Verbal Amnesia Secondary to Unilateral Infarct of the Mediodorsal Thalamic Nucleus

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ABSTRACT

Introduction: The mediodorsal nucleus is a subcomponent of the thalamus hypothesized to have a role in memory pathways. Given the limited number of reported cases and associated images, its clinical significance has not yet been fully elucidated.

Case Presentation: We report the case of a 53-year-old man who presented with verbal amnesia, including deficits of both recall and recognition. High-resolution magnetic resonance imaging demonstrated a well-defined infarct contained within the mediodorsal nucleus.

Discussion: Current literature reports a range of conclusions regarding the extent to which the mediodorsal nucleus is involved in memory pathways. Several case series have attempted to localize infarcts by combining neuropsychology testing with imaging but were constrained by dated imaging modalities often dispersed with impurities.

Conclusion: Our case demonstrates that isolated lesions of the mediodorsal nucleus can lead to deficits in both recall and recognition and that high-resolution magnetic resonance imaging is necessary when a thalamic infarct is suspected.

INTRODUCTION

The thalamus is a component of the diencephalon involved in information processing, memory, attention, and executive function.[1] The mediodorsal nucleus (MD)—a subcomponent of the thalamus—is largely attributed to limbic function.[1] Despite numerous investigations, the precise roles and mechanisms of the MD remain controversial. A particularly debated topic is the extent to which the MD is associated with memory consolidation. Previously, the long-term declarative memory center of the brain had been solely associated with the medial temporal lobe.[1] It is now understood that various components of the medial diencephalon, including the MD, also have contributions to memory processing and storage.[1] While studies have consistently revealed an association between verbal deficits and the MD, there remains controversy as to the extent these deficits are related to interference in recall and/or recognition. We present a rare case of verbal amnesia following a unilateral infarct of the MD accompanied by high-resolution magnetic resonance imaging (MRI) to support its localization.

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CASE PRESENTATION

An otherwise healthy 53-year-old right-handed man presented in memory clinic 1 year after experiencing acute onset dizziness and retrograde memory loss, with specific complaints of forgetting names of loved ones and getting lost while driving his regular routes. MRI revealed a chronic lacunar infarct in the left MD, which was compared to a normal MRI from 10 years prior. He was administered the Repeatable Battery for Assessment of Neuropsychological Status (RBANS) and scored in the 21st percentile. Nearly all of his scores were within normal limits except delayed memory, which showed highly selective impairment on verbal memory consolidation, including a severe deficit of both delayed recall and recognition. These results were consistent on repeat testing 1 year later, indicating the deficits are likely permanent.

DISCUSSION

The MD contributes to numerous neural processes but continues to elude researchers in terms of its exact role in memory process-

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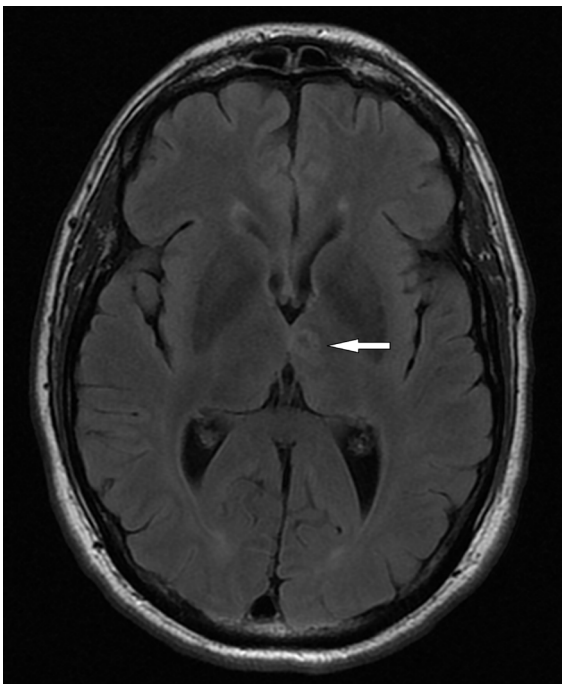
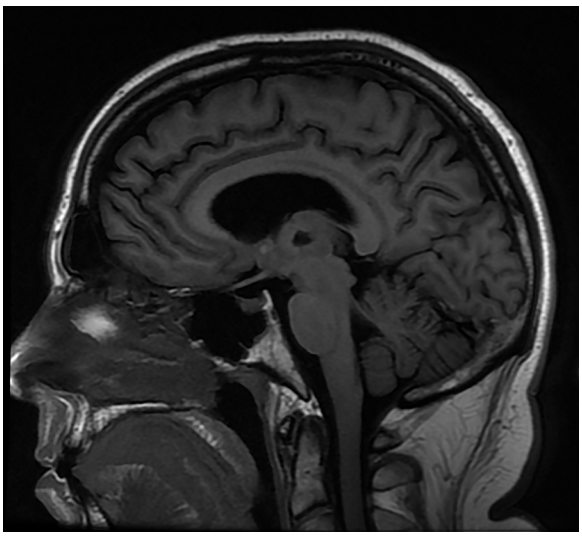
Figure 1. Axial FLAIR Image



