic of advanced stages of Alzheimer's Disease.

Physical Examination: WP's frail general physical health, malnutrition, and severe muscle atrophy indicate advanced decline, likely due to the progression of Alzheimer's Disease.

Neuropsychological Assessment: WP's inability to complete cognitive assessments due to communication difficulties further supports the diagnosis of advanced Alzheimer's Disease.

Brain Imaging: The MRI showing significant atrophy in the temporal and parietal lobes, including the hippocampus, along with ventricular enlargement and severe white matter hyperintensities, are indicative of advanced structural changes associated with late-stage Alzheimer's Disease.

Blood Tests and CSF Analysis: While blood tests and CSF analysis are within normal limits, they do not provide additional information beyond what is evident from WP's clinical presentation and neuroimaging.

Given WP's non-verbal state, severe cognitive and functional impairment, and advanced structural changes observed on brain imaging, it's evident that he is in the advanced stage of Alzheimer's Disease. In such cases, supportive care focusing on comfort and quality of life becomes paramount, along with measures to prevent complications such as aspiration pneumonia. Collaboration with a multidisciplinary team including healthcare professionals, caregivers, and family members is essential to ensure comprehensive care for WP.

CASE-4

According to the ChatGPT's response from Haj et al. [1], Case-4 was classified as "MCI" However, when ArunSundar M attempted with the exact prompt, Case-4 was classified as "normal aging or possibly mild cognitive impairment"

Authors: Name: MJ, Age: 70, Gender: Female, Education: High school graduate, Occupation: Retired librarian, Medical History: Hypertension & Hyperlipidemia. No family history of cognitive disorders.

Presenting Complaint: M is concerned about her memory. She has noticed that she occasionally forgets where she put her keys and sometimes has difficulty recalling names. Her memory lapses do not significantly affect her daily life, but she is worried that they are happening more frequently.

1. Physical Examination: M appears well-nourished and healthy. Vital signs are within normal range. No neurological deficits or focal motor deficits are observed.
2. Neuropsychological Assessment: Mini-Mental State Examination: Score of 28/30. While M shows difficulties on working memory tests, her performance on long-term memories are within normal ranges. Her performances on tasks of executive functions and language are also within normal ranges.
3. Blood Tests: Complete Blood Count: Within normal limits, Comprehensive Metabolic Panel: Within normal limits, Thyroid Function Tests: Normal, Lipid Panel: Elevated LDL cholesterol levels.
4. Neuroimaging: Magnetic Resonance Imaging of the brain shows: No significant atrophy. No evidence of acute infarcts or mass lesions. Minimal white matter hyperintensities for age.

ChatGPT: Based on the provided information, MJ's presentation does not strongly suggest Alzheimer's Disease. Here's an analysis based on the given data:

Memory Concerns: MJ's occasional forgetfulness about where she put her keys and difficulty recalling names could be considered mild memory lapses. However, these lapses do not significantly impact her daily life, suggesting they may be within the range of normal age-related memory changes.

Neuropsychological Assessment: MJ's Mini-Mental State Examination score of 28/30 is within the normal range and indicates relatively intact cognitive function. While she shows difficulties on working memory tests, her performance on long-term memory tests, tasks of executive functions, and language are within normal ranges. This suggests that her cognitive abilities are generally preserved.

Medical History: MJ's medical history includes hypertension, hyperlipidemia, and elevated LDL cholesterol levels. While these conditions may increase the risk of cognitive decline over time, they do not necessarily point towards Alzheimer's Disease on their own.

Physical Examination and Neuroimaging: MJ appears well-nourished and healthy on physical examination, with no neurological deficits observed. Additionally, the MRI of her brain shows no significant atrophy, acute infarcts, or mass lesions. Minimal white matter hyperintensities for age are noted, which could be attributed to normal aging.

Considering the overall picture, MJ's memory concerns seem relatively mild and may be attributed to **normal aging or possibly mild cognitive impairment**. While her lipid profile and medical history may indicate potential risk factors for cognitive decline, there is no strong evidence from the provided information to suggest Alzheimer's Disease at this time.

However, it's essential for MJ to continue monitoring her cognitive health and to address any concerns with her healthcare provider. Additionally, adopting lifestyle modifications to manage hypertension, hyperlipidemia, and other risk factors can help promote overall brain health and reduce the risk of cognitive decline over time. Regular follow-up appointments and cognitive assessments may also be beneficial for tracking any changes in cognitive function.