



Brain lesion and lesion network analyses of anterograde and retrograde amnesia

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BRAIN LESION AND LESION NETWORK ANALYSES OF ANTEROGRADE
AND RETROGRADE AMNESIA

by

Mengyuan Ding

A Dissertation Submitted to the Faculty of Harvard Medical School in

Partial Fulfillment of

the Requirements for the Degree of Master of Medical Sciences in Clinical
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Area of Concentration: Neurology/Brain circuit therapeutics

I have reviewed this thesis. It represents work done by the author under my
guidance/supervision.

Primary Mentor: Michael Fox

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I would also like to thank my family and friends for their unwavering support and understanding throughout my academic journey in America. Lastly, I owe my deepest gratitude to all those who offered me kindness, gentleness, generosity and help beyond what is mentioned here.

Thesis Overview

This thesis investigates lesion location and lesion network analyses in anterograde and retrograde amnesia using a systematic review of amnesia case reports and case series in the published peer-reviewed medical literature. We classified amnesia cases into three categories according to the severity of memory loss: predominately anterograde amnesia, predominately retrograde amnesia, and proportionate anterograde and retrograde amnesia.

Advances in neuroimaging techniques have enabled us to locate and segment brain lesions with research-grade accuracy and answer questions about human brain disease and symptoms. In this thesis, we used brain lesion analysis to identify differential brain structures associated with anterograde and retrograde amnesias. We also employed lesion network mapping to localize functional and structural brain networks underlying anterograde and retrograde amnesias, lending insight into dissociable processes for encoding and retrieving episodic memory in humans.

Our findings shed light on the specific brain networks contributing to anterograde and retrograde amnesias and provide insights into potential intervention targets for patients with memory disorders.

Overall, this thesis work contributes to understanding the neural basis of episodic memory by elucidating discrete encoding and retrieval functions impacted in anterograde and retrograde amnesia. This brain network understanding of discrete episodic memory processes has translational implications for developing effective interventions and treatments for patients with memory disorders.

Lesion location analysis: An anterograde and retrograde amnesia study

ABSTRACT

Background: Neurological injuries can lead to the loss of new memories (anterograde amnesia), loss of prior memories (retrograde amnesia), or both. Although many cases of lesion-induced amnesia have been reported, these cases have not been systematically examined in terms of lesion localization regarding anterograde versus retrograde amnesia.

Methods: We performed a systematic literature search for case reports of lesion-induced amnesia, including information on anterograde versus retrograde amnesia and traceable brain scans showing lesion location. Using a novel scoring system, we characterized demographics, lesion etiology, and amnesia profile (predominately anterograde, predominately retrograde, or combined). Lesion locations were traced on to a standard brain template, and the associations between lesion location and amnesia type were examined. We utilized the tool for evaluating the methodological quality of case reports for our lesion location study. Cases of acceptable quality were included to test the robustness of our findings.

Results: We identified 118 cases of lesion-induced amnesia meeting our criteria. 67 cases (57%) had combined anterograde and retrograde amnesia, 37 cases (31%) had predominately anterograde amnesia, and 14 cases (12%) had predominately retrograde amnesia. Retrograde amnesia was more common in younger patients ($P=0.023$), with non-stroke lesion etiologies ($P<0.003$), and with lesions intersecting the insular cortex ($P=0.015$), predominantly on the right ($P=0.015$). This result survived our subgroup analysis in cases of acceptable quality.

Conclusion: Focal brain damage may result in combined anterograde and retrograde amnesia, with predominately anterograde or retrograde amnesia being relatively rare. Patient

demographics, lesion etiology, and lesion location may all influence whether new memories or past memories are more affected.

Keywords: remote memory; systematic review; temporal lobe; insular lobe; frontal lobe; right hemisphere

INTRODUCTION

Memory is a complex cognitive process involving information encoding, storage, and retrieval(1). Amnesia is a severe memory disorder in which a person is unable to form new memories (anterograde amnesia, AA) and/or recall previously-acquired memories (retrograde amnesia, RA), despite otherwise intact cognitive functions(2). In this study, we classified amnesia into three categories: predominately anterograde amnesia, predominately retrograde amnesia, and combined anterograde and retrograde amnesia.

There is no consensus regarding the neural systems supporting retrograde and anterograde amnesia(3). Animal experiments and human case reports provide divergent results regarding the respective roles played by the neocortex and the Papez circuit in amnesia(2–17). Animal studies are costly and difficult to conduct(3,17), and their results may not translate to humans.

Furthermore, there is a great deal of heterogeneity in the methodology used to describe people with amnesia; as a result, it is challenging to draw conclusive results.

Currently, there are no available data on the incidence or prevalence of amnesia in the general population, as the manifestation of memory impairments can vary depending on the specific condition and population studied. In this lesion location analysis, we synthesized and critically evaluated the available human case reports of amnesia from both anterograde and retrograde

memory perspectives. We analyzed the etiology of amnesia, patient demographics, and lesion location in these patients. Using brain lesion location analysis, we identified human brain structures specifically associated with anterograde and retrograde amnesia.

Overall, this work contributes to our understanding of the neural basis of amnesia, with potential implications for developing effective interventions and treatments for memory disorders.

METHODS

Data Selection

We enlisted the expertise of a systematic review expert (P.B.) to help build the search builder for amnesia case reports and case series included by PubMed and Embase until July 20th, 2022 (Supplementary Table 1). Two independent cognitive scientists (M.O.C. and M.D.) reviewed the literature, including paper identification, screening based on title and abstract, full-text case review, and case inclusion, using Covidence and Zotero. We followed a predefined protocol for case selection and extraction to ensure consistency across reviewers. The inclusion and exclusion criteria are listed in Supplementary Table 2.

The study design and selection process were intended to maximize the reliability of our findings and reduce the risk of bias. By leveraging the expertise of multiple reviewers and using a rigorous selection process, we aimed to identify the most relevant case reports for our analysis.

Data Collection and Data Assessment

Two cognitive scientists (M.O.C. and M.D.) independently rated the severity of anterograde and retrograde amnesia categories using a four-point rating scale based on the extent of memory damage (Intact/around normal range [0-25% damage, 1 point], mild compromise [25-50%

damage, 2 points], moderate impairment [50-75% damage, 3 points], and severe/dense damage [75-100% damage, 4 points]). In cases of disagreement, a third cognitive scientist (M.A.F.) provided the final rating assessment.

The cases were then classified into three categories based on the severity scores of memory damage in anterograde amnesia and retrograde amnesia: predominately anterograde amnesia, defined as cases with more than a 2-point disparity in the anterograde memory score being more severe than the retrograded memory score; predominately retrograde amnesia, defined as cases with more than a 2-point disparity in the RA score being more severe than the anterograde memory score; and combined anterograde and retrograde amnesia, defined as cases with a 1 or 0-point disparity between anterograde memory and retrograde memory scores.

Two cognitive scientists (M.D. and C.H.) independently collected the following information through a case-by-case review: etiology related to amnesia onset event, age, gender, case origin (country), neuropsychological symptoms, comorbidities, time from onset-to-memory assessment, time from onset-to-image, follow-up time of memory performance, memory trajectory (stable, improve, decline), and neuropsychological tests. We selected these items based on our knowledge of variables and evidence related to lesion assessment and amnesia.

The use of multiple independent reviewers and predefined rating scales aimed to ensure the reliability and accuracy of our data collection and assessment. By standardizing our data collection process and focusing on key variables related to lesion assessment and amnesia, we aimed to obtain a comprehensive and accurate dataset for our analysis.

Study Risk of Bias Assessment

We used a modified version of the Methodological Quality and Synthesis of Case Series and Case Reports(18) and JBI Critical Appraisal Checklist for Case Reports(19) to assess the methodological quality of the included cases for our lesion analysis purpose (Supplementary Table 3). We evaluated each case for eight items under four categories: selection bias, ascertainment, relevance, and reporting. We categorized each case into four response options for each item: good, poor, unclear, or N/A.

We made an overall appraisal of methodological quality for each case based on the three most critical items: item 2 (event contributed to amnesia onset), item 3 (convincing quantitative test results/scores on both anterograde and retrograde memory assessment), and item 7 (time relevance between memory tests and lesion images). We considered all other items as supplementary data. The overall appraisal for each case was classified as low quality, high quality, or with some concerns. Two independent cognitive scientists (M.D. and C.H.) conducted the quality appraisal, and any disagreements were resolved by a third cognitive scientist (M.O.C.).

We used Zotero, Excel, and Stata/BE 17.0 to assess bias and calculate inter-rater reliability. By using a modified version of a validated tool and involving multiple independent reviewers, we aimed to ensure the reliability and accuracy of our methodological quality assessment. Focusing on key methodological quality items related to lesion assessment and amnesia, we aimed to obtain a comprehensive and reliable dataset for our analysis.

Lesion Tracing and Brain Masks

Four researchers (M.D., T.K., K.B., R.C.) participated in lesion tracing according to the images provided in the case reports. We used the MNI152 standard-space T1-weighted average

structural template image (2mm) and Slicer 2 for lesion tracing. A senior neuroscientist (F.S.) reviewed and confirmed all traced lesions before image processing and analysis.

We included the grey matter masks of the frontal lobe, temporal lobe, parietal lobe, occipital lobe, insular lobe, and cerebellum from the MNI Structural Atlas as regions of interest (ROIs) for lesion location analysis. To obtain left and right lateralization analysis, we divided each ROI mask into left and right. We created a binary brain left/right hemisphere mask by subtracting the brainstem(20) and cerebellum masks from the whole brain mask. We used MATLABR2022b, Python 3.9, and fslmaths for mask preparation.

Lesion Location Analysis

We performed a lesion location analysis in three subtypes of amnesia: predominately anterograde amnesia, predominately retrograde amnesia, combined anterograde and retrograde amnesia. Our analysis included testing the lesion location in the five main lobes (frontal, temporal, parietal, occipital, and insular lobes), cerebellum, and brain hemisphere (left, right, and bilateral hemispheres) among the three groups using the above masks. Lesions in each above region of interest (ROI) were counted as having any voxel overlap between the patient's brain lesion mask and our ROI brain mask. We set the lower threshold of display for our probability ROIs at 0 and 0.5 to test our results' robustness and avoid any lesion overflow outside the masks. We conducted a post hoc left/right analysis for ROIs that showed differences in the three-group comparisons. We conducted two pre-defined subgroup analyses on lesion location by restricting our analysis to an acceptable quality [including cases of high quality and with some concerns]) subgroup and a restricted solid lesion subgroup (amnesia etiology including stroke and post-brain surgery).

Our lesion location analyses were developed by W.D. and modified by M.D. We performed the analyses on the Jupyterhub server of Mass General Brigham using Python3.9.

Statistical Analysis

Continuous variables were presented as the mean and standard deviation for normally distributed data, while categorical variables were shown as frequency and percentage. Descriptive analysis was performed for all study variables, such as country, gender, age, etiology, and lesion location for all cases.

The univariate analysis compared age, gender, etiology, and lesion location among the three amnesia groups (predominately anterograde amnesia, predominately retrograde amnesia, and combined anterograde and retrograde amnesia). Fisher's exact test, Pearson's chi-squared test, or Bartlett's equal-variances test (*one-way*-ANOVA) was used for three amnesia group comparisons based on the data characteristics. Post hoc two-group comparisons were carried out using Bonferroni correction.

We calculated the inter-rater reliability of anterograde and retrograde amnesia severity ratings and overall case quality appraisals between two independent reviewers using Kendall's Tau-*b* statistic. A tau-*b* score of 0.6 or higher was considered good inter-rater reliability.

All *p*-values were set at <0.05. We performed all statistical analyses on Stata/BE 17.0 for Mac, and data visualization was conducted using GraphPad Prism 9.5.1.

RESULTS

Overview

Our final amnesia study enrolled 118 cases from 108 studies published and included by Embase and PubMed till 20th July 2022. The PRISMA flow diagram (Figure 1) described the framework of the amnesia case selection and listed the exclusion cases with reasons. The top four exclusion reasons were the lack of both anterograde and retrograde evaluation (169, 41.02%), the lack of traceable image (123, 29.85%), not being published in English (45, 10.92%), and brain atrophy (43, 10.44%). We listed the case characteristics in Supplementary Table 4 and the quality appraisal for each case in Supplementary Table 5.

We did an inter-rater reliability test on anterograde and retrograde memory severity ratings. The two reviewer's Kendall's tau-*b* score on anterograde memory was 0.76 ($SE= 303.95$ corrected for ties, $P<0.0001$ continuity corrected) and 0.87 on retrograde memory ($SE= 379.10$ corrected for ties, $P<0.0001$ continuity corrected), which indicated good inter-rater reliability. We also did an inter-rater reliability test on case overall appraisal ratings (low or high quality, or with some concerns). The two reviewer's Kendall's tau-*b* score on overall appraisal for case reports was 0.92 ($SE= 368.90$ corrected for ties, $P<0.0001$ continuity corrected).

Among 118 amnesia cases (Figure 2), 22 were deemed high quality (18.64%), 46 (38.98%) were reserved with some concerns, and 50 (42.37%) were evaluated as low quality. The comparison of overall appraisal ratings among the three amnesia groups showed statistical significance ($P=0.004$). The post hoc two-group comparisons revealed that predominately retrograde amnesia had higher quality appraisal ratings than predominately anterograde amnesia ($P<0.003$) but not between predominately retrograde amnesia and combined amnesia ($P=0.054$) or predominately anterograde amnesia and combined amnesia ($P=0.453$), indicating a potential publication bias in predominately retrograde amnesia cases.

In all 118 amnesia cases (Table 1), 67 (56.78%) cases were combined amnesia, 37 (31.36%) were predominately anterograde amnesia, and 14 (11.86%) were predominately retrograde amnesia. Forty-eight cases (40.68%) had lesions in the temporal lobes (Table 2), followed by the frontal lobes (46, 38.98%), parietal lobes (35, 29.66%), and occipital lobes (29, 24.58%). Twenty-six cases (22.03%) had lesions in the left hemisphere, 16 (13.56%) in the right hemisphere, and 76 (64.41%) in the bilateral hemispheres. We compared the three amnesia groups on age, gender, and etiology (Table 3). Patients in predominately retrograde amnesia group were younger ($F(2, 115) = 6.03$; $P=0.003$; post hoc two-group comparisons, *Bonferroni* corrected, Retrograde vs. Anterograde, $P= 0.023$; Retrograde vs. Combined, $P= 0.002$; Anterograde vs. Combined, $P> 0.999$), but sex did not differ (*Pearson Chi²*(2)=0.005, $P=0.998$) among the three. The etiology of amnesia onset differed among the three amnesia groups (*Fisher's exact*, $P<0.001$). The top three events related to predominately retrograde amnesia were traumatic brain injury (8, 57.14%), CNS inflammation (3, 21.43%), and post-brain surgery (2, 14.29%). In contrast, in predominately anterograde amnesia, those events were stroke (26, 70.27%), post-brain surgery (5, 13.51%), and CNS inflammation (3, 8.11%).

Lesion Location Analysis

The predominately retrograde amnesia group had more right-sided lesions than other groups. The frontal lobes ($P=0.009$), temporal lobes ($P<0.001$), and insular lobes ($P<0.001$) showed group differences among the three amnesia types, where the predominately retrograde amnesia showed more lesions in the frontal ($P=0.009$), temporal ($P<0.003$) and insula lobes ($P<0.003$) than the predominately anterograde amnesia group (Table 4).

Further analysis revealed that predominately retrograde amnesia had a right-sided preference over left in the frontal lobe ($P<0.003$), temporal lobe ($P<0.003$), and insular lobe ($P<0.003$) compared to predominately anterograde amnesia (Table 5).

Overall, our analysis indicates that there are significant differences in lesion location between the anterograde and retrograde amnesia, with more lesions observed in the frontal, temporal, and insular lobes in retrograde amnesia, especially in the right hemisphere.

Subgroup Analyses in Acceptable-quality Cases and Restricted Solid Lesion Cases

We performed a subgroup analysis in acceptable-quality cases to assess the robustness of our lesion location results. We had 68 cases of acceptable quality, in which predominately retrograde amnesia showed more lesions in the temporal ($P=0.009$) and insular lobes ($P=0.003$) than predominately anterograde amnesia (Table 6). We did not find a hemisphere laterality preference ($P=0.263$) among groups, which further convinced our findings that the temporal lobe ($P=0.003$) and insular lobe ($P<0.003$) had a right-sided preference in retrograde amnesia over anterograde amnesia (Table 7). Also, we conducted another subgroup analysis in cases with restricted solid lesions caused by stroke or brain surgery. Among 73 cases with solid lesions, we observed a significant difference between predominately retrograde amnesia and predominately anterograde amnesia in the ratio of cases that damaged the insular lobes ($P=0.015$) (Supplementary Table 6). No hemisphere preference was detected ($P=0.192$) in lesion location among the three groups, yet, predominately retrograde amnesia showed a significant right-sided preference over the left compared to predominately anterograde amnesia ($P=0.015$) (Supplementary Table 7). What's worth mentioning is that our sample size for predominately retrograde amnesia lesions in this analysis was relatively small ($n=3$); thus, these findings should be tested in future studies.

DISCUSSION

Our systematic review included 118 amnesia cases from 108 studies published on Embase or PubMed by July 20th, 2022, of which 12% of cases were predominately retrograde amnesia, 31% predominately anterograde amnesia, and 57% combined anterograde and retrograde amnesia, consistent with previous reports(5). Patients in the predominately retrograde amnesia group were younger than those in other groups and were most observed in TBI (57%), while stroke (70%) was the major cause of anterograde amnesia. Our findings indicate that lesions leading to predominately retrograde amnesia are more likely to impact the insular lobe, particularly on the right side, than those causing predominately anterograde or combined amnesia. Also, we noted that lesions resulting in retrograde amnesia (predominately or combined with anterograde amnesia) are more prone to intersect the temporal lobe than those causing predominately anterograde amnesia. This disparity stems from the lower likelihood of lesions causing predominately anterograde amnesia to intersect the temporal lobe.

A key aspect of novelty in our study is our focus on differentiating lesions causing predominately retrograde amnesia versus lesions causing predominately anterograde amnesia. Previous studies have observed that remote memory is less vulnerable or more resilient to damage than recent memory(2). However, the majority of amnesia cases represent a combination of both retrograde and anterograde amnesia. As such, prior work has been largely unable to differentiate locations specifically associated with anterograde functions (for example, memory encoding) versus locations specifically with retrograde functions (for example, memory retrieval).

Our findings support the idea that remote memory interacts with the neocortex(3,21), especially the insular lobe with a right-sided preference, within an unknown time boundary and through unknown mechanisms(2,13). Not many studies examine the insular lobes' role in remote memory. Still, previous research indicates that the insular cortex is crucial for consolidating object and taste recognition memory, relating conscious attention to stimuli(22), and storing recognition memory of different sensory modalities. Meanwhile, the temporal lobe is essential for object recognition memory storage(23), suggesting that these two lobes may cooperate(24) in remote memory functioning. The neocortex may be a tertiary or reciprocal "clouding site" for remote memory consolidation(2,9,12,21), or it may serve as a storage site for distant remote memory(21), according to Ribot's law(25). Experimental evidence has shown that the MTL directs and reactivates neocortex consolidation by binding them together for a single memory event(8,21), and changes in input lead to morphological changes in the neocortex and modify the connectivity strength among them(17,21), in a gradual but long-lasting way(21,26).

Future research should also explore the differences between remote episodic and semantic memory and their associations with lesion locations, as evidence is scarce concerning these two types of memory in brain regions. Current evidence does not rule out the existence of episodic and semantic memory systems(27). In our study, we assessed the severity of semantic and episodic memory in predominately retrograde amnesia patients (unpublished data), where 3 cases (21.43%) ($n=14$, 3 cases NA) displayed predominately episodic over semantic damage (severity scale 1-4 as above, thresholded ≥ 2 points) in remote memory. This discrepancy may partially explain the right-sided preference in these predominately retrograde amnesia patients since right laterality in remote episodic memory has been previously seen in small sample human studies(28–30) and case reports(31,32).

Our study has multiple strengths. Amnesia cases are rare, particularly for predominately retrograde amnesia. Previous studies have not comprehensively reviewed human amnesia cases from both anterograde and retrograde memory perspectives. Our study contributes to a better understanding of amnesia cases and explores brain regions that differentiate between anterograde and retrograde amnesia. This research lays the foundation for future insights into the brain networks underlying anterograde and retrograde amnesia. Additionally, with a systematic review and pre-defined subgroup analyses, our study provides robust evidence for the involvement of neocortices in remote memory in humans. Also, our modified quality appraisal for lesion studies of case reports can serve as a valuable tool for future lesion studies.