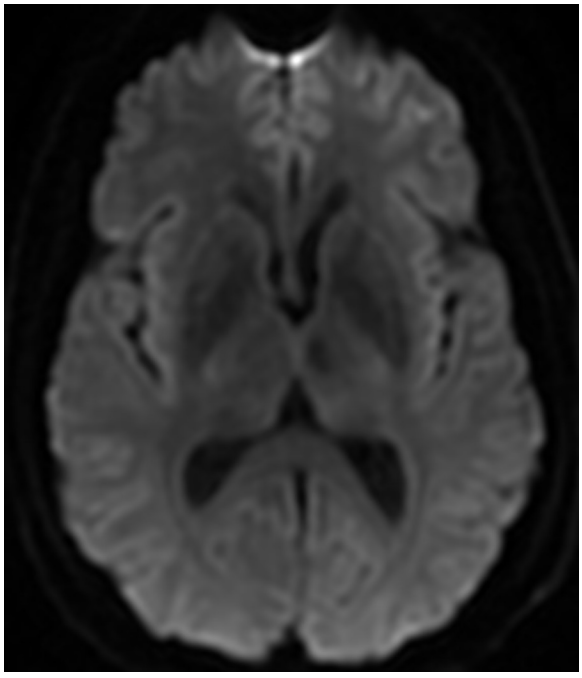
Abbreviation: FLAIR, fluid-attenuated inversion recovery.
Hyperintense signal change and gliosis, predominantly at the periphery of the infarct in the left mediodorsal thalamus, and relative low signal centrally. A classic appearance of a chronic infarction on FLAIR imaging.

Figure 2. Sagittal T1-Weighted Magnetic Resonance Imaging Scan



Encephalomalacia and volume loss of the left mediodorsal thalamus post-infarction.

Figure 3. Axial Diffusion Image



Area of low signal in the left thalamus, typical of chronic infarction. No abnormal diffusion signal to suggest acute infarction.

ing and storage. In 1999, Aggleton and Brown classically associated the MD with recognition—but not necessarily recall—in the perirhinal-MD system.[2] In 2011, they revised this model to include both recognition and recall, either directly or indirectly, via the MD's connection with the prefrontal cortex.[3] Other studies have proposed that the MD does not necessarily have an isolated role in the retention of previously learned material but, rather, knowledge acquisition.[4] It has even been suggested that memory impairments from lesions to the MD are due only to disruptions in executive processing, such as attention deficits, rather than primary memory storage or retrieval interference.[5] Animal studies have validated that the MD does have a role in memory processing but—similar to human studies—they have demonstrated a wide array of conclusions in terms of deficits reported secondary to MD lesions.[1]

An imperative component of diagnosing thalamic lesions clinically is utilizing high-resolution imaging. Previous case series have sought to demonstrate localization of thalamic infarcts by combining neuropsychology testing with magnetic resonance imaging.[6] However, many of these cases are now decades old and limited by organic and artificial imaging interference. The MRI scans in this patient's case provide pristine images with well-defined borders of the infarct within the MD and virtually no structural or vascular abnormalities elsewhere (Figures 1-3).

Pertinent neuropsychology findings include the patient's inability to recall words following a delay in word list discrimination testing, as well as recognition memory testing that was

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marginally better than chance-level performance. The clinical picture of highly specific recall and recognition deficits combined with the precise MRI findings lend support to Aggleton and Brown's revised model and contradict several others. Given the limited research in this area, we hope this case provides perspective for future studies investigating the role of the MD in memory pathways.

CONCLUSION

Our case provides a unique addition to current medical knowledge due to the clarity of the high-resolution imaging, specificity of neuropsychology testing, and presentation in a relatively younger patient with an otherwise normal MRI. This case supports that the MD has a specific role in working memory consolidation and that, in isolation, lesions of this nucleus can be linked to selective verbal amnesia of both recall and recognition. It also reinforces the clinical importance of high-resolution MRI scans to detect infarcts when neurological deficits are suspected.

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