However, our study also has several limitations. First, we limited our amnesia cases to those long-lasting, focal lesions induced, both retrograde and anterograde memory-measured ones. Amnesia cases involving other mechanisms, such as brain atrophy and neuropsychological factors, or measured old or new memories only, may not be generalizable to our conclusions. Second, we measured lesion locations in different brain regions as a binary outcome (lesions hitting the brain ROIs or not). Lesions in each case may range from partial to complete damage of the relevant brain structures, potentially biasing the results towards none. The actual effect and brain regions involved in anterograde and retrograde amnesia could be more extensive than we observe in the current study. Third, our lesions were traced in 2D NIfTIs from brain scans in published case reports. Our study did not adjust for lesion size, and undetected lesions by clinical brain scans may contribute to memory impairment, introducing an unknown bias. However, we performed lesion tracing on a common brain template and had a senior cognitive scientist review and approve all hand-traced lesions to minimize the impact of brain size variability and lesion measurement accuracy of 2D hand-tracing NIfTIs. Moreover, we selected the most available,

traceable brain scans close to the time point of patients' memory tests. Fourth, our lesion-focused systematic review is based on published English case reports, inherently subject to publication and language bias. In our study, we attempted to analyze the heterogeneity of case reports by quality appraisal and conducted a grey literature search to minimize such bias by contacting well-known cognitive scientists for unpublished cases, reports, and other materials. Finally, we cannot draw any causal conclusions due to the nature of case reports/series and lesion location analysis.

CONCLUSION

In conclusion, patient demographics, lesion etiology, and lesion location may all influence whether new memories or old memories are more affected. Future research should focus on elucidating the distinct neural networks involved in anterograde and retrograde memory.

FUNDING

This study is funded by NIH (R01NS127892).

COMPETING INTERESTS

The authors decline to have any competing interests.

DATA AVAILABILITY

All data and materials used in this study, including template data collection forms, data extracted from included studies, data used for all analyses, analytic code, and any other relevant materials, are available upon reasonable request.

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SUPPLEMENTARY MATERIALS

Supplementary Table 1 Search builder

Supplementary Table 2 Eligibility criteria

Supplementary Table 3 Modified tool for evaluating the methodological quality of case reports for lesion analysis

Supplementary Table 4 Case characteristics

Supplementary Table 5 Quality appraisal result of amnesia cases

Supplementary Table 6 Brain lesion location analysis for solid lesions in amnesia groups

Supplementary Table 7 Lesion laterality in frontal, temporal, and insular lobes for solid lesions

Figure 1 PRISMA flow diagram

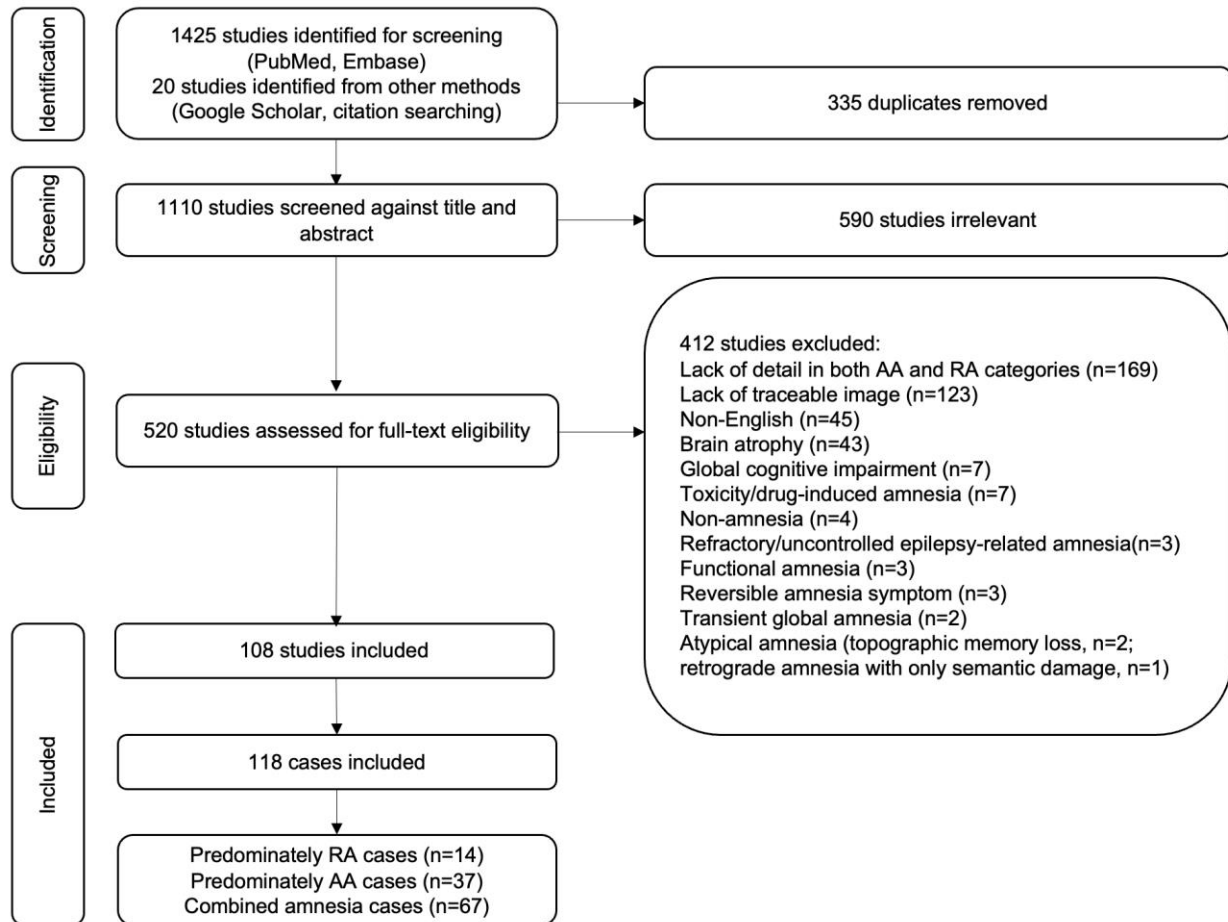
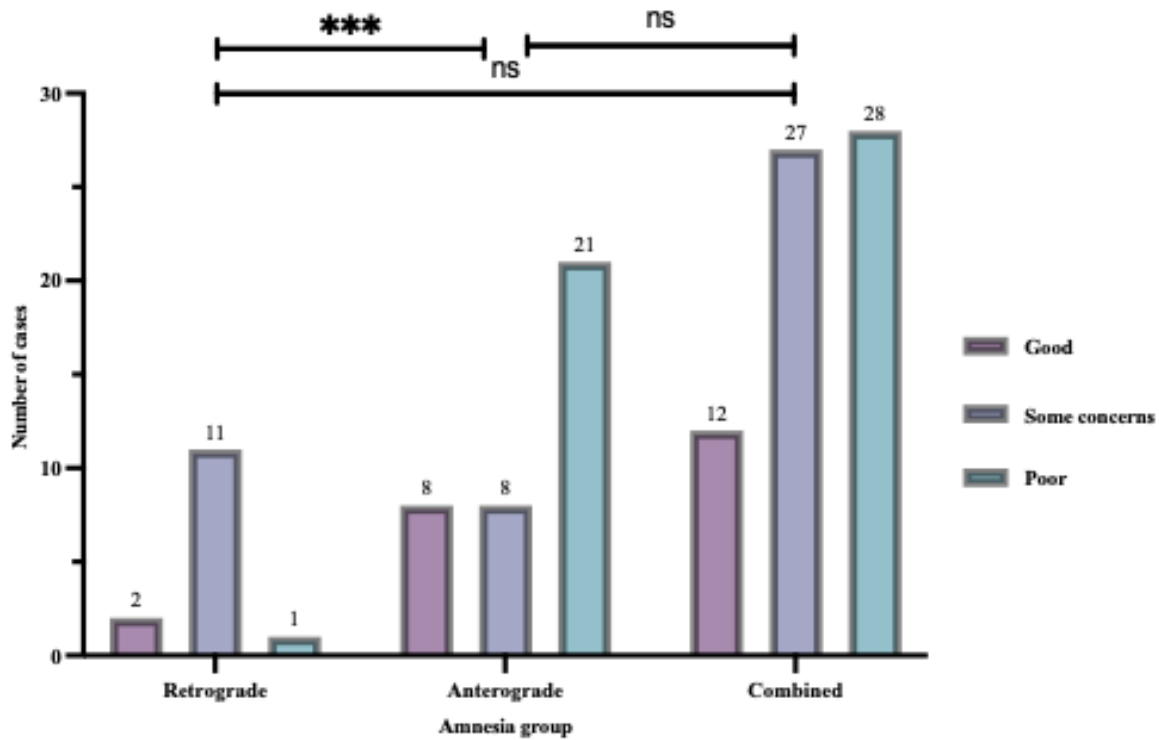


Figure 2 Quality appraisal of case reports in three amnesia groups



There was a difference in case quality among the three amnesia groups (*Fisher's exact test*, $P=0.004$). Post hoc two-group comparisons, *Bonferroni corrected*, revealed significant differences between predominately retrograde and predominately anterograde amnesia (marked as ***, $P<0.003$) but not between predominately retrograde and combined amnesia (marked as *ns*, $P=0.054$), or predominately anterograde and combined amnesia (marked as *ns*, $P=0.453$).

Table 1 Case characteristics on age, gender, amnesia type, and etiology

	Mean/No. <i>SD</i> /Percentage	
Age (years)	49.22	14.78
Gender		
Female	42	35.59
Male	76	64.41
Amnesia type		
Retrograde	14	11.86
Anterograde	37	31.36
Combined	67	56.78
Etiology		
Stroke	54	45.76
Inflammation	21	17.80
Traumatic brain injury	13	11.02
Post-brain surgery	19	16.10
Metabolism	6	5.08
Neoplasm	5	4.24

Table 2 Lesion location in amnesia cases

Lesion location	No. of cases	Present within % of cases
Frontal lobes	46	38.98
Temporal lobes	48	40.68
Parietal lobes	35	29.66
Occipital lobes	29	24.58
Insular lobes	23	19.49
Cerebellums	24	20.34
<i>Lateralization</i>		
Left hemisphere	26	22.03
Right hemisphere	16	13.56
Bilateral hemisphere	76	64.41

Table 3 Case characteristics in amnesia groups

	Amnesia group			Total (n, %)	Pearson χ^2 / Fisher's exact/ F statistics	P
	Retrograde (n=14)	Anterograde (n=37)	Combined (n=67)			
Age^{\$}* (mean, SD)	37.21(10.90)	49.32(13.72)	51.69(15.66)	49.23(14.78)	$F(2,115)=6.03$	0.003
Gender (n, %)						
Female	5(35.71)	13(35.14)	24(35.82)	42(35.59)	Pearson $\chi^2(2)=0.005$	0.998
Male	9(64.29)	24(64.86)	43(64.18)	76(64.41)		
Etiology (n, %)^{\$*}						
Stroke	1(7.14)	26(70.27)	27(40.30)	54(45.76)		<0.001
TBI	8(57.14)	1(2.70)	4(5.97)	13(11.02)		
Brain surgery	2(14.29)	5(13.51)	12(17.91)	19(16.10)		
CNS inflammation	3(21.43)	3(8.11)	15(22.39)	21(17.80)		
Neoplasm	0(0)	1(2.70)	4(5.97)	5(4.24)		
Metabolism	0(0)	1(2.70)	5(7.46)	6(5.08)		

Post-hoc two-group comparison (*Bonferroni corrected*): *:Retrograde vs. Anterograde,

^{\$}:Retrograde vs. Combined, [#]:Anterograde vs. Combined

Age: * $P=0.023$, $P=0.002$, $P>0.999$; Etiology: * $P<0.003$, $P<0.003$, $P=0.106$.

Table 4 Brain lesion location analysis in amnesia groups

Brain region	Frequency of lesions presented within each amnesia group (n)			Total (n, %)	Pearson χ^2	P
	Retrograde (n=14)	Anterograde (n=37)	Combined (n=67)			
Frontal lobe[*]	10	9	27	46(38.98)	Pearson $\chi^2(2)=2.41$	0.009
Temporal lobe^{#*}	11	7	30	48(40.68)		<0.001
Parietal lobe	6	8	21	35(29.66)		0.300
Occipital lobe	4	7	18	29(24.58)		0.645
Insular lobe^{\$}	10	1	12	23(19.49)		<0.001
Cerebellum	3	5	16	24(20.34)		0.485
Lesion Lateralization^{*\$} (n,%)						
Left hemisphere	0(0)	14(37.84)	12(17.91)	26(22.03)		0.003
Right hemisphere	5(35.71)	5(13.51)	6(8.96)	16(13.56)		
Bilateral hemispheres	9(64.29)	18(48.65)	49(73.13)	76(64.41)		

Post-hoc two-group comparison (*Bonferroni corrected*): *Retrograde vs. Anterograde,

^{\$}:Retrograde vs. Combined, [#]:Anterograde vs. Combined

Frontal lobe: * $P=0.009$; Temporal lobe: $P=0.030$, * $P<0.003$; Insular lobe: $P<0.003$, * $P<0.003$.

Lesion lateralization: * $P=0.021$, $P=0.042$, $P=0.117$

Table 5 Lesion laterality in frontal, temporal and insular lobes in amnesia groups

Brain region	Frequency of lesions presented within each amnesia group (n)			Total (n, %)	Pearson Chi^2 / Fisher's exact	P
	Retrograde (n=14)	Anterograde (n=37)	Combined (n=67)			
<i>Frontal lobe</i>						
Left	5	6	19	30(25.42)	Pearson $Chi^2(2)=2.74$	0.254
Right^{S*}	10	6	17	33(27.97)		0.001
<i>Temporal lobe</i>						
Left[#]	6	6	27	39(33.05)	Pearson $Chi^2(2)=6.94$	0.031
Right^{#S*}	11	5	26	42(35.59)		<0.001
<i>Insular lobe</i>						
Left	3	1	8	12(10.17)		0.079
Right^{S*}	9	0	8	17(14.41)		<0.001

Post-hoc two-group comparison (*Bonferroni corrected*): *Retrograde vs. Anterograde,

^{\$}:Retrograde vs. Combined, [#]:Anterograde vs. Combined

Right frontal lobe: * $P<0.003$, $P=0.006$; Left temporal lobe: $P=0.045$; Right temporal lobe: $P=0.021$, $P=0.024$, * $P<0.003$; Right insular lobe: $P<0.003$, * $P<0.003$.

Table 6 A subgroup analysis of lesion locations in cases with acceptable quality

Brain region	Frequency of lesions presented within each amnesia group (n)			Total (n, %)	P
	Retrograde (n=13)	Anterograde (n=16)	Combined (n=39)		
Frontal lobe	9	5	16	30(44.12)	0.109
Temporal lobe[*]	11	4	20	35(51.47)	0.006
Parietal lobe	6	2	11	19(27.94)	0.132
Occipital lobe	4	2	12	18(26.47)	0.335
Insular lobe^{\$*}	9	1	8	18(26.47)	<0.001
Cerebellum	3	3	9	15(22.06)	>0.999
<i>Hemisphere Lateralization</i>					
Left hemisphere	0	4	8	12(17.65)	0.263
Right hemisphere	4	2	5	11(16.18)	
Bilateral hemispheres	9	10	26	45(66.18)	

Post-hoc two-group comparison (*Bonferroni corrected*): *Retrograde vs. Anterograde,

^{\$}:Retrograde vs. Combined, [#]:Anterograde vs. Combined

Temporal lobe: * $P=0.009$; Insular lobe: $P=0.006$, * $P=0.003$.

Table 7 A subgroup analysis of lesion laterality in temporal and insular lobes in cases with acceptable quality

Brain region	Frequency of lesions presented within each amnesia group (<i>n</i>)			Total (<i>n</i> , %)	<i>P</i>
	Retrograde (<i>n</i> =13)	Anterograde (<i>n</i> =16)	Combined (<i>n</i> =39)		
<i>Temporal lobe</i>					
Left	6	3	19	28(41.18)	0.125
Right ^{S*}	11	3	17	31(45.59)	0.001
<i>Insular lobe</i>					
Left	3	1	6	10(14.71)	0.510
Right ^{S*}	8	0	5	13(19.12)	<0.001

Post-hoc two-group comparison (*Bonferroni corrected*): *Retrograde vs. Anterograde, \$:Retrograde vs. Combined, #:Anterograde vs. Combined

Right temporal lobe: $^{\$}P=0.036$, $^*P=0.003$; Right insular lobe: $^{\$}P=0.003$, $^*P<0.003$.

Supplementary Table 1 Search builder

PubMed

1. (stroke OR cerebrovascular OR ischemia OR infarct OR hemorrhage) AND ((remote memory) OR (autobiographical amnesia) OR (retrograde amnesia) OR (retrograde memory) OR (autobiographical memory)) Filters: Case Reports, Humans
2. ("Tomography, X-Ray Computed"[Mesh] OR "Magnetic Resonance Imaging"[Mesh] OR computed tomograph*[tiab] OR computer assisted tomograph*[tiab] OR ct scan*[tiab] OR cat scan*[tiab] OR magnetic resonance[tiab] OR mri[tiab]) AND ("Amnesia, Retrograde"[Mesh] OR "Amnesia, Anterograde"[Mesh] OR remote memor*[tiab] OR autobiographical memor*[tiab] OR retrograde amnesia*[tiab] OR retrograde memory loss*[tiab] OR pre-ictal amnesia*[tiab] OR pre-ictal memory loss*[tiab] OR autobiographical amnesia*[tiab] OR anterograde amnesia*[tiab] OR anterograde memory loss*[tiab] OR post ictal amnesia*[tiab] OR post-ictal memory loss*[tiab]) AND (casereports[Filter] OR case report*[tiab] OR case series*[tiab])

Embase

1. ('anterograde amnesia'/exp OR 'retrograde amnesia'/exp OR ((retrograde or anterograde or 'pre ictal' or 'post ictal' or autobiographical) NEAR/3 (amnesia* OR 'memory loss*')):ab,ti,kw OR 'remote memory':ab,ti,kw) AND ('x-ray computed tomography'/exp OR 'nuclear magnetic resonance imaging'/exp OR ('computed tomograph*' OR 'magnetic resonance' OR 'ct scan*' OR 'cat scan*' OR mri):ab,ti,kw) AND ('case report'/de OR ('case report*' OR 'case series*'):ab,ti,kw)
-

Supplementary Table 2 Eligibility criteria

Inclusion Criteria

1. Amnesia case reports and case series included by PubMed or Embase until July 20th, 2022

Exclusion Criteria

1. Transient amnesia, reversible amnesia symptom, severe confabulation or drug use, toxicity, epilepsy-related confusion, psychological or psychiatric-related amnesia (functional amnesia)
 2. Did not examine/report both retrograde and anterograde memory domains
 3. Without descriptive/qualitative/quantitative data on amnesia severity/memory tests/questions/scenarios/details
 4. Had global cognitive impairment disproportionate to memory loss
 5. Without measurable lesion-related brain MRI/CT scans
 6. Had focal or widespread brain atrophy
 7. Atypical cases with selective (e.g., semantic) memory loss or material/topographic-specific memory loss
 8. Not published in English
-

Supplementary Table 3 Modified tool for evaluating the methodological quality of case reports for lesion analysis

Domains	Major Components	Response options			
Selection bias	1. Does the patient(s) represent(s) the whole experience of the investigator (center) or is the selection method unclear to the extent that other patients with similar presentation may not have been reported?	Good	Poor	Unclear	N/A
Ascertainment	2. Was patient's exposure clearly described?	Good	Poor	Unclear	N/A
	3. Were diagnostic tests or assessment methods and the results clearly described (amnesia tests reproducibility)?	Good	Poor	Unclear	N/A
Relevance	4. Were other alternative causes that may explain the observation (amnesia) ruled out?	Good	Poor	Unclear	N/A
	5. Were patient's demographics, medical history, comorbidities clearly described?	Good	Poor	Unclear	N/A
	6. Were patient's symptoms, interventions, and clinical outcomes clearly presented as a timeline?	Good	Poor	Unclear	N/A
	7. Was the lesion image taken around the time of observation (amnesia) assessment?	Good	Poor	Unclear	N/A
Reporting	8. Is the case(s) described with sufficient details to allow other investigators to replicate the research or to allow practitioners make inferences related to their own practice?	Good	Poor	Unclear	N/A

Supplementary Table 4 Case characteristics

Publications	Patient	Disease	Age	Sex	Amnesia type	Country	Neuropsychological symptoms	Comorbidities	Onset-to-memory assessment	Onset-to-image	Memory function follow-up time	Memory trajectory	Memory tests
Abbate et al., “Delusion of Inanimate Doubles.”	MP	TBI	38	M	Retrograde	Italy	disinhibited, dysexecutive ‘frontal’ syndrome, déjà-vu	delusion of inanimate doubles	7y	1m	12m	unclear	MMSE, Prose Recall, Rey-Osterrieth Complex Figure Recall Test, Corsi Supra-Span Test, verbal section of the Long Term Memory ‘88 Test, Picture Naming Task, Picture Naming Task, Processing of Unfamiliar Faces, Italian Battery for Prosopagnosia
Abe et al., “Amnesia after a Discrete Basal Forebrain Lesion.”	A	post-surgery	64	M	Combined	Japan	disorientation and agitation	unclear	31m	30m	31m	improve	MMSE, WAIS, Rey-Osterrieth-copy, WMS-R, Rey Auditory Verbal Learning, Paired Verbal Association (3 trials), Remote Recall (%), Remote Autobiographical Recall
Adamovich et al., “Teaching NeuroImages.”	A	stroke	53	F	Combined	US	confusion	unclear	unclear	unclear	2m	stable	MMSE
Amuluru, Filippi, and Lignelli, “Acute Amnesia Due to Isolated Mammillary Body Infarct.”	A	stroke	50	F	Anterograde	US	confusion	hypertension, diabetes	acute	acute	10d	NA	unclear
Arai, “Severe Amnesia after a Restricted Lesion in the Left Hippocampal Body.”	A	hemorrhage	72	M	Anterograde	Japan	disorientation	unclear	1m	1m	1m	stable	WMS-R, Benton Visual Retention Test, Rey-Osterrieth Complex Figure Test, Wechsler Adult Intelligence Scale-Revised, Autobiographical Memory Interview
Asiri, Aljarallah, and Alayed, “Polyneuropathy and Korsakoff Syndrome Complicating Sleeve Gastrectomy.”	A	Wernicke’s encephalopathy	36	M	Combined	Saudi Arabia	severe vomiting and food intolerance, alert, disoriented to time and place	hypothyroidism, sleeve gastrectomy procedure for morbid obesity	unclear	unclear	NA	NA	unclear
Azevedo Kauppila et al., “Memory Impairment Due to Bilateral Fornix Infarction.”	A	stroke	68	F	Anterograde	Portugal	topographic disorientation	hypertensive crisis	72h	24h	12m	improve	unclear
Babinsky et al., “Clinical Case Report: Memory Functions after Anterior Communicating Artery Aneurysm Rupture.”	PE	stroke	36	M	Anterograde	Germany	none	unclear	6w	about 4w	unclear	NA	Reduced German WAIS, WCST, WMS-R, ROCF, Benton Test, AVLT, Corsi Span, Word Stem-Completion Task, AMMI, Famous Events Test 1971-1992, Famous Faces Test 1966-1992
Baird and Robinson, “Novel Cognitive Insights from the First Year after Bi-Thalamic Infarct.”	NG	stroke	44	M	Combined	Australia	drowsy, confused with fluctuating consciousness, hyperosmia, hyperacusis	B cell lymphoma, sepsis, multi-organ failure	8m	1d	17m	stable	WAIS-IV, WMS-IV, RAVLT, Rey Complex Figure Copy, Autobiographical Memory Interview
Beglinger, Haut, and Parsons, “The Role of the Mammillary Bodies in Memory: A Case of Amnesia Following Bilateral Resection.”	BR	neoplasma, post-surgery	51	F	Anterograde	US	visual defect, disoriented, confused, agitated, apathy, perseveration	depression, panhypopituitarism, lower extremity deep venous thromboses, pulmonary emboli	10w	9m	30w	stable	Auditory Consonant Trigrams and Paced Auditory Serial Additions Test, Wisconsin Card Sorting Test and Verbal Fluency
Brown et al., “Isolated, Relative Aproverbia without Focal Lesion.”	A	ischaemia	40	M	Anterograde	US	aproverbia	unclear	12d	1w	unclear	NA	unclear
Buccione et al., “Retrograde Episodic and Semantic Memory Impairment Correlates with Side of Temporal Lobe Damage.”	AS	encephalitis	53	M	Combined	Italy	malaise, confusion, disoriented in time and space	none	1m	unclear	unclear	NA	WAIS, Autobiographical Memory Interview, Digit Span, Corsi Span, 15-word list and Short Story for verbal episodic memory, Rey’s Figure, Crovitz Test, Italian Questionnaire for Remote Events, New Words Test

Cachia et al., "Selective Cognitive Patterns Resulting from Bilateral Hippocampal Ischemia."	A	ischaemia	54	M	Anterograde	US	emotional, psychological distress	type 2 diabetes, hypertension, hypercholesterolemia, moderate-severe obstructive sleep apnea, depression	acute	10d	12m	stable	Wechsler Adult Intelligence Scale-III, Wechsler Memory Scale-III, Rey Auditory Verbal Learning Test, Rey Complex Figure,
Caglio et al., "Virtual Navigation for Memory Rehabilitation in a Traumatic Brain Injured Patient."	WP	TBI, hemorrhage	24	M	Combined	Italy	unclear	none	12m	0d	24m	stable	Corsi Block-Tapping Test, Corsi Block-Tapping Test, Backward Digit Span, Rey Auditory Verbal Learning Test, Trail Making Test TMT A-B, Phonemic fluency, Alzheimer's Disease Assessment Scale, The Rivermead Behavioural Memory Test,
Calabrese et al., "Right Temporofrontal Cortex as Critical Locus for the Ephyory of Old Episodic Memories."	A	encephalitis	54	F	Retrograde	Germany	nausea, tiredness, disoriented, visual hallucinations, drowsiness	left sided mastectomy for breast cancer, hysterectomy	24m	3m	24m	unclear	WMS-R, AMI, Crovitz Form Test, Rey Auditory Verbal Learning Test, Famous Faces Test, Semantic General Knowledge Test
Carlesimo et al., "ANALYSIS OF THE MEMORY IMPAIRMENT IN A POST-ENCEPHALITIC PATIENT WITH FOCAL RETROGRADE AMNESIA."	AV	encephalitis	29	F	Retrograde	Italy	depressed mood, social isolation, temporo-spatial disorientation, misidentification of people, agitation alternating with lethargy	unclear	10m	2w	14m	stable	WAIS, WMS, Semantically Related Word List, Semantically Unrelated Word List, Autobiographical Memory, Famous Events Recognition test, Famous Face and Famous Name Tests,
Carrasco et al., "Spontaneous Acute Hemorrhage within a Subependymoma of the Lateral Ventricle."	A	hemorrhage	71	M	Combined	Spain	disorientation, confabulation	arterial hypertension, chronic atrial fibrillation, biventricular obstructive hydrocephalus	unclear	1w	9m	improve	unclear
Caulo et al., "Functional MRI Study of Diencephalic Amnesia in Wernicke-Korsakoff Syndrome."	A	Wernicke's encephalopathy	34	M	Combined	Italy	persistent vomiting, severe malnutrition, confusional state	oesophageal stenosis after cancer surgery	4w	1w	4w	improve	MMSE, Prose Memory test, Rey Complex Figure, Crovitz test, the Wechsler Adult Intelligence Scale (WAIS)
Chan et al., "Extensive and Temporally Ungraded Retrograde Amnesia in Encephalitis Associated With Antibodies to Voltage-Gated Potassium Channels."	KC2	encephalitis	43	M	Combined	UK	confabulate	unclear	12m	12m	17m	improve	Recognition Memory Test scores, Public Events Questionnaire, Paired Associate Learning scores, Memory for Public Events, Memory for Famous Faces
Chen, Zayas, and Gold, "Anterograde Amnesia and Fornix Infarction."	A	stroke	72	F	Anterograde	US	unclear	diabetes, hypercholesterolemia, hypertension, coronary artery disease	unclear	unclear	unclear	NA	unclear
Clarke et al., "Pure Amnesia after Unilateral Left Polar Thalamic Infarct: Topographic and Sequential Neuropsychological and Metabolic (PET) Correlations."	A	stroke	54	F	Combined	Switzerland	unclear	unclear	7-19d	6d	8m	improve	Boston naming, Token test, Corsi test, Wisconsin Card Sorting, Progressive Matrices, Autobiographical memory (autobiographical and public events), Famous Faces
Coffey, "Hypothalamic and Basal Forebrain Germinoma Presenting with Amnesia and Hyperphagia."	A	tumor	24	F	Combined	US	photophobia, visual obscurations, disoriented to time, papilledema	hydrocephalus	39m	39m	50m	decline	unclear
Collinson, Meyyappan, and Rosenfeld, "Injury and Recovery."	DD	TBI, hemorrhage	26	M	Combined	Singapore	disorientation to place	unclear	3m	24h	4m	improve	WTAR, Rey complex figure test, Word list memory, Logical memory I/II, Face memory I/II, CVMT, Wisconsin card sorting test (WSCT-64)
Conesa et al., "ACUTE IMPAIRMENT OF SHORT-TERM MEMORY", "ESO-WSO 2020 Joint Meeting Abstracts", page 295	A	stroke	43	M	Anterograde	Spain	unclear	unclear	unclear	2m	NA	NA	unclear

Di Gennaro et al., "Severe Amnesia Following Bilateral Medial Temporal Lobe Damage Occurring on Two Distinct Occasions."	MV	lobectomy and tumour	38	F	Combined	Italy	depression	post-surgery right temporal lobectomy state, chronic epilepsy	3y	3y	37m	decline	WAIS, RAVLT, Story recall, Figure of Rey, Raven's Coloured Progressive Matrices
Dromerick et al., "Simultaneous Bilateral Thalamic Hemorrhages Following the Administration of Intravenous Tissue Plasminogen Activator."	A	stroke	73	F	Combined	US	inattention, disturbance of visual perception, confabulation, dysnomia	acute myocardial infarction	acute	2d	9m	stable	MMSE, unclear
Edelstyn et al., "Contribution of the Left Dorsomedial Thalamus to Recognition Memory: A Neuropsychological Case Study."	QX	stroke	55	M	Anterograde	UK	disinhibited behaviour, reduced motivation	unclear	unclear	unclear	unclear	NA	WAIS-R, WCST, Facial processing, visual processing, WMS, Rey Complex Figure, AMI
Ernst et al., "Autobiographical Memory and the Self in a Single-Case of Chronic Unilateral Spatial Neglect."	DR	hemorrhage	59	F	Combined	France	unilateral spatial neglect (USN)	unclear	4w-15w	15d	unclear	NA	Autobiographical memory: test episodique de la mémoire du passé autobiographique (TEMPau), Hopkins verbal learning test, form 1 (number of words)
Fertl et al., "Persistent Amnesic Syndrome as Long-Term Outcome of Cognitive Function after Whipple's Disease."	A	Whipple's disease, infection	51	M	Combined	Austria	disorientation in time and space, confabulation, alert, apathetic, reduced attention and motivation	none	30m	7w	42m	stable	Pair-Associate-Learning: 5 Faces-Names, 5 Words-Colours, 3 German-Turkish words; Digit span, Logical memory RBMT, Faces RBMT, Objects RBMT
Fujii et al., "DISPROPORTIONATE RETROGRADE AMNESIA IN A PATIENT WITH HERPES SIMPLEX ENCEPHALITIS."	A	encephalitis	51	F	Combined	Japan	none	lung tuberculosis, uterine cancer surgery, controlled intermittent complex partial and generalized seizures	28d-52d	35d	unclear	NA	WAIS-R, Raven Test, Kohs Cube Test, 100 Pictures Naming, Wisconsin Card Sorting Test, Corsi Block Tapping Test, Lag 1 Digit Span, Corsi" Type Tapping Test, Wechsler MemoryScale – Revised, Rey Auditory Verbal Learning Test, Rey Complex Figure, Recognition Memory Test, Autobiographical Memory Interview, Public Events, Dead or Alive Test
Futamura et al., "Singular Case of the Driving Instructor."	A	hemorrhage	39	M	Anterograde	Japan	unclear	unclear	8y	unclear	unclear	NA	MMSE, WAIS-III, WMS-R, ROCFT and autobiographical memory test (unclear)
Gainotti et al., "Retrograde Amnesia in a Patient with Retrosplenial Tumour."	AP	tumor	43	F	Combined	Italy	mental confusion, difficulty in maintaining attention and concentration, occasional episodes of headache	unclear	16m	17m	18m	stable	Rey's 15 Words Auditory Learning Test, Rey's complex figure, WMS, Rey's Auditory Verbal Learning Test, Autobiographical Incident Schedule, Corsi's test, Picture Recognition test
Gentilini, De Renzi, and Crisi, "Bilateral Paramedian Thalamic Artery Infarcts."	3	stroke	35	M	Combined	Italy	apathetic, disoriented to time and place, hypersomnolent, irritable, confusion, confabulation, bulimia	unclear	15d	4d-3m	3y	stable	WAIS, Immediate and Delayed Recall of a Story, Learning a 10 Word List and 10 Verbal Paired-Associates
Goldenberg et al., "Basal Forebrain Amnesia."	A	stroke	55	M	Combined	Germany	disoriented to time, somnolent, confused, loss of libido, flattening of emotional reactions	hypertension	unclear	unclear	unclear	NA	WMS- R, Rivermead behavioural memory battery, Berlin Amnesia Test z Scores, Recognition memory, CVLT, Learning of Eight Paired Associates (words, objects, face-name), Story Recall (16 and 24 units of information), Taylor figure recall, German WAIS-R, Famous Faces, AMI, modified Crovitz

Graff-Radford, Tranel, and Van, "DIENCEPHALIC AMNESIA."	A	stroke	68	F	Combined	US	confused, obtunded, somnolent	borderline diabetes	5y3m	5y3m	5y3m	stable	WAIS-R, Copy of the Rey-Osterreith Complex Figure, Facial Discrimination Test, Judgement of Line Orientation Test, WCST, Rey Auditory Verbal Learning Test with 30 min Delayed Recall and Recognition, WMS (subtests logical memory, paired associates) and 30 min delayed recall, Craik Tulving Encoding, Release from proactive interference, Warrington Recognition Memory Test (words), Rey-Osterreith Figure Recall (30 min delay), Warrington Recognition Memory Test (faces), Autobiographical Construction and Interview, Recall of US Presidents, Boston Famous Faces Test, Boston Recognition of Events Test, Boston Recall of Events Test, Squire Recall and Recognition of Past Events (forms A and B)
Graff-Radford, Tranel, and Van, "DIENCEPHALIC AMNESIA."	B	stroke	19	F	Anterograde	US	confusion, intermittently drowsy	none	6m	6m	15m	unclear	WAIS-R, Copy of the Rey-Osterreith Complex Figure, Facial Discrimination Test, Judgement of Line Orientation Test, WCST, Rey Auditory Verbal Learning Test with 30 min Delayed Recall and Recognition, WMS (subtests logical memory, paired associates) and 30 min delayed recall, Craik Tulving Encoding, Release from proactive interference, Warrington Recognition Memory Test (words), Rey-Osterreith Figure Recall (30 min delay), Warrington Recognition Memory Test (faces), Autobiographical Construction and Interview, Recall of US presidents, Boston Famous Faces Test, Boston Recognition of Events Test, Boston Recall of Events Test, Squire Recall and Recognition of Past Events (forms A and B)
Grewal, "Severe Amnesia Following a Unilateral Temporal Lobe Stroke."	A	stroke	60	M	Combined	US	none	diabetes mellitus, hypercholesterolemia and hypertension	unclear	unclear	unclear	NA	A Rey's Auditory-Verbal Learning Test (RVLT), public facts, events and famous faces, Autobiographical Memory Interview
Grilli et al., "The Contribution of the Left Anterior Ventrolateral Temporal Lobe to the Retrieval of Personal Semantics."	MK	post-surgery	51	M	Combined	US	unclear	controlled epilepsy	unclear	unclear	unclear	NA	WAIS-IV, WMS-IV, RAVLT, Rey Complex Figure Copy, Autobiographical Memory Interview, Boston Naming Test and Animal Fluency, Cambridge Naming Test
Grilli et al., "The Contribution of the Left Anterior Ventrolateral Temporal Lobe to the Retrieval of Personal Semantics."	DW	post-surgery	48	F	Combined	US	unclear	unclear	unclear	unclear	unclear	NA	WAIS-IV, WMS-IV, RAVLT, Rey Complex Figure Copy, Autobiographical Memory Interview, Boston Naming Test and Animal Fluency, Cambridge Naming Test
Guberman and Stuss, "The Syndrome of Bilateral Paramedian Thalamic Infarction."	I	stroke	54	M	Combined	Canada	disoriented to time and space, hypokinetic, apathetic, perseveration, confabulation, hypersomnolent	hypertension, mild obesity	3w	10d	1y	improve	Boston Naming Test, Rey-Osterreith Figure, Digit Span, Trail Making Test, Stroop Test, WMS, Benton Visual Retention, WAIS
Hashimoto, Tanaka, and Nakano, "Amnesic Confabulatory Syndrome after Focal Basal Forebrain Damage."	A	hemorrhage	73	F	Anterograde	Japan	disorientation, confabulation	unclear	1m	10d	3m	stable	WAIS-R, WMS-R (Japanese version), AVLT(Japanese version), Rey-Osterreith Complex Figure Test (R-O CFT), the Public Event Test and Autobiographical Memory Questionnaire, New Modified Wisconsin Card Sorting Test, Trail making test part B
Hirayama, "Limbic Encephalitis Presenting with Topographical Disorientation and Amnesia."	A	encephalitis	70	F	Combined	Japan	attentional disturbance, disorientation	unclear	unclear	unclear	unclear	NA	WAIS-R, Digit Span, Spatial Span, Paired Associate Task, Benton Visual Retention Test, Autobiographical Memory (unclear), Public Event Test

Hodges and Carpenter, "Anterograde Amnesia with Fornix Damage Following Removal of Illrd Ventricle Colloid Cyst."	1	post-surgery	45	F	Anterograde	UK	disorientated in time	unclear	1m	days	24m	improve	IQ verbal, NART, Digits Forward and Backward, Verbal memory (paragraph immed, delayed), PALT, Warrington RMT, Words, Faces, Non-verbal Memory Form, Rey Figure Copy Recall, Corsi Block Span, Spatial Memory Test, Famous Faces
Hodges and Carpenter, "Anterograde Amnesia with Fornix Damage Following Removal of Illrd Ventricle Colloid Cyst."	2	post-surgery	33	M	Combined	UK	none	unclear	8w	unclear	12m	improve	IQ verbal, NART, Digits Forward and Backward, Verbal memory (paragraph immed, delayed), PALT, Warrington RMT, Words, Faces, Non-verbal Memory Form, Rey Figure Copy Recall, Corsi Block Span, Spatial Memory Test, Famous Faces
Hodges and McCarthy, "Autobiographical Amnesia Resulting from Bilateral Paramedian Thalamic Infarction. A Case Study in Cognitive Neurobiology."	PS	stroke	67	M	Combined	UK	severe confused, disorientated in time and place, apathetic, lethargic	none	13m-29m	4m	unclear	NA	Recognition Memory Test, WMS, Rey-Osterrieth Figure, WAIS-R Subsets Age Scale, Digits Forwards and Backwards, Corsi Block Tapping Forwards/Backwards, Paragraph Recall (WMS), Paired Associate Learning (WMS), WRMT(words, faces), WCST, Free Recall, Cued Recall (Galton-Crovitz), Autobiographical Memory Interview, Family Photograph Identification, Cued Recall of Family Events, Famous Faces Test, Famous Events Test
Honda et al., "P300 Abnormalities in Patients with Selective Impairment of Recent Memory."	4	encephalitis	69	F	Combined	Japan	unclear	well controlled epilepsy	unclear	unclear	NA	NA	Digit Span, Miyake's Retention Test, Benton Visual Retention Test
Honda et al., "P300 Abnormalities in Patients with Selective Impairment of Recent Memory."	6	anoxia	32	F	Combined	Japan	unclear	dermatomyositis, central pontine and extra-pontine myelinolysis, generalized seizure	8m	7m	8m	improve	Digit Span, Miyake's Retention Test, Benton Visual Retention Test
Honda et al., "P300 Abnormalities in Patients with Selective Impairment of Recent Memory."	7	post-surgery	31	F	Combined	Japan	confabulation, disorientation in time and place	amenorrhea, galactorrhea syndrome, bilateral frontal craniotomy and total resection of craniopharyngioma and pituitary stalk, panhypopituitarism, diabetes, insipidus, anosmia	2m	unclear	unclear	NA	Digit Span, Miyake's Retention Test, Benton Visual Retention Test
Iizuka, Suzuki, and Mori, "Severe Amnesic Syndrome and Collecting Behavior After Surgery for Craniopharyngioma."	A	stroke	50	M	Anterograde	Japan	behavioral changes(hyperphagia and affective incontinence)	craniopharyngioma surgery, panhypopituitarism	13m	unclear	unclear	NA	Wechsler Memory Scale—Revised, Autobiographical Memory Interview, Recognition Memory Test (Words,Faces), Wisconsin Card Sorting Test, Verbal Fluency
Jamjoom et al., "Autobiographical Memory Loss Following a Right Prefrontal Lobe Tumour Resection."	VF	post-surgery	18	F	Retrograde	UK	unclear	unclear	18m	3m	18m	almost stable	unclear
Kapur and Brooks, "Temporally-Specific Retrograde Amnesia in Two Cases of Discrete Bilateral Hippocampal Pathology."	BE	encephalitis	46	M	Anterograde	UK	odd sense of smell, episodes of de'j'a vu	possible rheumatoid arthritis	months	1y	unclear	NA	Wechsler Adult Intelligence Scale-Revised, National Adult Reading Test-NART, Wechsler Memory Scale-Revised, Adult Memory and Information Processing Battery, Recognition Memory Test, Autobiographical Memory Interview, Shared Experiences Test, Dead-or-Alive Test
Kapur and Brooks, "Temporally-Specific Retrograde Amnesia in Two Cases of Discrete Bilateral Hippocampal Pathology."	LC	encephalitis	36	M	Anterograde	UK	confabulation	chronic myelocytic leukaemia, bone-marrow transplant	about 3w	within 1 month	died in one month	unclear	Wechsler Memory Scale-Revised, Dead-or-Alive Test, a short form of the Verbal News Events Test, Adult Reading Test, Wechsler Adult Intelligence Scale-Revised

Kapur et al., “Anterograde but Not Retrograde Memory Loss Following Combined Mammillary Body and Medial Thalamic Lesions.”	KK	Wernicke’s encephalopathy	57	M	Anterograde	UK	none	diabetes insipidus	days	days	unclear but died 4 months later	NA	Wechsler Adult Intelligence Scale–Revised, FAS, Rey Figure, Real Fictitious public events test, Dead-or-Alive test, Autobiographical Memory Interview, Recognition Memory Test
Kapur et al., “FOCAL RETROGRADE AMNESIA FOLLOWING BILATERAL TEMPORAL LOBE PATHOLOGY.”	LT	TBI, hemorrhage	26	F	Retrograde	UK	unclear	unclear	18m-19m	1.5y	unclear	NA	Wechsler Adult Intelligence Scale (Revised), modified Wisconsin Card Sorting Test, Revised Wechsler Memory Scale, Autobiographical Cued Recall Test, Identification of Famous Scene, Famous Faces Test, the Dead/Alive Test, Famous Names Test
Kartsounis, Rudge, and Stevens, “Bilateral Lesions of CA1 and CA2 Fields of the Hippocampus Are Sufficient to Cause a Severe Amnesic Syndrome in Humans.”	A	ischaemia	67	M	Combined	UK	a major convulsion	chronic obstructive airways disease, migraine, supraventricular tachycardia	unclear	unclear	unclear	NA	Wechsler Adult Intelligence Scale (WAIS-R), Recognition Test (words, faces), Recall Test, Autobiographical Memory Interview, Public Remote Memory (famous faces, major events), Galton-Crovitz Technique
Kataoka, Furiya, and Ueno, “Limbic Encephalitis With Involvement of Prefrontal Cortices and Persistent Amnesia.”	A	encephalitis	64	F	Combined	Japan	disoriented to time, place and age	unclear	days to weeks	7d	5y	stable	Hasegawa Dementia Scale, Mini-Mental Status Examination, Miyake Memory Test
Koll et al., “Acute Amnesic Syndrome with Hippocampal Lesion Due to Influenza B-Associated Encephalopathy.”	A	encephalitis	77	F	Combined	Austria	respiratory infection, confusion	right sphenoid ridge meningioma surgery, arterial hypertension, hyperlipidemia, type 2 diabetes mellitus	days	1w	22m	improve	unclear
Korematsu et al., “Memory Impairment Due to a Small Unilateral Infarction of the Fornix.”	A	stroke	52	M	Combined	Japan	unclear	unclear	acute	4d	3m	slightly improve	Wechsler Memory Scale-Revised test, Wechsler Adult Intelligent Scale-Third Edition, Hasegawa Dementia Scale-Revised, Mini Mental State Examination, Miyake Paired Verbal Association Learning Test
Kroll, Markowitsch, and Knight, “Retrieval of Old Memories: The Temporofrontal Hypothesis.”	AA	TBI	44	M	Retrograde	US	disorientated	unclear	unclear	18y	unclear	NA	WMS-R, Wechsler Adult Intelligence Scale—Revised, Wisconsin Card Sorting Test, Boston Naming Test, Sentence Comprehension Test, Controlled Oral Fluency Test, Incomplete Pictures test, Subjective Memory Questionnaire, paired associate learning, California Verbal Learning test, Picture Recognition test, Rey–Osterrieth Figure, Rivermead Behavioural Memory Test, a headlines memory test, Time magazine news test, Transient events test, General knowledge of the world, Famous faces test, Headlines memory test, Old Memories, a Crovitz-form test, Twelve Significant Events, Autobiographical Events and an Autobiographical Memory Interview
Kroll, Markowitsch, and Knight, “Retrieval of Old Memories: The Temporofrontal Hypothesis.”	BB	TBI	49	M	Retrograde	US	unclear	unclear	unclear	18y	unclear	NA	WMS-R, Wechsler Adult Intelligence Scale—Revised, Wisconsin Card Sorting Test, Boston Naming Test, Sentence Comprehension Test, Controlled Oral Fluency Test, Incomplete Pictures Test, Subjective Memory Questionnaire, Paired Associate Learning, California Verbal Learning test, Picture Recognition test, Rey–Osterrieth Figure, Rivermead Behavioural Memory Test, a Headlines Memory Test, Time Magazine News Test, Transient Events Test, General Knowledge of the World, Famous Faces Test, Headlines Memory Test, Old Memories, a Crovitz-form Test, Twelve Significant Events, Autobiographical Events and an Autobiographical Memory Interview

Kwan et al., "Dissociations in Future Thinking Following Hippocampal Damage."	KC	TBI	57	M	Combined	Canada	unclear	unclear	unclear	unclear	unclear	NA	WAIS-R, WMS-R, Boston Naming, Semantic Fluency, Letter Fluency, CVLT, ROCF, WCST, Adapted Autobiographical Interview, Delay Discounting Task, Probability Discounting Task, Each Time Perspective
Kwan et al., "Dissociations in Future Thinking Following Hippocampal Damage."	DA	encephalitis	59	M	Combined	Canada	unclear	unclear	unclear	unclear	unclear	NA	WAIS-R, WMS-R, Boston Naming, Semantic Fluency, Letter Fluency, CVLT, ROCF, WCST, Adapted Autobiographical Interview, Delay Discounting Task, Probability Discounting Task, Each Time Perspective
Levine et al., "Episodic Memory and the Self in a Case of Isolated Retrograde Amnesia."	ML	TBI	36	M	Retrograde	Canada	unclear	none	14m	2.4y	unclear	NA	Galveston Orientation and Amnesia Test, Autobiographical Memory Interview, WAIS-R, NAART-R, WMS-R, Word List Learning, Crovitz Cue-Word Test, Boston Naming Test, Verbal Fluency, Trail Making, Stroop Interference Procedure, Wisconsin Card Sorting Test (WCST), Conditional Associative Learning, Recall and recognition performance, Remember/Know responses
Maeshima et al., "Memory Impairment Caused by Cerebral Hematoma in the Left Medial Temporal Lobe Due to Ruptured Posterior Cerebral Artery Aneurysm."	A	hemorrhage	56	M	Anterograde	Japan	disorientation of time and place	unclear	1w	10d	10w	improve	MMSE, Digit Span, Raven's Progressive Matrices, Wechsler Adult Intelligence Scale 3rd edition, Auditory Verbal Learning Test, Wechsler Memory Scale-Revised, Rivermead Behavioural Memory Test
Malamut et al., "Memory in a Case of Bilateral Thalamic Infarction."	MP	stroke	31	M	Anterograde	US	abulia, lack of initiative	none	3y	3y	3y	improve	Benton Orientation, WAIS-R, Modified Card Sorting, Wisconsin Card Sorting, Continuous Performance Test and Stroop, Finger tapping, Controlled Word Association, Animal naming, Boston Naming, WMS, CVLT, RAVLT, Rey Osterrieth, Facial Memory, Spatial Learning, Tactual Performance Test, Corsi Spatial Block Learning
Male and Zand, "Isolated Mammillary Body Infarct Causing Global Amnesia."	A	stroke	53	M	Anterograde	US	confusion	hypertension, anosognosia	acute	acute	3m	unclear	unclear
Marín Conesa et al. "Non transitory global amnesia", European Journal of Neurology 2020;27:802	A	stroke	43	M	Anterograde	Spain	unclear	unclear	3d	3d	unclear	NA	unclear
Markowitsch and Ewald, "Right-Hemispheric Fronto-Temporal Injury Leading to Severe Autobiographical Retrograde and Moderate Anterograde Episodic Amnesia-Implications for the Anatomy of Memory."	DD	TBI	53	M	Retrograde	Germany	severe vision impairment, depressed	porencephalic cyst, obsessive compulsive tendencies, depression, moderate anxiety, mild phobic anxiety, paranoid ideation, moderate psychoticism	3y	3y	unclear	NA	WAIS-R, Rey Auditory Verbal Learning Test, RAVLT, WMS-R, Verbal Fluency Test, Buschke Selective Reminding Test, Motor-Free Visual Perception Test, Draw-a-Clock Test, Inhibitory Hand Tapping, WCST, Crovitz test, Autobiographical Memory Interview
Markowitsch et al., "Retrograde Amnesia after Traumatic Injury of the Fronto-Temporal Cortex."	D	TBI	45	M	Retrograde	Germany	unclear	unclear	about 4y	unclear	unclear	NA	Wechsler Memory-Scale-R, Rivermead Behavioural Memory Test, Corsi-block-tapping; Digit span, WCST, Tower of Hanoi, Word stem completion, Mirror Image Reading, Famous Faces Test, Famous names, Semantic Knowledge Test, Autobiographical Memory Interview, Personal Objects Test, Verbal Recognition Test, Rey-Osterrieth-Figure, Verbal Learning of New Facts
Markowitsch et al., "Verbal Memory Deterioration After Unilateral Infarct of the Internal Capsule in an Adolescent."	C	stroke	15	M	Combined	Germany	none	left eye-lids inflammation	9m	4y	unclear	NA	Wechsler Intelligence Scale, Rivermead Behavioural Memory Test battery, Tests of Remote Memory (a questionnaire and the Crovitz-type remote memory test), Paired-Associate Learning, Prose Text composed of 23 logical units, Selective Reminding Task, Muramoto Task, Tower of Hanoi Problem, Buschke's Verbal/List Learning Task

Markowitsch, von Cramon, and Schuri, "Mnemonic Performance Profile of a Bilateral Diencephalic Infarct Patient with Preserved Intelligence and Severe Amnesic Disturbances."	AB	stroke	67	M	Combined	Germany	none	TIA	unclear	16m	unclear	NA	Revised Wechsler Memory Scale, Rivermead Behavioural Memory Test, Incomplete Pictures Test, Famous Faces Test, Subjective Memory Questionnaire, Rivermead Behavioural Memory Test, Recurring Figures and Words Tests, Nonverbal Selective Reminding Task, Mirror Drawing Task, CVLT, Block Tapping (Corsi), Benton Test (recognition), Face Recognition Test, Rey-Osterrieth Complex Figure, Word Paired Associates, Auditory Verbal Learning Test (Rey), Face/Name Paired Associates, Object Paired Associates, Recurring Figures Test, Recurring Figures Test, Wisconsin Card Sorting Test, Famous Names, Free Recall of a 57-unit Story after 48-hr delay, Recognition of 10 Faces after 48-hr delay, WAIS, Autobiographical Memory Test
Masuo et al., "A Case of Amnesic Syndrome Caused by a Subcortical Haematoma in the Right Occipital Lobe."	A	post-surgery	62	M	Anterograde	Japan	left homonymous hemianopsia, disorientation	subcortical haematoma	10d	6m	6m	stable	Digit Span, MMSE, Wechsler Adult Intelligence Scale-Revised, Benton Visual Recognition Test, Auditory Verbal Learning Test, Raven's CPM, Wechsler Memory Scale, Auditory Verbal Learning Test, Miyake's Associate Learning Test
Mccarthy and Warrington, "ACTORS BUT NOT SCRIPTS: THE DISSOCIATION OF PEOPLE AND EVENTS IN RETROGRADE AMNESIA."	RFR	encephalitis	54	M	Combined	UK	panic attack	unclear	unclear	unclear	unclear	NA	WAIS, Recognition Memory Test, National Adult Reading Test, Famous Faces Test, Famous Names Test, Tests of Knowledge of Friends, Who and What Questions: Examples of stimuli
Miller et al., "Right Medial Thalamic Lesion Causes Isolated Retrograde Amnesia."	JG	stroke	33	M	Retrograde	Australia	disorientation	mildly depressed	12m	7m	18m	stable	Autobiographical Memory Interview, Major Life Events, Recognition of Friends and Relatives, Famous People Tests, Famous Events Test, Boston Naming Test, Pyramids and Palm Trees, Animal Fluency, WMS-R, Rey Complex Figure, Rey Auditory Verbal Learning Test, WAIS-R, Wisconsin Card Sorting Test, Benton Facial Recognition
Mori, Yamadori, and Mitani, "Left Thalamic Infarction and Disturbance of Verbal Memory."	A	stroke	41	M	Anterograde	Japan	diplopia, slightly euphoric, deficits unconcerned, hypersomnia, inattention, disoriented for time and place	unclear	1-2m	2m	5m	stable	WAIS, SLTA, Token test, WMS, AVLT, BVRT, ROCF, WCS, Miyake's Reaction Test, Benton Visual Retention Test, Wisconsin Card Sorting Test
Morris et al., "AMNESIA FOLLOWING A DISCRETE BASAL FOREBRAIN LESION."	SJ	post-surgery	51	M	Combined	US	alternating periods of agitation and lethargy, irritability, emotional lability, inappropriate jocularity, diminished initiative and motivation, aggressive outbursts, self-destructive threats, apathy	history of poorly controlled complex partial seizures before surgery, low-grade astrocytoma surgery, hypertension, two closed head injuries	2ws during hospitalization	days? Post surgery MRI	18m	stable	WAIS-R, Rey-Osterrieth-Copy, Cancellation Task, Boston Naming, Finger Tapping, Grooved Pegboard, Digit Span, Auditory Consonant Trigrams, Wisconsin Card Sorting Test, Booklet Category Test, Word Fluency, Wechsler Memory Scale California Verbal Learning, Continuous Visual Memory, Boston Remote Recall/Recognition/Faces, Remote Autobiographical Recall/Recognition, Verbal levels of processing, Verbal rate of forgetting, Boston Retrograde Amnesia Examination
Mosimann et al., "Fornix Infarction and Korsakoff Dementia after Coiling of a Large Anterior Communicating Artery Aneurysm."	A	post-surgery	47	M	Combined	France	unclear	subcortical hemorrhage, dysphoria	unclear	unclear	24m	minor improve	unclear

Müller et al., "Persistent Klüver-Bucy Syndrome after Bilateral Thalamic Infarction."	A	stroke	69	F	Anterograde	Switzerland	distractable, affectively dyscontrolled, socially inappropriately, somnolent, confabulation	chronic atrial fibrillation, arterial hypertension	1m	unclear	13m	stable	unclear
Murr et al., "Selective Infarction of the Anterior Genu Fornices Associated with Giant Cell Arteritis."	A	stroke	60	F	Anterograde	US	confusion	multinodular goiter, hypertension	unclear	unclear	unclear	NA	unclear
O'Connor et al., "The Dissociation of Anterograde and Retrograde Amnesia in a Patient with Herpes Encephalitis." Eslinger et al., "Nonverbal Amnesia and Asymmetric Cerebral Lesions Following Encephalitis."	LD	encephalitis	26	F	Retrograde	US	visual agnosia	none	8y	3y	8y	improve	Wechsler Adult Intelligence Scale-Revised, National Adult Reading Test, Corsi Blocks, Word List Generation (FAS), Trail-Making Test, Part B, Wisconsin Card Sorting Test, Wisconsin Card Sorting Test, Benton Line Orientation Test, Hooper Visual Organization Test, Keegan Faces, Benton Facial Recognition Test, Map Localization, Rey Osterrieth Complex Figure, Wechsler Memory Scale-Revised, Rey Auditory Verbal Learning Test, Warrington Recognition Memory Test, Continuous Visual Memory Test, Autobiographical Events Questionnaire, Remote Memory Questionnaire, Free Association Test, Transient Events Test, Crovitz and Schiffman's Technique, Autobiographical Events Schedule
Ogden, "Visual Object Agnosia, Prosopagnosia, Achromatopsia, Loss of Visual Imagery, and Autobiographical Amnesia Following Recovery from Cortical Blindness."	MH	TBI	30	M	Retrograde	New Zealand	visual object agnosia, prosopagnosia, totally blind	unclear	3y	6y	unclear	NA	WAIS-R, Digit Span, Copeis of Drawing, Category-specific Visual Recognition, Semantic Knowledge of Objects, New Verbal Learning, WMS, Recognition Memory Test, Autobiographical Memory Interview
Oishi et al., "Pure Topographical Disorientation in Novel Environments without Anterograde Amnesia."	KW	encephalitis	56	F	Combined	Japan	spatio-temporal disorientation	unclear	3m	95d	unclear	NA	Wechsler Adult Intelligence Scale-Third Edition, JART, Wechsler Memory Scale-Revised, Rey Osterrieth Complex Figure Test, Benton Visual Retention Test, Paired Verbal Paired Associate Learning Test, Rivermead Behavioral Memory Test, Trail Making Test (Part A, Part B) in Japanese, Developmental Test of Visual Perception for Adults, Birmingham Object Recognition Battery, Visual Perception Test for Agnosia, Retrograde Memory Test on Famous Landscapes, Faces, and Past Events; Autobiographical Memory Interview, Developmental Test of Visual Perceptual Skills-Adolescent and Adult (DTVP-A)
Osawa et al., "Neuropsychological Deficits Associated with a Tumour in the Posterior Corpus Callosum."	A	tumor	62	M	Anterograde	Japan	disorientation	Gerstmann's syndrome	7-9d	within 20d	35d	improve	MMSE, Kana-Hiroi Test, Word Fluency, WAIS-R, Raven's Coloured Progressive Matrices, Digit Span, Auditory Verbal Learning Test (AVLT), Benton Visual Retention Test, Rivermead Behavioural Memory Test
Ouellet et al., "Two Routes to Losing One's Past Life."	DD	post-surgery	40	M	Retrograde	Canada	fatigability, chronic pain	mild anxiety and depression, implantation of a thalamo-lemniscal electrode for the treatment of pain syndrome	16y	7y9m, 11y6m	unclear	NA	RAVLT, Logical Memory, Rey-Osterrieth Figure, Visual Reproduction, WMS-R, Public Events and Famous People, WAIS-R, Chapman-Cook Test, Benton's Tests of Facial Recognition and Judgment of Line Orientation, Hooper Visual Organisation, Object Assembly and Block Design, WCST, Trail A & B, Luria's Graphic Series and Gestural Sequences, Stroop Test

Pachalska et al., "A Case of 'Borrowed Identity Syndrome' after Severe Traumatic Brain Injury."	PA	TBI	43	M	Combined	Poland	sleeping problems, bouts of aggressiveness, visuospatial disorientation, inaccurate spatial orientation, confabulation, abrupt changes in personal habits and routines, loss of personal history, social roles, and lifestyle	anosognosia, identity disturbance, prosopagnosia	unclear	4m	unclear	NA	unclear
Park et al., "Amnesic Syndrome in a Mammillothalamic Tract Infarction."	C	stroke	70	M	Combined	Korea	none	hypertension, two times of stroke pre-onset	4d	4d-7d	4m	stable	MMSE, Seoul Neuropsychological Screening Battery, Wechsler Adult Intelligence Scale, Digit Span, Korean version of the Boston Naming Test, Rey-Osterrieth Complex Figure, Seoul Verbal Learning Test, Autobiographical Memory Interview
Park et al., "Memory Deficits after Bilateral Anterior Fornix Infarction."	A	stroke	60	F	Anterograde	Korea	disoriented to time	hypertension, diabetes	7d	3d	4m	slightly improve	Korean Wechsler Adult Intelligence Scale, Digit Span, Pen-Watch-Keys Test, Rey Figure Copy Test, AVLIT, Rey-Osterrieth Complex Figure test, RVDLT, Autobiographical Memory Interview, Corsi Block Tapping
Park, Seo, and Yoon, "Selective Anterograde Amnesia with Thalamus and Hippocampal Lesions in Neuro-Behcet's Disease."	B	Behcet's disease	50	M	Anterograde	Korea	disorientated	neuro-Behcet's disease	7d	5d	5m	modest improve	Rey-Osterrieth Complex Figure test, MMSE, Autobiographical Memory Interview, Korean Famous Events Test, Hopkins Verbal Learning Test
Parkin, "IMPAIRMENT OF MEMORY FOLLOWING DISCRETE THALAMIC INFARCTION."	JR	stroke	48	M	Anterograde	UK	unclear	unclear	unclear	unclear	unclear	NA	WMS, Wechsler Adult Intelligence Scale, National Adult Reading Test, WCST, FAS, Cognitive Estimation Test, Trail Making, Paired Associate Learning, Temporal List Discrimination, Spatial List Discrimination, Scenes Test, Dead or Alive Test
Peru and Fabbro, "Thalamic Amnesia Following Venous Infarction."	DB	stroke	41	M	Combined	Italy	apathetic, confused, disoriented to time and space, hypersomnia, mental slowness	arteriovenous fistula and urgical embolization	acute	7d	2y	improve	WAIS-R, Raven Progressive Matrices, Verbal Fluency Test, Arithmetic Judgement Test, Bilingual Aphasia Test, Acaculia Test, Recency Effect of the Serial Position Curve, Digit Forward Test, Bisyllabic Word Repetition Test, Corsi's Block Tapping Test, Rey-Osterrieth Complex Figure, Serial Position Curve Recency Effect, Maze Learning Test, Rey-Osterrieth Complex Figure 15 min Picture, Corsi's Block Tapping Supra Span, Rey Memory Test, Story Recall, Serial Position Curve, Word List, Rey Memory Test, MLT '88, Famous Personalities of the Present, Semantic Knowledge (animals, common objects, verbs, famous personalities of the past)
Peters et al., "Postoperative Amnesic State with Impairment of Static Visual Perception."	A	post-surgery, ischemia	60	M	Combined	Germany	visual disturbance	hypertension, coronary artery disease	unclear	2d-1w	unclear	NA	Rivermead Behavioural Memory Test, California Verbal Learning Test
Poreh et al., "Anterograde and Retrograde Amnesia in a Person with Bilateral Fornix Lesions Following Removal of a Colloid Cyst."	AD	post-surgery	45	M	Combined	Canada	confused	colloid cyst surgery, diabetes insipidus, anxiety, moderate depression	3m	2m	9m	stable	Autobiographical Memory Interview, Personal Events, Famous Faces, and Famous Events (Famous Israeli Faces and Famous Israeli Public Events Tests) Wechsler Intelligence Test III, Boston Naming Test, Wisconsin Card Sorting Test, Verbal Fluency Test, RAVLT Learning Curve, Spatial Span, Digit Span, Rey Complex Figure Test, Stroop Test, Wechsler Memory Scale

Reed and Squire, "Retrograde Amnesia for Facts and Events."	EP	encephalitis	74	M	Combined	US	unclear	unclear	unclear	unclear	unclear	NA	WAIS-R, WMS-R, Rey-Osterrieth Figure, Paired Associates, Word Recall, Word Recognition, Words, Faces, Autobiographical Memory Interview, Word Association Test, New Vocabulary, Public Events, Famous Faces, and Famous Names Test
Reed and Squire, "Retrograde Amnesia for Facts and Events."	GT	encephalitis	60	M	Combined	US	unclear	unclear	unclear	unclear	unclear	NA	New Vocabulary (recall and recognition), Public Events (recall and recognition), Famous Faces, Famous Names Completion and Famous Names Recognition, Autobiographical Memory Interview, Rey-Osterrieth Figure, Word Association Test of Autobiographical Memory, Information and Vocabulary subscales and Boston Naming Test, WAIS-R
Richardson et al., "Patients Undergoing High Dose Chemotherapy for Primary CNS Lymphoma Should Receive Prophylactic Thiamine to Prevent Wernicke's Encephalopathy."	A	Wernicke's encephalopathy	62	F	Combined	UK	fluctuating confusion	severe sepsis, mild hypomagnesaemia, recalcitrant thrombocytopenia, multi-organ failure	unclear	17d	unclear	NA	unclear
Ruggeri, "Left Dorsomedial Thalamic Damage Impairs Verbal Recall More Than Recognition."	B	stroke	51	M	Anterograde	Italy	confused, somnolent	unclear	1y	1y	unclear	NA	Visual Search, Trail Making Test Part A, Paced Auditory Serial Addition Test-2 seconds, Digit Span Forward and Backward, Trail Making Test Part B, Raven Progressive Matrices 47, Wechsler Adult Intelligence Scale Revised, Rey-Osterrieth Complex Figure, Phonetic Verbal Fluency 60-seconds, Nouns Oral Naming task of the Batteria per l'Analisi dei Deficit Afasici, Rivermead Behavioural Memory Test, Rey Auditory Verbal Learning Test, Corsi Supra-Span Block-Tapping Test, Rey-Osterrieth Figure, Semantically Related and Unrelated Words Learning test, Paired-Associate Learning test, Short Story
Ruggeri, Guariglia, and Sabatini, "Amnesia after Right Frontal Subcortical Lesion, Following Removal of a Colloid Cyst of the Septum Pellucidum and Third Ventricle."	AA	post-surgery	40	M	Anterograde	Italy	spatial and temporal disorientation	bilateral retinitis	2m	50d	13m	mildly improve	Paced Auditory Serial Addition test, Rivermead Behavioural Memory Test, Stroop Test, Rey's 15-Words, Words-Paired, Short Story, Corsi's Spatial Sequence and Rey's Complex Figure Test, Associated Learning test, Famous Events, Retrograde Memory Questionnaire, Rey Auditory Verbal Learning Test, Words Paired Associated Learning, Supra-Span Spatial Learning, Rey Figure 30sec/20min Recall, Retrograde Memory Social Events, WSCT
Rusconi, Morganti, and Paladino, "Long-Lasting Topographical Disorientation in New Environments."	RG	hemorrhage	22	F	Anterograde	Italy	unclear	ventricular-peritoneal valve derivation, right arteriovenous chorioidea malformation	10y	10y	8y	decline	Gordon's Questionnaire, Vividness Visual Imagery Questionnaire, Drawing from Memory test, WAIS, Short-Story recall, Rey's 15 Words Learning Task — delayed recall, Rey's Figure — delayed recall, Raven Coloured Progressive Matrices, Boston Naming Test, Semantic Word Fluency, Digit Span, Corsi Span, Paired Words Learning, Short-Story Recall, Spatial Learning (Corsi Supraspan), Recurring Faces Test, Behavioural Inattention Test, Poppelreuter Test, Maze Learning Test
Sala, Spinnler, and Venneri, "Persistent Global Amnesia Following Right Thalamic Stroke: An 11-Year Longitudinal Study."	LC	stroke	68	M	Combined	UK	dizziness, disorientation in time and space	stroke, hypertension	7w-11y	2y-11y	11y	stable	Wechsler-Bellevue Intelligence Scale, Digit Span, Corsi Block Visuo-Spatial Span, Prose Memory, Supra-Span Verbal Learning, Supra-Span Spatial Learning, Corsi Block test, Autobiographical memory, Italian Questionnaire for Public Events, Fibonacci Series, Free Word Association, Famous Events Questionnaire, Autobiographical Memory Inquiry, Paired Associated, Mirror-Tracing Test, Wilcoxon Signed Rank Test, Mirror-Reading of Words, Puzzle Task, Motor Skill Task

Schapiro et al., "The Necessity of the Medial Temporal Lobe for Statistical Learning."	LSJ	encephalitis	57	F	Combined	US	unclear	unclear	unclear	unclear	unclear	NA	Famous Faces, Famous Landmarks, Wechsler Memory Scale II, WAIS-IV, Visual Object and Space Perception Battery, Montreal Battery of Evaluation of Amusia
Schnider et al., "Dissociation of Color From Object in Amnesia."	A	stroke	66	M	Combined	Switzerland	disorientation in time and space	hypertension, myocardial infarctions twice, three aortocoronary bypasses, anterior myocardial aneurysm	unclear	7d	6m	improve	Digit Span, Corsi Cubes, Rey Auditory Verbal Learning Test, Rey Figural Learning Test, copied Rey Complex Figure, Color Naming and Color Recognition, 16 hue Farnsworth Color Perception Test
Siebert and Warrington, "Spared Retrograde Memory with Anterograde Amnesia and Widespread Cognitive Deficits."	TW	TBI, stroke	26	M	Anterograde	UK	unclear	post-meningitis sequelae, left humerus neck impacted fracture	unclear	unclear	6w	stable	Contemporary Famous Faces, WAIS-R, National Adult Reading Test, Graded Naming Test, Visual Object and Space Perception Battery, Object Decision test, Wisconsin Card Sorting Test, Recognition Memory Test, Story Recall, List Learning, Figure Recall parts of the Adult Memory and Information Processing Battery, Wechsler Memory Scale, Paired-Associates Learning test, Famous Faces Test, Autobiographical Memory Interview, Crovitz test
Snyder et al., "Artery of Percheron Infarction with Persistent Amnesia."	A	stroke	40	F	Combined	Canada	alert, disorientation, lack of judgement, some impulsiveness	recurrent deep vein thrombosis (DVT)	4m	1d	1y	stable	unclear
Solcà et al., "Impairment of Semantic Memory after Basal Forebrain and Fornix Lesion."	TW	post-surgery	54	F	Anterograde	Switzerland	none	none	6w	2w	8w	semantic memory improved slightly	Visual Recognition, Copy of Geometrical Figures and Drawings, Verbal Span, Episodic Memory CERAD, Autobiographical Memory Interview, Cambridge Semantic Battery, Word BECS-GRECO, Picture BECS-GRECO
Speedie and Heilman, "Amnesic Disturbance Following Infarction of the Left Dorsomedial Nucleus of the Thalamus."	A	stroke	33	M	Anterograde	US	disorientation and confusion	past psychiatric history	unclear	unclear	unclear	NA	Wechsler Adult Intelligence Test, Boston Naming Test, Wisconsin Card Sorting Test, Wechsler Memory Scale, Rey Auditory Verbal Learning Task, Rey Osterrieth Complex Figure, Kimura's Recurring Figures Technique, Ben Seltzer Retrograde Amnesia Questionnaire, Logical Memory Stories, Paired Associates
Stuss et al., "The Neuropsychology of Paramedian Thalamic Infarction."	RC	stroke	54	M	Combined	Canada	apathetic, unconcerned, disoriented for time	hypertension	6m	unclear	12m	stable	Wechsler Adult Intelligence Scale, Wechsler Memory Scale, Benton Visual Retention Test, Three word Memory, Consonant Trigrams, Retrograde Amnesia Test, Remote Memory Test, Knowledge of Generic Facts, Knowledge of Singular Facts
Takahashi et al., "Amnesia as a Result of Symmetrical Infarction of the Bilateral Fornices."	A	stroke	51	M	Combined	Japan	none	unclear	unclear	0d-2w	8m	improve	Miyake Memory Test, MMSE
Tsukiura et al., "Preserved Ability to Recognize Keywords Related to Remote Events in the Absence of Retrieval of Relevant Knowledge."	EC	encephalitis	52	F	Combined	Japan	mild personality change, disoriented to time and place	none	unclear	about 1m	unclear	NA	Public Event Test, modified version of the Dead or Alive Test, Wechsler Memory Scale-Revised, Rey Complex Figure, Rey Auditory Verbal Learning Test, Digit span, MMSE, Wechsler Adult Intelligent Scale-Revised, Autobiographical Incidents Schedule and the Personal Semantic Memory Test, Public Event Test, Dead or Alive Test, Public Semantic Memory Test
Valenstein et al., "RETROSPLIAL AMNESIA." Tsukiura et al., "Preserved Ability to Recognize Keywords Related to Remote Events in the Absence of Retrieval of Relevant Knowledge."	A	hemorrhage	39	M	Combined	US	confused, somnolent, orientated only for person	AVM	1m-5m	9m	2y	improve	Wechsler Adult Intelligence Scale-Revised, Verbal Fluency, Proverb Interpretations, Stroop, Visual-Verbal Test, Wisconsin Card Sorting test, Albert Remote Memory Battery, Wechsler Memory Scale-I, California Verbal Learning Test, Milner Facial Memory Task, Benton Visual Recognition Task, Rey Osterrieth Figure, Word Lists (California), Peterson-Peterson Words (visual presentation), Peterson-Peterson Words (auditory presentation), Albert Remote Memory, Florida Recent/Remote, Personal Autobiographical

Vann et al., "Memory Loss Resulting from Fornix and Septal Damage."	DN	surgery, hematoma	25	M	Combined	UK	unclear	pre-surgery seizure	8m, 20-21m, 32m, 4-4.5y	26m	4y	stable	Warrington Recognition Memory Test, WMS-III, WAIS-III, WTAR, FAS, RMT-Immediate, Doors and People Test, Adult Memory and Information Processing Battery (AMIPB), Hayling and Brixton Tests of Dysexecutive Syndrome, Remember/Know, RMT-Delayed, Autobiographical Memory Interview, WMS-R, RMT-Delayed, Autobiographical Memory Interview, WMS-R
von Cramon and Schuri, "The Septo-Hippocampal Pathways and Their Relevance to Human Memory."	DC	post-surgery	25	M	Combined	Germany	somnolent, disoriented	moderate meningism, left atrium vascular malformation	3m, 9m	9m	9m	improve	extended German version of part A of the "Trail Making Test", Paced Serial Addition Task, Standard Progressive Matrices, Digit Span, Word Span, Free Recall of a 10-item Word List, Reading Span, Corsi Block Tapping Test, Free Immediate Recall of a Story, Story Recall after 48 hours, Learning of 8 Word Paired Associates, California Verbal Learning Test, Recurring Words Test, LGT-3: Verbal Memory, Complex Figure Test, Figural Selective Reminding Test, Recurring Figures Test, Recognition Memory for Faces, Recognition of 10 Faces after 48 hours, LGT-3: Visual Memory
Von Cramon, Hebel, and Schuri, "A CONTRIBUTION TO THE ANATOMICAL BASIS OF THALAMIC AMNESIA."	B4	stroke	58	F	Anterograde	Germany	unclear	unclear	unclear	unclear	unclear	NA	Free Recall of a Word List, Free Recall of a 57unit Story, Recognition of Ben ton's Figures, Recognition of 10 Faces, Famous Faces, Life Events, Word Paired-Associates, Face/Name Paired-Associates, Object Paired-Associates, Visually Guided Styling Maze, Auditory Verbal Learning
Von Cramon, Hebel, and Schuri, "A CONTRIBUTION TO THE ANATOMICAL BASIS OF THALAMIC AMNESIA."	2	stroke	42	F	Combined	Germany	unclear	unclear	12m	unclear	unclear	NA	Digit Span, Block Span, Free Recall of a Word List, Free Recall of a 57 unit Story, Recognition of Benton's Figure, Free Recall of a 57 unit Story, Recognition of 10 Faces, Famous Faces, Life Events, Word Paired Associates, Face/Name Paired Associates, Object Paired Associates, Visually Guided Styling Maze, Auditory Verbal Learning
Wank et al., "Autobiographical Memory Unknown."	A	stroke	80	M	Combined	US	unclear	prior stroke, hypertension, chronic depression	1.5y	1.5y	unclear	unclear	Autobiographical Memory Interview, Famous Faces Task, Famous Landmarks Task, Social and Non-Social Concepts Task, Personality Trait Self Ratings, WAIS-IV, WMS-IV, Pyramids and Palm Trees, Boston Naming Test-II, Boston Naming Test-II, Verbal Phonemic and Animal Fluency, Trail Making Test A & B, Historical Events performance, Autobiographical Interview, Life Story Task, Self-Defining Memory Task, Tennessee Self-Concept Scale-II, Self-Projection Task
Wheatley and McGrath, "Co-Occurrence of Executive Impairment and Amnesic Syndrome Following Sub Arachnoid Haemorrhage."	PP	hemorrhage	37	M	Combined	UK	disoriented for time and place, withdrawn, confused, impoverished in activity, confabulated	a standard transphenoidal hypophysectomy for non functioning pituitary adenoma	unclear	unclear	unclear	unclear	N.A.R.T., Shipley-Hartford Vocabulary, Shipley-Hartford Vocabulary Matrices, Oldfield Wingfield Object Naming Test, Verbal Fluency (F.A.S.), Rey Osterrieth Complex Figure Copy, WMS-R, Digit span, RBMT, Autobiographical Memory Interview, Dead or Alive Test
Wicklund and Knopman, "Brain MRI Findings in Wernicke Encephalopathy."	A	Wernicke's encephalopathy	71	F	Combined	US	disorientation, fluctuating alertness, diplopia	myelofibrosis, stroke with secondary generalized tonic-clonic seizures	unclear	unclear	unclear	NA	unclear
Yasuda, Watanabe, and Ono, "DISSOCIATION BETWEEN SEMANTIC AND AUTOBIOGRAPHIC MEMORY: A CASE REPORT."	MN	post-surgery	56	F	Combined	Japan	right eye vision blur, diabetes insipidus, nervous, selfish, aggressive, insomnia	meningioma, Lineac radiation	6y	6y	unclear	NA	Paired-Associate Learning Test, WAIS-R, Benton Visual Retention Test, Wechsler Adult Intelligence Scale-Revised, Free Recall of Autobiographic Events, Photograph Description, Portraits Naming, Map Drawing, Public Events, Personally-involved Public Events, Historical Figures, Famous Singers, Famous Entertainers, Map Drawing, City Locations, Famous Monuments, Music, Technical Terms, and Other Memories

Yoon, Na, and Park, "Retrograde Amnesia Associated with Fornix Lymphoma."	A	tumor	65	M	Combined	Korea	personality changes (apathy and indifference), unawareness	stroke, diabetes	unclear	15d	3m (representative observation)	stable	MMSE, Seoul Neuropsychological Screening Battery, Korean version of the Boston Naming Test, Copy of Rey-Osterrieth Complex Figure, Rey-Osterrieth Complex Figure, Seoul Verbal Learning Test, Controlled Oral Word Association and Stroop Color-Word Interference Test, Digit span, Korean Public Event Recall Test
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Supplementary Table 5 Quality appraisal result of amnesia cases

Subject	Citation	1.selection bias	2.exposure	3.outcome	4.attribution error	5.pre- event accessment	6.post- event assessment	7.assessment related images	8.replicability	overall appraisal
Abbate_A	Abbate et al., "Delusion of Inanimate Doubles."	unclear	good	good	good	poor	good	poor	good	some concerns
Abe_A	Abe et al., "Amnesia after a Discrete Basal Forebrain Lesion."	unclear	good	good	good	unclear	poor	good	good	high
Adamovich_A	Adamovich et al., "Teaching NeuroImages."	poor	good	poor	poor	unclear	poor	poor	poor	low
Amuluru_A	Amuluru, Filippi, and Lignelli, "Acute Amnesia Due to Isolated Mammillary Body Infarct."	good	good	poor	good	good	unclear	good	poor	low
Arai_A	Arai, "Severe Amnesia after a Restricted Lesion in the Left Hippocampal Body."	unclear	good	good	good	unclear	unclear	good	good	high
Asiri_A	Asiri, Aljarallah, and Alayed, "Polyneuropathy and Korsakoff Syndrome Complicating Sleeve Gastrectomy."	unclear	good	poor	good	good	good	unclear	poor	low
Azevedo_A	Azevedo Kauppila et al., "Memory Impairment Due to Bilateral Fornix Infarction."	unclear	good	poor	poor	unclear	good	good	good	high
Babinsky_P E	Babinsky et al., "Clinical Case Report: Memory Functions after Anterior Communicating Artery Aneurysm Rupture."	unclear	good	good	good	unclear	good	good	unclear	some concerns
Baird_A	Baird and Robinson, "Novel Cognitive Insights from the First Year after Bi- Thalamic Infarct."	unclear	good	good	good	good	unclear	poor	good	some concerns
Beglinger_BR	Beglinger, Haut, and Parsons, "The Role of the Mammillary Bodies in Memory: A Case of Amnesia Following Bilateral Resection."	unclear	good	good	good	unclear	good	poor	good	some concerns

brown_A	Brown et al., “Isolated, Relative Aproverbia without Focal Lesion.”	unclear	good	poor	good	poor	poor	good	poor	low
Buccione_ AS	Buccione et al., “Retrograde Episodic and Semantic Memory Impairment Correlates with Side of Temporal Lobe Damage.”	unclear	good	good	good	good	poor	unclear	good	some concerns
Cachia_A	Cachia et al., “Selective Cognitive Patterns Resulting from Bilateral Hippocampal Ischemia.”	unclear	good	poor	good	good	good	good	poor	low
Caglio_A	Caglio et al., “Virtual Navigation for Memory Rehabilitation in a Traumatic Brain Injured Patient.”	unclear	good	poor	good	good	poor	poor	poor	low
Calabrese_ A	Calabrese et al., “Right Temporofrontal Cortex as Critical Locus for the Ecphory of Old Episodic Memories.”	unclear	good	good	good	good	poor	poor	good	some concerns
Carlesimo_ A	Carlesimo et al., “ANALYSIS OF THE MEMORY IMPAIRMENT IN A POST- ENCEPHALITIC PATIENT WITH FOCAL RETROGRADE AMNESIA.”	unclear	good	good	good	poor	good	poor	good	some concerns
Carrasco_ A	Carrasco et al., “Spontaneous Acute Hemorrhage within a Subependymoma of the Lateral Ventricle.”	unclear	good	poor	good	good	poor	unclear	poor	low
Caulo_A	Caulo et al., “Functional MRI Study of Diencephalic Annesia in Wernicke–Korsakoff Syndrome.”	unclear	good	poor	good	good	poor	poor	poor	low

	Chan et al., "Extensive and Temporally Ungraded Retrograde Amnesia in Encephalitis Associated With Antibodies to Voltage-Gated Potassium Channels."	unclear	good	good	good	poor	good	good	good	high
Chan_KC2	Chen, Zayas, and Gold, "Anterograde Amnesia and Fornix Infarction."	poor	good	poor	good	good	poor	good	poor	low
Chen_A										
	Clarke et al., "Pure Amnesia after Unilateral Left Polar Thalamic Infarct: Topographic and Sequential Neuropsychological and Metabolic (PET) Correlations."	unclear	good	good	good	poor	poor	good	good	high
Clarke_A	Coffey, "Hypothalamic and Basal Forebrain Germinoma Presenting with Amnesia and Hyperphagia."	unclear	good	poor	good	poor	good	good	poor	low
Coffey_A	Collinson, Meyyappan, and Rosenfeld, "Injury and Recovery."	unclear	good	poor	good	poor	poor	good	poor	low
Collinson_A	"ESO-WSO 2020 Joint Meeting Abstracts."	poor	poor	poor	poor	poor	poor	unclear	poor	low
Conesa_A										
	Von Cramon, Hebel, and Schuri, "A CONTRIBUTION TO THE ANATOMICAL BASIS OF THALAMIC AMNESIA."	good	poor	poor	poor	poor	poor	poor	poor	low
Cramon_A	Di Gennaro et al., "Severe Amnesia Following Bilateral Medial Temporal Lobe Damage Occurring on Two Distinct Occasions."	poor	good	poor	poor	good	good	good	poor	low
DiGennaro_A										

Dromerick_A	Dromerick et al., “Simultaneous Bilateral Thalamic Hemorrhages Following the Administration of Intravenous Tissue Plasminogen Activator.”	poor	good	poor	good	poor	good	good	poor	low
Edelstyn_A	Edelstyn et al., “Contribution of the Left Dorsomedial Thalamus to Recognition Memory: A Neuropsychological Case Study.”	poor	good	good	poor	poor	poor	unclear	poor	some concerns
Ernst_A	Ernst et al., “Autobiographical Memory and the Self in a Single-Case of Chronic Unilateral Spatial Neglect.”	unclear	good	good	good	poor	poor	poor	good	some concerns
Fertl_A	Fertl et al., “Persistent Amnesic Syndrome as Long- Term Outcome of Cognitive Function after Whipple’s Disease.”	unclear	good	good	good	good	good	poor	good	some concerns
Fujii_A	Fujii et al., “DISPROPORTION ATE RETROGRADE AMNESIA IN A PATIENT WITH HERPES SIMPLEX ENCEPHALITIS.”	unclear	good	good	good	good	good	good	good	high
Futamura_A	Futamura et al., “Singular Case of the Driving Instructor.”	unclear	poor	poor	poor	poor	poor	unclear	poor	low
Gainotti_A	Gainotti et al., “Retrograde Amnesia in a Patient with Retrosplenial Tumour.”	unclear	good	good	good	poor	good	good	good	high
Gentilini_A	Gentilini, De Renzi, and Crisi, “Bilateral Paramedian Thalamic Artery Infarcts.”	unclear	unclear	poor	poor	poor	poor	good	poor	low
Goldenberg_A	Goldenberg et al., “Basal Forebrain Amnesia.”	poor	good	good	good	good	poor	unclear	good	some concerns
GraffRadford_A	Graff-Radford, Tranel, and Van, “DIENCEPHALIC AMNESIA.”	unclear	good	good	good	good	poor	good	good	high

GraffRadford_B	Graff-Radford, Tranel, and Van, "DIENCEPHALIC AMNESIA."	unclear	good	good	good	good	poor	good	good	high
Grewal_A	Grewal, "Severe Amnesia Following a Unilateral Temporal Lobe Stroke."	poor	good	good	good	good	poor	unclear	poor	some concerns
Grilli_DW	Grilli et al., "The Contribution of the Left Anterior Ventrolateral Temporal Lobe to the Retrieval of Personal Semantics."	unclear	good	good	good	unclear	poor	unclear	good	some concerns
Grilli_MK	Grilli et al., "The Contribution of the Left Anterior Ventrolateral Temporal Lobe to the Retrieval of Personal Semantics."	unclear	good	good	good	good	poor	unclear	good	some concerns
Guberman_1	Guberman and Stuss, "The Syndrome of Bilateral Paramedian Thalamic Infarction."	unclear	good	poor	poor	good	good	unclear	poor	low
Hashimoto_A	Hashimoto, Tanaka, and Nakano, "Amnesic Confabulatory Syndrome after Focal Basal Forebrain Damage."	poor	good	good	good	poor	poor	good	good	some concerns
Hirayama_A	Hirayama, "Limbic Encephalitis Presenting with Topographical Disorientation and Amnesia."	unclear	good	poor	good	poor	good	good	poor	low
Hodges_Carpenter_1	Hodges and Carpenter, "Anterograde Amnesia with Fornix Damage Following Removal of IIIrd Ventricle Colloid Cyst."	unclear	good	good	good	poor	unclear	poor	good	some concerns
Hodges_Carpenter_2	Hodges and Carpenter, "Anterograde Amnesia with Fornix Damage Following Removal of IIIrd Ventricle Colloid Cyst."	unclear	good	good	good	poor	unclear	unclear	good	some concerns

	Hodges and McCarthy, “Autobiographical Amnesia Resulting from Bilateral Paramedian Thalamic Infarction. A Case Study in Cognitive Neurobiology.”	unclear	good	good	good	good	unclear	poor	good	high
Hodges_McCarthy_A	Honda et al., “P300 Abnormalities in Patients with Selective Impairment of Recent Memory.”	unclear	good	poor	unclear	unclear	unclear	unclear	poor	low
honda_4	Honda et al., “P300 Abnormalities in Patients with Selective Impairment of Recent Memory.”	unclear	good	poor	poor	good	unclear	good	poor	low
Honda_6	Honda et al., “P300 Abnormalities in Patients with Selective Impairment of Recent Memory.”	unclear	good	poor	poor	good	unclear	good	poor	low
honda_7	Jamjoom et al., “Autobiographical Memory Loss Following a Right Prefrontal Lobe Tumour Resection.”	unclear	good	poor	poor	good	unclear	unclear	poor	low
Jamjoom	Kapur et al., “FOCAL RETROGRADE AMNESIA FOLLOWING BILATERAL TEMPORAL LOBE PATHOLOGY.”	unclear	good	good	good	good	unclear	good	good	high
kapur_A	Kapur et al., “Anterograde but Not Retrograde Memory Loss Following Combined Mamumillary Body and Medial Thalamic Lesions.”	unclear	good	good	good	good	good	good	good	high
Kapur_B	Kapur and Brooks, “Temporally-Specific Retrograde Amnesia in Two Cases of Discrete Bilateral Hippocampal Pathology.”	unclear	good	good	unclear	good	good	good	good	high
Kapur_Brooks_A										

	Kapur and Brooks, "Temporally- Specific Retrograde Amnesia in Two Cases of Discrete Bilateral									
Kapur_Brooks_B	Hippocampal Pathology."	unclear	good	good	poor	good	good	good	good	some concerns
	Kartsounis, Rudge, and Stevens, "Bilateral Lesions of CA1 and CA2 Fields of the Hippocampus Are Sufficient to Cause a Severe Amnesic Syndrome in Humans."	unclear	good	good	unclear	good	poor	unclear	good	some concerns
Kartaounis_A	Kataoka, Furiya, and Ueno, "Limbic Encephalitis With Involvement of Prefrontal Cortices and Persistent Amnesia."	unclear	good	good	good	unclear	good	good	good	high
Kataoka_A	Koll et al., "Acute Amnesic Syndrome with Hippocampal Lesion Due to Influenza B- Associated Encephalopathy."	unclear	good	poor	good	good	good	good	poor	low
Koll_A	Korematsu et al., "Memory Impairment Due to a Small Unilateral Infarction of the Fornix."	unclear	good	good	good	unclear	good	good	good	high
Korematsu_A	Kroll, Markowitsch, and Knight, "Retrieval of Old Memories: The Temporofrontal Hypothesis."	unclear	good	good	unclear	poor	unclear	unclear	good	some concerns
kroll_A	Kroll, Markowitsch, and Knight, "Retrieval of Old Memories: The Temporofrontal Hypothesis."	unclear	good	good	unclear	poor	unclear	unclear	good	some concerns
Kroll_B	Kwan et al., "Dissociations in Future Thinking Following Hippocampal Damage."	unclear	good	good	unclear	poor	unclear	unclear	good	some concerns
Kwan_DA		unclear	good	good	unclear	poor	unclear	unclear	good	some concerns

Kwan_KC	Kwan et al., “Dissociations in Future Thinking Following Hippocampal Damage.”	unclear	good	good	unclear	poor	unclear	unclear	good	some concerns
Levine_A	Levine et al., “Episodic Memory and the Self in a Case of Isolated Retrograde Amnesia.”	unclear	good	good	good	good	unclear	poor	good	some concerns
Iizuka_A	Iizuka, Suzuki, and Mori, “Severe Amnesic Syndrome and Collecting Behavior After Surgery for Craniopharyngioma.”	unclear	good	good	good	unclear	good	unclear	good	some concerns
Maeshima_A	Maeshima et al., “Memory Impairment Caused by Cerebral Hematoma in the Left Medial Temporal Lobe Due to Ruptured Posterior Cerebral Artery Aneurysm.”	unclear	good	poor	good	unclear	good	good	poor	low
Malamut_A	Malamut et al., “Memory in a Case of Bilateral Thalamic Infarction.”	unclear	good	unclear	good	good	unclear	good	poor	some concerns
male_A	Male and Zand, “Isolated Mammillary Body Infarct Causing Global Amnesia.”	unclear	good	poor	good	good	good	good	poor	low
MarinCone sa_A	European Journal of Neurology 2020;27((Marín Conesa E.; Gómez López E.; Martínez Zarco M.; Pellicer Espinosa I.) General Universitary Hospital Reina Sofia De Murcia, Murcia, Spain(Iniesta Valera J.) Neurology, General Universitary Reina Sofia's Hospital, Murcia, Spain):802	unclear	good	poor	unclear	poor	poor	good	poor	low

Markowitsch h_B	Markowitsch, von Cramon, and Schuri, "Mnemonic Performance Profile of a Bilateral Diencephalic Infarct Patient with Preserved Intelligence and Severe Amnesic Disturbances."	unclear	good	good	good	good	unclear	unclear	good	some concerns
Markowitsch h_C	Markowitsch et al., "Verbal Memory Deterioration After Unilateral Infarct of the Internal Capsule in an Adolescent."	unclear	good	unclear	good	good	good	poor	good	some concerns
markowitsch h_D	Markowitsch et al., "Retrograde Amnesia after Traumatic Injury of the Fronto-Temporal Cortex."	unclear	good	good	good	unclear	unclear	unclear	good	some concerns
Markowitsch h_Ewald_A	Markowitsch and Ewald, "Right-Hemispheric Fronto-Temporal Injury Leading to Severe Autobiographical Retrograde and Moderate Anterograde Episodic Amnesia- Implications for the Anatomy of Memory."	poor	good	good	unclear	unclear	good	good	good	some concerns
masuo_A	Masuo et al., "A Case of Amnesic Syndrome Caused by a Subcortical Haematoma in the Right Occipital Lobe."	unclear	good	poor	good	unclear	unclear	good	poor	low
Mccarthy_A	Mccarthy and Warrington, "ACTORS BUT NOT SCRIPTS: THE DISSOCIATION OF PEOPLE AND EVENTS IN RETROGRADE AMNESIA."	unclear	good	good	poor	poor	poor	unclear	poor	some concerns
miller_A	Miller et al., "Right Medial Thalamic Lesion Causes Isolated Retrograde Amnesia."	unclear	good	good	good	good	good	good	good	high

Mori_A	Mori, Yamadori, and Mitani, "Left Thalamic Infarction and Disturbance of Verbal Memory."	unclear	good	poor	unclear	good	good	good	poor	low
Morris_A	Morris et al., "AMNESIA FOLLOWING A DISCRETE BASAL FOREBRAIN LESION."	unclear	good	good	unclear	good	good	unclear	good	some concerns
Mosimann_A	Mosimann et al., "Fornix Infarction and Korsakoff Dementia after Coiling of a Large Anterior Communicating Artery Aneurysm."	unclear	good	poor	unclear	unclear	unclear	unclear	poor	low
Muller_A	Müller et al., "Persistent Klüver-Bucy Syndrome after Bilateral Thalamic Infarction."	unclear	good	poor	good	good	good	unclear	poor	low
Murr_A	Murr et al., "Selective Infarction of the Anterior Geniculate Nucleus Associated with Giant Cell Arteritis."	unclear	good	poor	unclear	good	unclear	unclear	poor	low
OConnor_slinger_A	O'Connor et al., "The Dissociation of Anterograde and Retrograde Amnesia in a Patient with Herpes Encephalitis."	unclear	good	good	good	unclear	good	poor	good	some concerns
Ogden_A	Ogden, "Visual Object Agnosia, Prosopagnosia, Achromatopsia, Loss of Visual Imagery, and Autobiographical Amnesia Following Recovery from Cortical Blindness."	unclear	good	good	good	unclear	good	poor	good	some concerns

oishi_A	Oishi et al., "Pure Topographical Disorientation in Novel Environments without Anterograde Amnesia."	unclear	good	good	unclear	unclear	good	good	good	high
Osawa_A	Osawa et al., "Neuropsychological Deficits Associated with a Tumour in the Posterior Corpus Callosum."	unclear	good	poor	unclear	poor	good	good	poor	low
ouellet_A	Ouellet et al., "Two Routes to Losing One's Past Life."	unclear	good	good	good	good	good	poor	good	some concerns
Pachalska_A	Pachalska et al., "A Case of 'Borrowed Identity Syndrome' after Severe Traumatic Brain Injury."	unclear	good	poor	good	good	good	unclear	poor	low
Park_A	Park et al., "Memory Deficits after Bilateral Anterior Fornix Infarction."	unclear	good	good	good	good	good	good	good	high
park_B	Park, Seo, and Yoon, "Selective Anterograde Amnesia with Thalamus and Hippocampal Lesions in Neuro-Behcet's Disease."	unclear	good	good	good	good	good	good	good	high
Park_C	Park et al., "Amnesic Syndrome in a Mammillothalamic Tract Infarction."	unclear	good	unclear	good	good	unclear	good	poor	some concerns
Parkin_A	Parkin, "IMPAIRMENT OF MEMORY FOLLOWING DISCRETE THALAMIC INFARCTION."	unclear	good	good	unclear	unclear	unclear	unclear	unclear	low
Peru_A	Peru and Fabbro, "Thalamic Amnesia Following Venous Infarction."	unclear	good	good	good	good	good	good	unclear	some concerns
Peters_A	Peters et al., "Postoperative Amnesic State with Impairment of Static Visual Perception."	unclear	good	poor	poor	good	unclear	good	poor	low

Proeh_A	Poreh et al., “Anterograde and Retrograde Amnesia in a Person with Bilateral Fornix Lesions Following Removal of a Colloid Cyst.”	unclear	good	good	good	unclear	poor	good	good	high
Reed_EP	Reed and Squire, “Retrograde Amnesia for Facts and Events.”	unclear	good	good	unclear	unclear	unclear	unclear	unclear	some concerns
Reed_GT	Reed and Squire, “Retrograde Amnesia for Facts and Events.”	unclear	good	good	unclear	unclear	unclear	unclear	unclear	some concerns
Richardson_A	Richardson et al., “Patients Undergoing High Dose Chemotherapy for Primary CNS Lymphoma Should Receive Prophylactic Thiamine to Prevent Wernicke’s Encephalopathy.”	unclear	good	poor	poor	poor	poor	unclear	poor	low
Ruggeri_A	Ruggeri, Guariglia, and Sabatini, “Amnesia after Right Frontal Subcortical Lesion, Following Removal of a Colloid Cyst of the Septum Pellucidum and Third Ventricle.”	poor	good	poor	unclear	poor	good	good	poor	low
Ruggeri_B	Ruggeri, “Left Dorsomedial Thalamic Damage Impairs Verbal Recall More Than Recognition.”	unclear	good	poor	good	unclear	good	good	poor	low
rusconi_A	Rusconi, Morganti, and Paladino, “Long-Lasting Topographical Disorientation in New Environments.”	unclear	good	poor	unclear	unclear	poor	good	poor	low
sala_A	Sala, Spinnler, and Venneri, “Persistent Global Amnesia Following Right Thalamic Stroke: An 11-Year Longitudinal Study.”	unclear	good	good	unclear	good	good	good	good	high
schapiro_A	Schapiro et al., “The Necessity of the Medial Temporal Lobe for Statistical Learning.”	unclear	good	poor	unclear	unclear	good	unclear	poor	low

schneider_A	Schneider et al., "Dissociation of Color From Object in Amnesia."	unclear	good	poor	good	good	good	unclear	poor	low
Siebert_A	Siebert and Warrington, "Spared Retrograde Memory with Anterograde Amnesia and Widespread Cognitive Deficits."	unclear	good	good	good	unclear	unclear	unclear	unclear	low
Snyder_A	Snyder et al., "Artery of Percheron Infarction with Persistent Amnesia."	unclear	good	poor	good	good	good	poor	poor	low
Solca_A	Solca et al., "Impairment of Semantic Memory after Basal Forebrain and Fornix Lesion."	unclear	good	good	good	good	unclear	unclear	good	high
Speedie_A	Speedie and Heilman, "Amnesic Disturbance Following Infarction of the Left Dorsomedial Nucleus of the Thalamus."	unclear	good	poor	poor	poor	good	unclear	poor	low
Stuss_RC	Stuss et al., "The Neuropsychology of Paramedian Thalamic Infarction."	unclear	good	good	good	good	unclear	unclear	good	some concerns
Takahashi_A	Takahashi et al., "Amnesia as a Result of Symmetrical Infarction of the Bilateral Fornices."	unclear	good	poor	unclear	unclear	unclear	good	poor	low
tsukiura_A	Tsukiura et al., "Preserved Ability to Recognize Keywords Related to Remote Events in the Absence of Retrieval of Relevant Knowledge."	unclear	good	good	good	unclear	good	unclear	unclear	some concerns
valenstein_A	Valenstein et al., "RETROSPLINIAL AMNESIA."	unclear	good	good	good	good	good	unclear	good	some concerns
Vann_DN	Vann et al., "Memory Loss Resulting from Fornix and Septal Damage."	unclear	good	good	poor	unclear	poor	good	unclear	some concerns

VonCramo n_2	Von Cramon, Hebel, and Schuri, "A CONTRIBUTION TO THE ANATOMICAL BASIS OF THALAMIC AMNESIA."	unclear	good	poor	unclear	unclear	unclear	unclear	poor	low
VonCramo n_A	von Cramon and Schuri, "The Septo- Hippocampal Pathways and Their Relevance to Human Memory."	poor	good	poor	good	good	good	good	poor	low
Wank_A	Wank et al., "Autobiographical Memory Unknown."	unclear	good	good	good	unclear	unclear	good	good	some concerns
Wheatley_ A	Wheatley and McGrath, "Co- Occurrence of Executive Impairment and Amnesic Syndrome Following Sub Arachnoid Haemorrhage."	unclear	good	good	good	unclear	good	unclear	good	some concerns
Wicklund_ A	Wicklund and Knopman, "Brain MRI Findings in Wernicke Encephalopathy."	unclear	good	poor	poor	unclear	poor	unclear	poor	low
Yasuda_A	Yasuda, Watanabe, and Ono, "DISSOCIATION BETWEEN SEMANTIC AND AUTOBIOGRAPHI C MEMORY: A CASE REPORT."	unclear	good	good	unclear	unclear	good	good	good	some concerns
Yoon_A	Yoon, Na, and Park, "Retrograde Amnesia Associated with Fornix Lymphoma."	unclear	good	poor	good	good	good	good	poor	low

Supplementary Table 6 Brain lesion location analysis for solid lesions in amnesia groups

Brain region	Frequency of lesions presented within each amnesia group (n)			Total (n, %)	P
	Retrograde (n=3)	Anterograde (n=31)	Combined (n=39)		
Papez Circuit	3	31	39	73(100)	-
Frontal lobe	1	8	14	23(31.51)	0.684
Temporal lobe	1	5	9	15(20.55)	0.521
Parietal lobe	0	6	9	15(20.55)	0.889
Occipital lobe	0	5	7	12(16.44)	>0.999
Insular lobe*	2	0	4	6(8.22)	0.002
Cerebellum	0	3	5	8(10.96)	>0.999
<i>Hemisphere Lateralization</i>					
Left hemisphere	0	12	11	23(31.51)	0.192
Right hemisphere	2	5	5	12(16.44)	
Bilateral hemispheres	1	14	23	38(52.05)	

Post-hoc two-group comparison (Bonferroni corrected): *:Retrograde vs. Anterograde
 Insular lobe: * $P=0.015$.

Supplementary Table 7 Lesion laterality in frontal, temporal, and insular lobes for solid lesions

Brain region	Frequency of lesions presented within each amnesia group (n)			Total (n, %)	P
	Retrograde (n=3)	Anterograde (n=31)	Combined (n=39)		
<i>Insular lobe</i>					
Left	0	0	3	3(4.11)	0.339
Right*	2	0	2	4(4.48)	0.003

Post-hoc two-group comparison (Bonferroni corrected): *:Retrograde vs. Anterograde
 Right insular lobe: * $P=0.015$.

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Lesion network analysis: Anterograde and retrograde amnesia

ABSTRACT

Background: Amnesia is a rare disorder of severe memory loss. When it occurs, amnesia most typically impairs the ability to form new memories (anterograde) and recall previously acquired memories (retrograde). However, the underlying neural networks specifically responsible for anterograde encoding versus retrograde retrieval processes are unclear. This study aims to investigate the functional and structural connectivity of lesion networks in patients with anterograde and retrograde amnesia.

Methods: We systematically reviewed amnesia case reports and case series by searching Embase and PubMed (date cutoff: July 20th, 2022) and identified 118 amnesia cases in which both anterograde and retrograde memory functions were clinically assessed. We used the normative maps of the functional and structural human connectomes to map the lesion networks using functional and structural connectomes in amnesia patients. We applied a permutation analysis of linear models (PALM) strategy to a two-sample t-test specificity paradigm of lesion networks for anterograde amnesia and retrograde amnesia to identify neural substrates that are specifically associated with memory encoding and memory retrieval processes, respectively.

Results: Our results showed that the onset of amnesia was highly related to the right hippocampus and left parahippocampal gyrus. The right frontal midorbital gyrus and right middle temporal lobe were predominantly associated with retrograde amnesia, particularly involving the right inferior occipitofrontal fasciculus, uncinate fasciculus, and arcuate fasciculus. In contrast, the right anterior and superior cerebellum, the left superior frontal lobe, and the left superior and inferior colliculi were more functionally associated with anterograde amnesia.

Conclusions: Our study supports the primary role of the bilateral medial temporal lobes (MTLs) in human memory. Moreover, our results suggest that retrograde and anterograde amnesia have distinct neural networks.

Keywords: remote memory; lesion network mapping; functional connectivity; structural connectivity; working memory; fiber track

INTRODUCTION

Amnesia is a severe memory disorder that can present clinically in various forms. Anterograde amnesia (AA) results in the inability to form new memories after a specific event, while retrograde amnesia (RA) is the loss of memories before the event. Understanding the neural networks underlying these two forms of amnesia can provide insights into the complex interactions and separations of brain networks involved in human memory coding and retrieval. Lesion network analysis is an emerging approach that measures the effect of brain lesions on structural and functional connectivity in human brains, enabling scientists to study how lesions affect brain networks and their function. This study utilized lesion network mapping techniques to comprehensively understand the networks contributing to amnesia in patients with anterograde and retrograde amnesia. We intend to identify intervention targets for patients with memory disorders and, potentially, those seeking memory enhancement.

Previous research has identified multiple brain regions and structures related to memory processes. Still, our work focuses on understanding the collaborative and specific networks of anterograde and retrograde memory contributing to amnesia, providing a more comprehensive understanding of the neural basis of memory disorders. Previously, we published our systematic review of amnesia case reports, including 118 cases with both anterograde and retrograde memory tested and traceable brain lesion images. Our study was based on this cohort and may have implications for a wide range of memory disorders, spanning severe memory loss in Alzheimer's disease to dysregulated memory recall in posttraumatic stress disorder (PTSD).

Localization of memory circuits that are relevant to these disorders may potentially inform translation into focal brain circuit therapeutic strategies such as transcranial magnetic stimulation (TMS), deep brain stimulation (DBS) treatment planning, or even surgical lesioning techniques such as high-intensity focused ultrasound (HIFU).

METHODS

Data resources (patients and lesions)

We systematically reviewed case reports and case series included by Embase and PubMed (up to July 20th, 2022) to collect 118 amnesia cases, measured in both anterograde and retrograde memory perspectives. We excluded cases not published in English, those not examined for both anterograde and remote memory, those without sufficient details, cases with transient/reversible amnesia, drug/toxicity-induced amnesia, epilepsy-related/severe confusion, functional amnesia, disproportionate global cognitive impairment to memory loss, brain atrophy, atypical or selective memory loss, or without traceable lesion in brain scans. We attached the PRISMA flow chart of our amnesia cohort in Supplementary Figure 1. Lesions were manually traced in binary 2D NIfTI format and mapped onto a standard brain template (MNI152 standard-space T1-weighted average structural template image, 2mm, asymmetry, 2009b). Based on the severity of anterograde and retrograde memory damage, cases were rated and categorized into three groups: predominately retrograde amnesia (12%), predominately anterograde amnesia (31%) and combined anterograde and retrograde amnesia (57%).

Lesion preprocessing

To ensure the quality of our lesion mapping, we performed several preprocessing steps. First, we checked for any voxel overload outside the brain mask and removed them. Then, we created a

lesion overlap map to provide an overview of the lesions in the 118 amnesia cases. We used the MNI152_T1_2mm_brain_mask_dil as our brain mask in the imaging analysis pipeline. All analyses were conducted using Python 3.9 on the Jupyterhub server of Mass General Brigham. These preprocessing steps ensured the accuracy and quality of our lesion network mapping analyses.

Lesion network mapping

Lesion network mapping is a powerful tool that matches lesions of a specific symptom or disease to functionally or structurally connected brain regions(1–3). This study utilized lesion network mapping to investigate the neural basis of anterograde and retrograde amnesia. For functional connectivity analysis, we tested the resting state functional connectivity between each voxel of our amnesia lesions to the rest of the brain. Based on the Harvard genomic superstruct project, the standard functional connectivity map was generated from a 1000-healthy volunteer resting-state functional MRI data from Yeo(4). This method has been developed by Fox et al.(2) and has been tested on multiple diseases and symptoms. On the other hand, for structural connectivity analysis, using the Brain Connectivity Blueprint (BCB) Disconnectome, we traced our lesions and compared them with the diffusion-weighted imaging (DWI) data from 178 healthy subjects with 1mm resolution from the Human Connectome Project (HCP) 7T dataset. We utilized the method developed by Chris et al.(5) to track fibers passing through each lesion location and investigate the impact of these lesion locations on the structural connectivity probability map. This approach offers valuable insights into the relationship between lesion locations and the disruption of structural connectivity in the brain, helping to further our understanding of the neural mechanisms underlying memory impairments. We applied a range of T values to

determine the corresponding two-sided, fractional functional lesion network mapping peak overlap in 118 amnesia patients. We selected a threshold of $t > 4$, fractional threshold > 0.90 , minimum size = 100 mm^3 , and neighbors: “*Faces*” to identify regions of interest (ROIs) in the functional lesion network overlap in amnesia patients. Analyses were conducted using Python 3.9 on the Jupyterhub server of Mass General Brigham and MRICroGL 13.1. We utilized Automated Anatomical Labeling (AAL)(6), the tractography-based atlas of human brain connections(7), and the 3D white matter tract atlas(8) as brain atlases for locating gray matter and white matter tracts.

Three-group comparison using Permutation Analysis of Linear Models (PALM) comparing RA to AA for functional and structural connectivity analyses

Permutation Analysis of Linear Models (PALM) is a widely used tool for functional and structural connectivity analyses, which has the advantage of detecting multiple brain structure interactions and associations with specific cognitive or behavioral processes while adjusting for the risk of multiple comparisons using family-wise error rate (FWER) or false discovery rate (FDR)(9,10). To compare RA to AA for functional and structural connectivity analyses, we used PALM to build a three-group comparison design matrix and contrast matrix ["RA vs. AA"] = [0, 1, -1, 0, 0, 0], adjusting for age, sex, and lesion property (solid or diffuse lesions). Since lesion volume overwhelmed other covariates and dependents and led to dependence to zero, we did not adjust for lesion volume in this analysis. We performed PALM analyses separately for functional and structural connectivity, yielding voxel-based FWER-corrected p -maps, and voxel-based FDR-corrected p -maps. All p values were set to < 0.05 .

RESULTS

Amnesia Overall View

In this study, we analyzed 118 amnesia cases for our lesion network analysis, which included 14 (12%) predominately retrograde amnesia cases, 37 (31%) predominately anterograde amnesia cases, and 67 (57%) combined retrograde and anterograde amnesia cases. Figure 1 displays the lesion overlap in the 118 amnesia cases, with red areas representing more common amnesia-related regions than yellow areas. The most affected areas include bilateral medial temporal lobes (MTLs), fornices, and thalami, with a particular emphasis on the anterior thalamic nuclei (ATNs).

We conducted a lesion network overlap analysis for the 118 amnesia cases using a t -value > 4 and an overlap threshold of $\geq 90\%$, as shown in Figure 2. The regions identified include the mamillary bodies, bilateral hippocampi and parahippocampal gyri, fornices, precuneus, lingual gyri, posterior cingulate gyri, cerebral peduncle, and medial and lateral geniculate nuclei. By applying a fraction (> 0.90) and voxel size ($\geq 100 \text{ mm}^3$) threshold, along with the voxel clustering mode ("*Face*"), we determined that the peak regions of interest (ROIs) are in the right hippocampus and the left parahippocampal gyrus (Table 1 and Figure 2).

Functional connectivity map: Anterograde vs. retrograde memory

We conducted a three-group comparison for AA and RA components, using AA as the comparison group. The voxel-wise FDR-corrected p map of functional connectivity revealed that AA relies heavily on the midline structure of the brain, the left cerebrum, and the right cerebellum. At the same time, RA depends more on the right frontal lobe and bilateral temporal lobes. To further investigate the key structures in AA and RA and simplify the results, we used a

more stringent voxel-wise FWE-corrected p map of functional connectivity. This analysis showed that RA was more associated with the right middle temporal lobe and right frontal midorbital gyrus. In contrast, the left superior frontal lobe, the left superior and inferior colliculi, and the right anterior and superior cerebellum were more functionally related to AA (Figure 3).

Structural connectivity map: Anterograde vs. retrograde memory

Similarly, we conducted a three-group comparison for AA and RA components, using AA as the comparison group, but this time employing our structural connectome. The voxel-wise FWE-corrected p map revealed that RA was associated with the inferior occipitofrontal fasciculus, uncinate fasciculus, and arcuate fasciculus (anterior and posterior segment), and only in the right hemisphere (Figure 4 A and B).

DISCUSSION

Our study is based on a systematic review of amnesia case reports with 2D lesion images available in the literature. By examining 118 amnesia cases, we demonstrated the pivotal role of bilateral hippocampal structures in amnesia onset and the right middle temporal lobe and right frontal midorbital gyrus in remote memory. Our results indicate the importance of the right-sided inferior occipitofrontal fasciculus, uncinate fasciculus, and arcuate fasciculus in forming the remote memory network. In contrast, our data suggest that the right cerebellum, left frontal lobe, and left superior and inferior colliculi are more specifically associated with AA, indicating different neural networks underlying the two types of memory.

The medial temporal lobes (MTLs) are crucial in amnesia, particularly the bilateral hippocampi and parahippocampi. Our study further confirms this conclusion through functional connectivity

analysis. Additionally, our functional connectivity analysis supports the specific role of the right middle temporal lobe and right frontal midorbital gyrus in RA, which is consistent with previous findings that the neocortex may function as a tertiary component or a storage site for remote memory, intertwining with the MTLs, especially the hippocampal structures, to be co-affected in RA.

To interpret the structural connectivity-derived fiber tracks composing the retrograde amnesia network, here we recall the anatomy of these involved fibers and their related functions in the brain network known to us previously. In our results, the arcuate fasciculus, including the anterior and posterior segments, connects the inferior frontal to the inferior parietal lobe and the inferior parietal to the temporal lobe, respectively; the uncinate fasciculus connects the anterior temporal pole to the orbital frontal and inferior frontal cortex(11); and the inferior occipitofrontal fasciculus connects "the occipital lobe, the temporal-basal area, superior parietal lobe, and the precuneus to the frontal lobe"(12).

As we know, the uncinate fasciculus plays an important role in the limbic system(11), associated with episodic memory, semantic memory(12), and the language system. It is also believed to be associated with particular types of learning and memory(11). Fink *et al.* discovered that the right uncinate fasciculus was associated with auditory-verbal memory in multiple sclerosis(13).

However, no convincing proof has linked the uncinate fasciculus to episodic memory. Current evidence only supports that the uncinate fasciculus acts in specific types of associative learning, such as stimuli-associated reward, non-reward, or punishment processing(11,14). Also, previous lesion studies showed that the inferior occipitofrontal fasciculus, especially the right-sided inferior occipitofrontal fasciculus, is involved in visuospatial memory(12,15–17), visual information processing speed, facial emotion recognition(17), and face memory(18), and

semantic memory(19). Additionally, clinical experiments of electrostimulation on the inferior occipitofrontal fasciculus in patients induced vivid visual hallucinations combined with strong emotional and mnemonic contents, indicating that the inferior occipitofrontal fasciculus is involved in a network combining information of “complex visual, mnemonic, and emotional content”(20). Besides associative learning and visual processing, verbal memory may also function in remote memory. The right arcuate fasciculus and the right inferior frontal and superior temporal cortices were found to participate in verbal learning and verbal fluency, according to a study in psychosis patients using structural/diffusion-weighted MRI(21). Similar results of the right arcuate fasciculus's association with verbal memory were also demonstrated in healthy adults(22) and patients with mild traumatic brain injury(23).

Besides what we know of the above independent fiber's role in memory, fibers involved in the RA network detected in our study are known to be responsible for integrating semantic and sensory information for memory(24), which is essential for remote memory. Our research increased our knowledge of how these fibers connected and cooperated to function in remote memory. Also, the RA structural network and its corresponding fiber volume may be useful in predicting patients' prognosis and monitoring patients' treatment effects in the future(19,25). In our study, we observed a brainstem linkage with anterograde memory, consistent with the theory that the brainstem nuclei have structural connectivity with the cortical limbic system, namely the amygdala, insula, and hippocampus, in cognitive function(26). However, the involving nuclei in our study were different from previous studies due to the fact that we are looking for the differential structures responsible for AA and RA. We observed an association between the left superior and inferior colliculi and AA. This indicates that these two sensory-relayed nuclei, which function in visual processing and eye movement coordination, along with

auditory processing and sound localization, play an important role in new memory formation, likely referring to the specific sensory systems naming the visual and auditory systems. They may filter and process these visual and auditory signals and transmit them to the higher cortex, namely, the frontal and temporal cortices(15,26), and help encode new memories(26).

Our cohort's right anterior and superior cerebellum was associated with AA, coherent with the previous theory that “the cerebellum generally supports working memory by engaging inner speech mechanisms”(27). Our results also validated that the crossed cortico-cerebral network, namely the left frontal lobe and right cerebellum, constituting the affective and cognitive network and working memory(28–32), was also responsible for the AA network.

In our study, although 118 amnesia cases were generated from case reports and case series, which has a huge diversity in memory tests taken and reporting quality among each case, 10 out of 118 cases reported had visual deficits ranging from visual hallucination, visual blur, diplopia, and visual agnosia to visual loss. Notably, in these 10 cases, 5 were combined amnesia, 4 were predominately retrograde amnesia, and 1 was predominately anterograde amnesia. We have many predominately retrograde cases with visual deficits (4 out of 14, 28.6%), which may impact memory test performance in these patients. We have listed all possible confounding (namely “Neuropsychological symptoms” and “Commodities”) that may intervene with memory performance/tests, including sensory deficits (Supplementary Table 1). However, from our experience, except for 3 cases in our cohort with severe visual deficits that may intervene with most of the memory tests, other cases had a relatively acceptable level of remaining visual ability to conduct most of the memory tests, which yielded memory test results with acceptable reliability. Besides, we acknowledge that certain diagnostic tests for amnesia might be biased towards one hemisphere over the other, potentially affecting the assessment of memory

impairments. Due to the limitation of literature case reports, we usually do not have information on the handedness of patients and the dominant brain hemisphere. However, according to a recent meta-analysis study(33), the prevalence of left-handedness is 10.6%, 9.33% for mixed-handedness, and the rest for right-handedness. We assume the individual variance in the dominant brain hemisphere may not change the conclusion in our overall amnesia analysis but may have an unpredictable impact on predominately retrograde amnesia analysis due to a relatively small sample size ($n=14$). On the other hand, the memory tests performed in these cases usually had a comprehensive memory assessment by assessing different aspects of memory functioning. They provided a balanced evaluation of memory impairments across both hemispheres (See Supplementary Table 1). Moreover, our findings were consistent with the previous animal and human studies on the conclusion that the lateralization of hemispheres plays a great part in various memory processes.

In conclusion, our study proves that retrograde memory is highly associated with the participation of verbal memory, visual processing, and associative learning, which requires the involvement of the right inferior occipitofrontal fasciculus, right uncinate fasciculus, and the right arcuate fasciculus. Also, our result supports that the right middle temporal lobe and right frontal midorbital gyrus are essential to retrieving and storing remote memory. On the other hand, our study proposes that the left superior frontal lobe-crossed right anterior-superior cerebellum and the left superior and inferior colliculi participate in new memory encoding, which engages the participation of auditory and visual processing, overt and inner speech, and motor systems.

Our study has the following strengths. First, we derived the respective RA and AA networks using our largest available anterograde and retrograde amnesia lesion cohort, adjusting for age,

sex, and lesion property. We avoided the inter-variability in these confounding variables, which could bias our results to an unpredictable direction when applied to the general population. Second, we used multimodal analyses, including lesion network mapping of functional and structural connectivity at overall amnesia and anterograde and retrograde amnesia levels. This allows us to understand better the underlying networks participating in remote memory, including how the fiber pathways connect the corresponding functional cortex uniquely involved in RA. Our results will shed light on future brain interventions, such as transcranial magnetic stimulation (TMS), in treating remote memory-targeting diseases like post-traumatic stress disorder (PTSD).

Our study has several limitations. We excluded small clusters (e.g., voxel size $< 100\text{mm}^3$) in generating ROIs from functional connectivity network overlaps. Some essential components of memory, such as the fornix, and some sensory fibers and structures supporting memory, such as the optic and olfactory tracts, may not survive such a strict lower threshold of voxel size, which would underestimate some key structures related to causing amnesia. Moreover, although the HCP 7T dataset includes fiber tracts involving the cerebellum, the quality and resolution of tractography in the cerebellum may be lower than that in the cerebral cortex due to the current deficit in technology. This could partially explain the dissociation of fibers involving functional and structural connectomes in RA concerning the cerebellum. Moreover, the mean age for the Yeo healthy subject cohort was 21.3 years, and the HCP 7T dataset consists of healthy adults aged 22-35 years, with only 2 subjects over 36 years old(34). In contrast, the mean age for our amnesia cohort was 49.2 years. We acknowledged the fact that age-related brain structure and function changes might affect the connectivity patterns observed in our analyses, as previous studies had demonstrated the effects of aging on both functional and structural brain

connectivity(35). Although the subjects of structural and functional connectomes picked for our study were much younger than the amnesia cohort, we adjusted age as a crucial confounder in our functional and structural connectivity analyses. This will not eliminate our concerns over age-related connectivity change. However, it will partially explain other variations derived by age in cognitive functions. Besides, our analyses did not adjust for brain volume loss since our study is based on hand-traced 2D lesion images. This may limit our understanding of the broader neuroanatomical changes associated with amnesias, such as mild brain atrophy, and important insights into the relationship between structural brain changes and amnesia. Finally, we cannot draw any causal conclusions from this study because of the limitations of the study design and lesion network mapping strategy.

CONCLUSION

In conclusion, our results showed that the right hippocampus and left parahippocampal gyrus are highly related to the onset of amnesia, which supports the primary role of bilateral medial temporal lobes in human memory. We also found that the right middle temporal lobe and right frontal midorbital gyrus were intensely associated with retrograde amnesia, particularly involving the right inferior occipitofrontal fasciculus, right uncinate fasciculus, and right arcuate fasciculus in forming the remote memory network. These findings suggest the essential roles of verbal memory, visual processing, and associative learning in retrieving and storing remote memories. In contrast, the right anterior and superior cerebellum, the left superior frontal lobe, and the left superior and inferior colliculi were more specifically associated with anterograde amnesia, which indicates the participation of auditory and visual processing, overt and inner speech and motor systems were highly essential in encoding new memories.

SUPPLEMENTARY MATERIALS

Supplementary Figure 1 PRISMA flow chart of amnesia cases

Supplementary Table 1 Case characteristics of 118 amnesia cases

Table 1 Regions of interest (ROIs) within the lesion-derived network overlap in amnesia

Peak MNI coordinates	Peak structure
(20, -24, -8)	Right Hippocampus
(-22, -26, -12)	Left parahippocampal gyrus

Figure 1 Lesion overlap in all amnesia patients

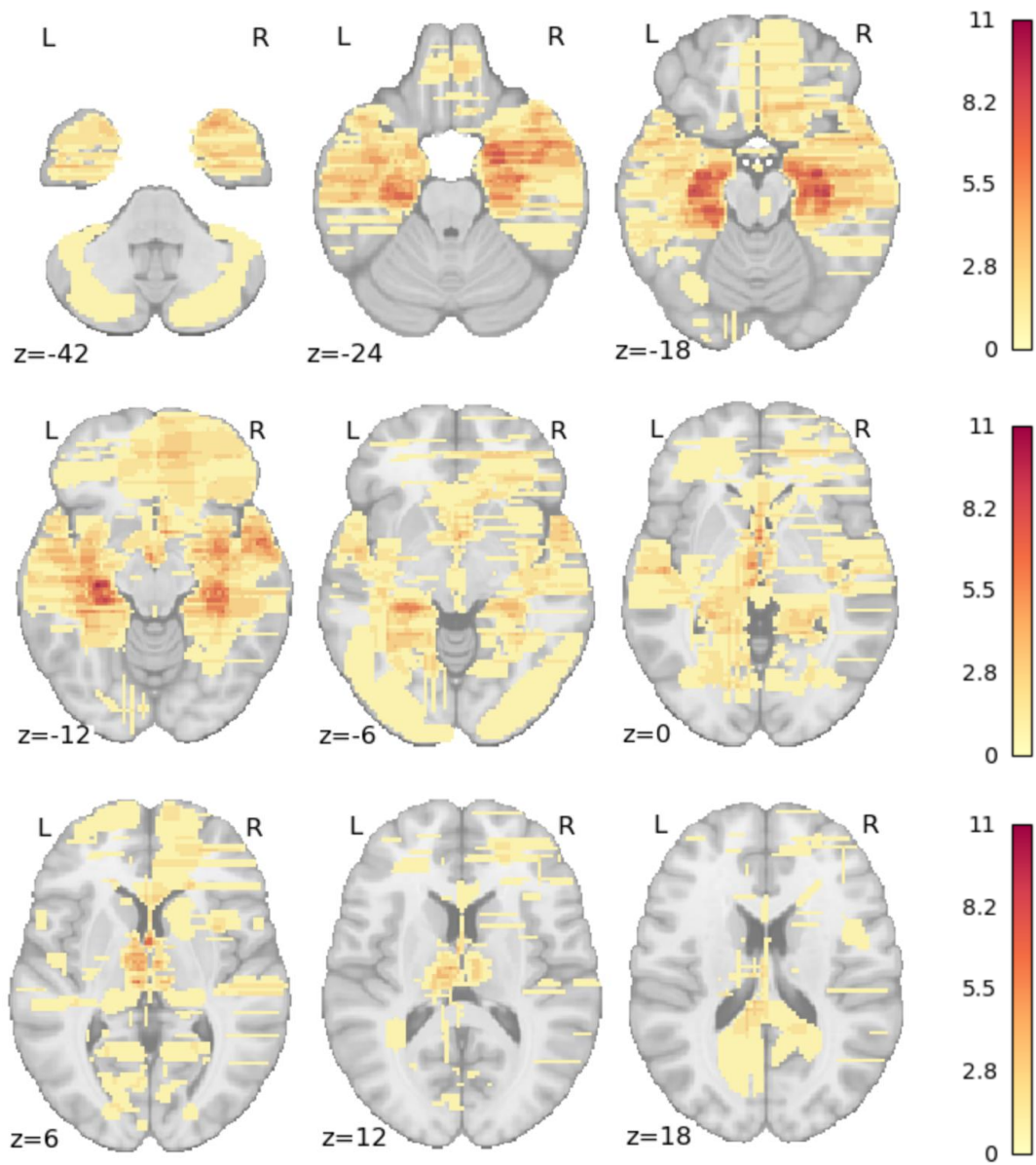
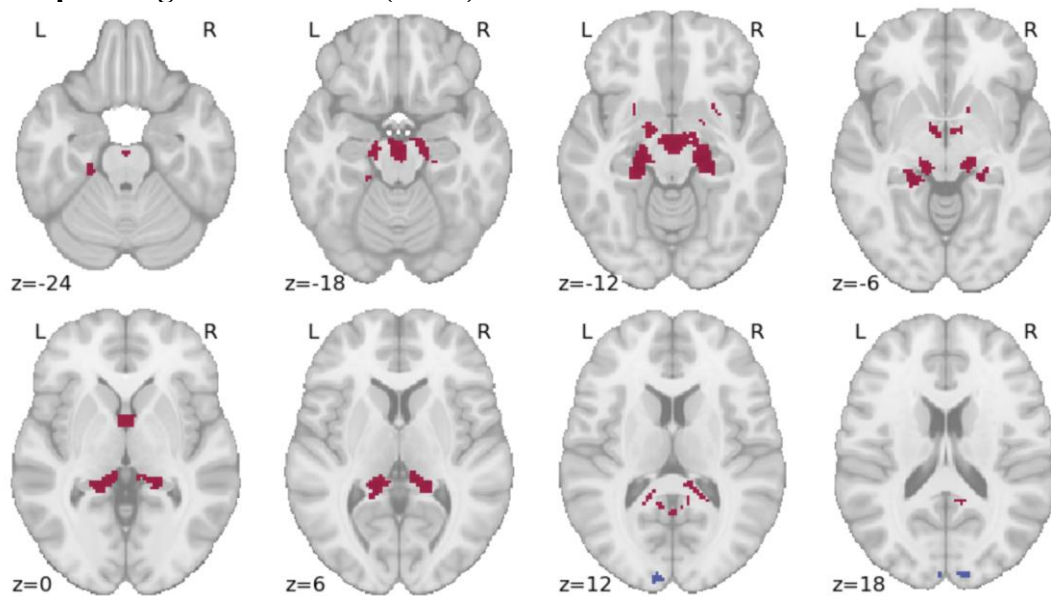
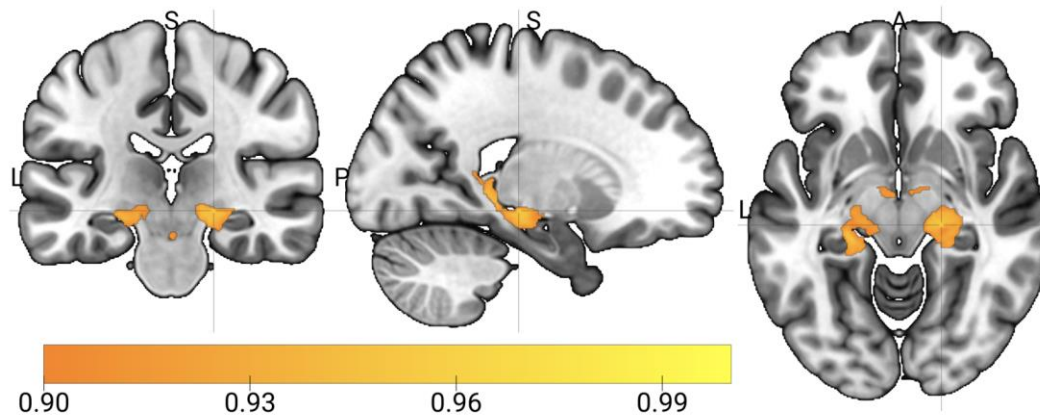


Figure 2 Lesion network overlap for all amnesia cases ($n=118$) ($t\text{-value}>4$, $\geq 90\%$ overlap) and peak regions of interest (ROIs)



ROI #1: Right hippocampus



ROI #2: Left parahippocampal gyrus

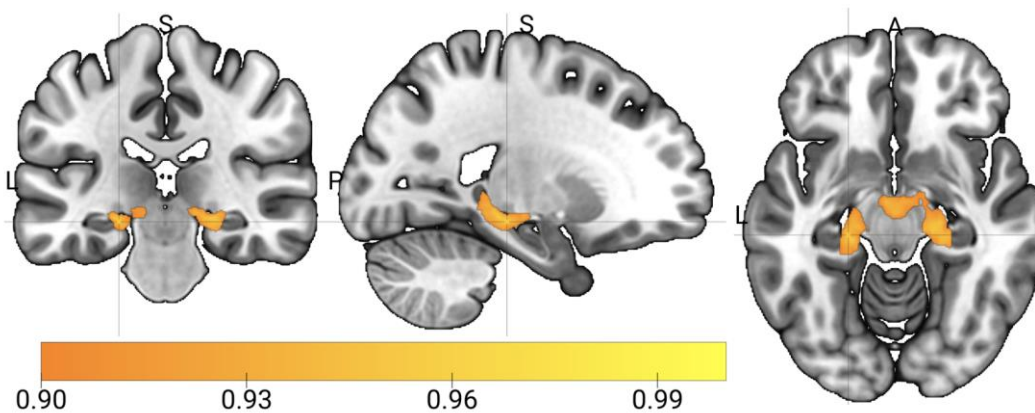


Figure 3 Functional connectivity analysis comparing retrograde amnesia to anterograde amnesia using permutation analysis of linear models in a three-group comparison

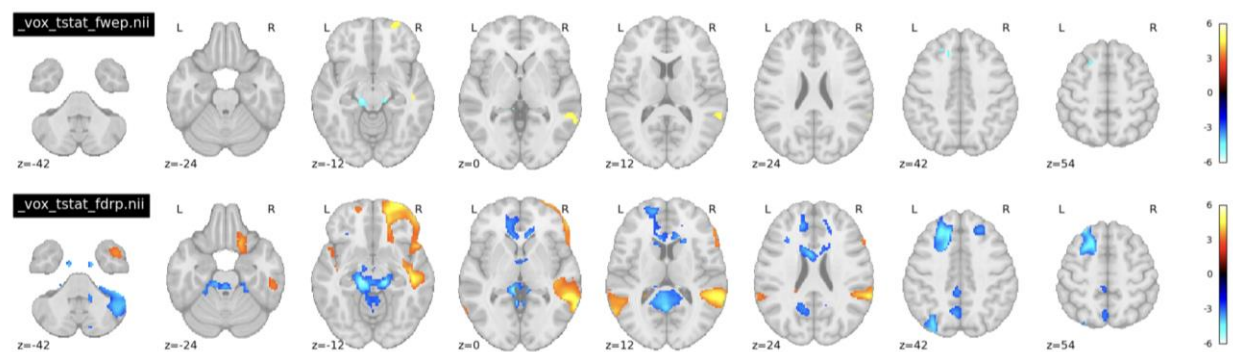
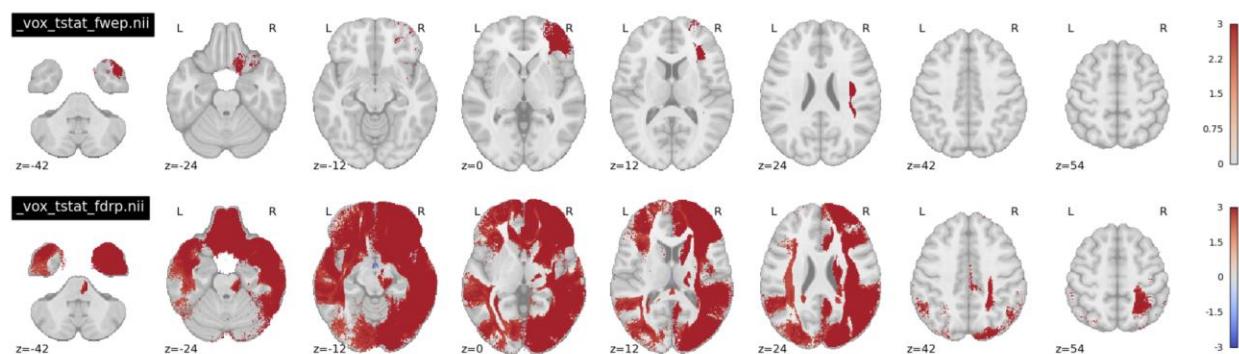
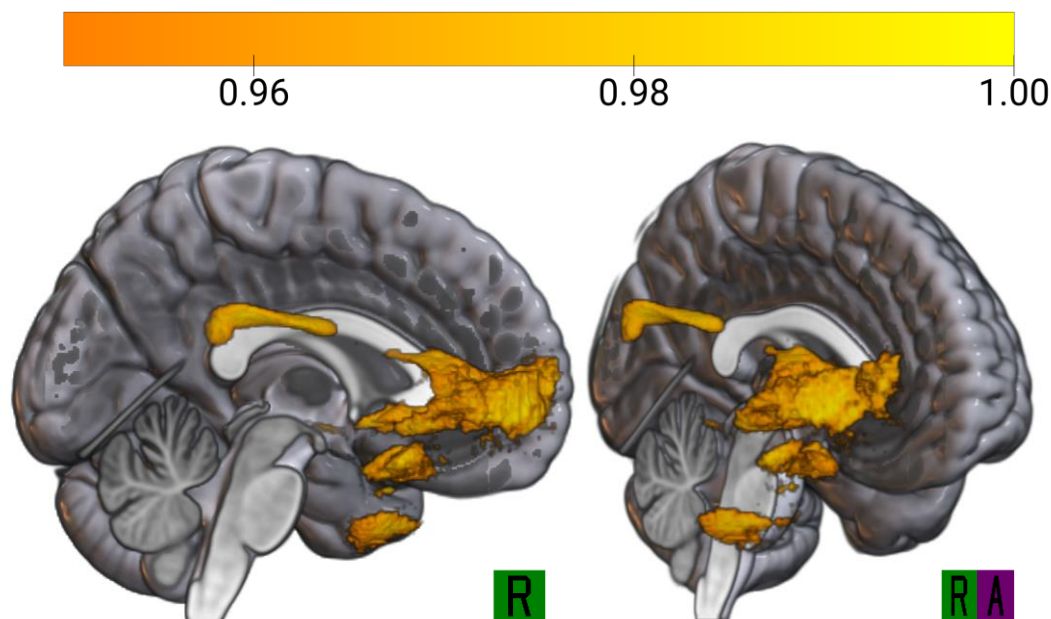


Figure 4 Structural connectivity analysis comparing retrograde amnesia to anterograde amnesia using permutation analysis of linear models in a three-group comparison

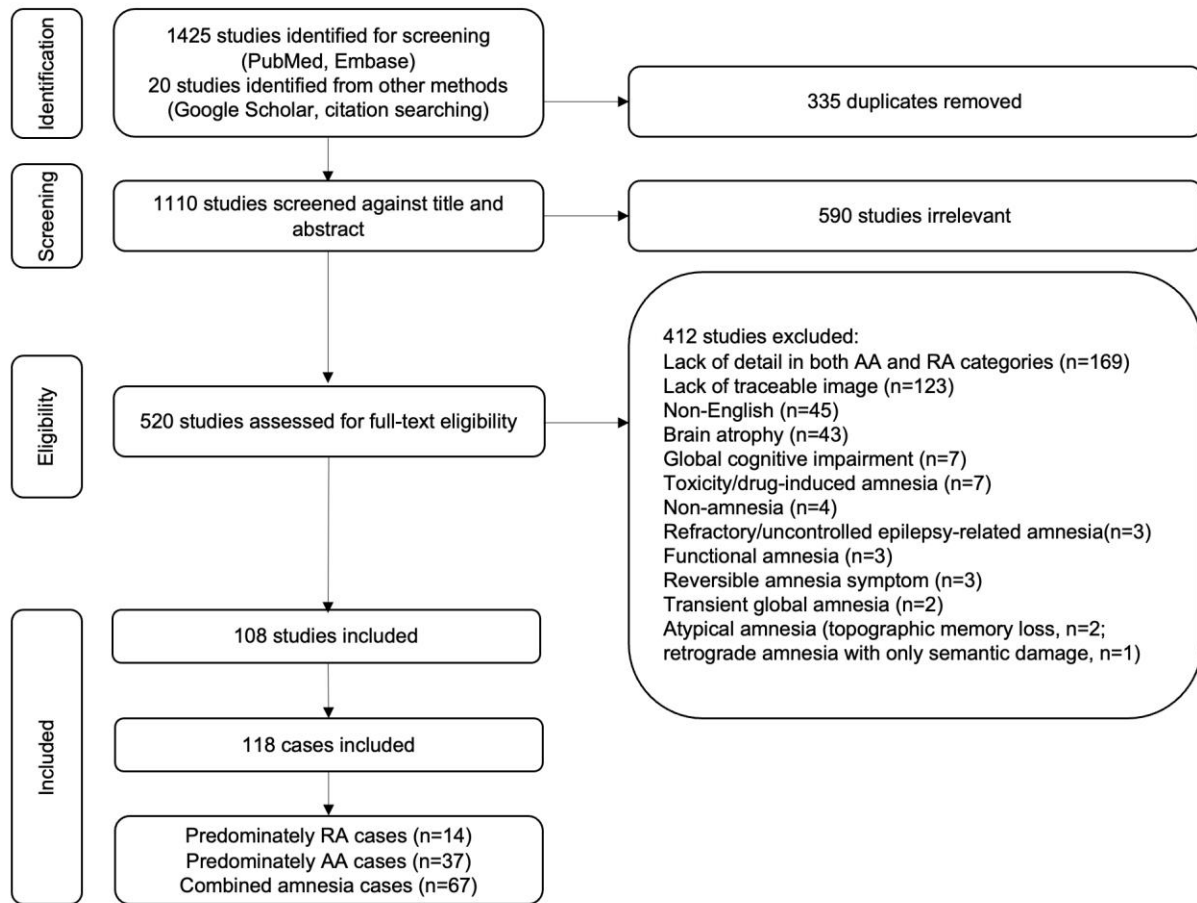
A



B



Supplementary Figure 1 PRISMA flow chart of amnesia cases



Supplementary Table 1 Case characteristics of 118 amnesia cases

Publications	Patient	Disease	Age	Sex	Amnesia type	Country	Neuropsychological symptoms	Comorbidities	Onset-to-memory assessment	Onset-to-image	Memory function follow-up time	Memory trajectory	Memory tests
Abbate et al., “Delusion of Inanimate Doubles.”	MP	TBI	38	M	Retrograde	Italy	disinhibited, dysexecutive ‘frontal’ syndrome, déjà-vu	delusion of inanimate doubles	7y	1m	12m	unclear	MMSE, Prose Recall, Rey-Osterrieth Complex Figure Recall Test, Corsi Supra-Span Test, verbal section of the Long Term Memory ‘88 Test, Picture Naming Task, Picture Naming Task, Processing of Unfamiliar Faces, Italian Battery for Prosopagnosia
Abe et al., “Amnesia after a Discrete Basal Forebrain Lesion.”	A	post-surgery	64	M	Combined	Japan	disorientation and agitation	unclear	31m	30m	31m	improve	MMSE, WAIS, Rey-Osterrieth-copy, WMS-R, Rey Auditory Verbal Learning, Paired Verbal Association (3 trials), Remote Recall (%), Remote Autobiographical Recall
Adamovich et al., “Teaching NeuroImages.”	A	stroke	53	F	Combined	US	confusion	unclear	unclear	unclear	2m	stable	MMSE
Amuluru, Filippi, and Lignelli, “Acute Amnesia Due to Isolated Mammillary Body Infarct.”	A	stroke	50	F	Anterograde	US	confusion	hypertension, diabetes	acute	acute	10d	NA	unclear
Arai, “Severe Amnesia after a Restricted Lesion in the Left Hippocampal Body.”	A	hemorrhage	72	M	Anterograde	Japan	disorientation	unclear	1m	1m	1m	stable	WMS-R, Benton Visual Retention Test, Rey-Osterrieth Complex Figure Test, Wechsler Adult Intelligence Scale-Revised, Autobiographical Memory Interview
Asiri, Aljarallah, and Alayed, “Polyneuropathy and Korsakoff Syndrome Complicating Sleeve Gastrectomy.”	A	Wernicke’s encephalopathy	36	M	Combined	Saudi Arabia	severe vomiting and food intolerance, alert, disoriented to time and place	hypothyroidism, sleeve gastrectomy procedure for morbid obesity	unclear	unclear	NA	NA	unclear
Azevedo Kauppila et al., “Memory Impairment Due to Bilateral Fornix Infarction.”	A	stroke	68	F	Anterograde	Portugal	topographic disorientation	hypertensive crisis	72h	24h	12m	improve	unclear
Babinsky et al., “Clinical Case Report: Memory Functions after Anterior Communicating Artery Aneurysm Rupture.”	PE	stroke	36	M	Anterograde	Germany	none	unclear	6w	about 4w	unclear	NA	Reduced German WAIS, WCST, WMS-R, ROCF, Benton Test, AVLIT, Corsi Span, Word Stem-Completion Task, AMMI, Famous Events Test 1971-1992, Famous Faces Test 1966-1992
Baird and Robinson, “Novel Cognitive Insights from the First Year after Bi-Thalamic Infarct.”	NG	stroke	44	M	Combined	Australia	drowsy, confused with fluctuating consciousness, hyperosmia, hyperacusis	B cell lymphoma, sepsis, multi-organ failure	8m	1d	17m	stable	WAIS-IV, WMS-IV, RAVLT, Rey Complex Figure Copy, Autobiographical Memory Interview
Beglinger, Haut, and Parsons, “The Role of the Mammillary Bodies in Memory: A Case of Amnesia Following Bilateral Resection.”	BR	neoplasma, post-surgery	51	F	Anterograde	US	visual defect, disoriented, confused, agitated, apathy, perseveration	depression, panhypopituitarism, lower extremity deep venous thromboses, pulmonary emboli	10w	9m	30w	stable	Auditory Consonant Trigrams and Paced Auditory Serial Additions Test, Wisconsin Card Sorting Test and Verbal Fluency
Brown et al., “Isolated, Relative Aproverbia without Focal Lesion.”	A	ischaemia	40	M	Anterograde	US	aproverbia	unclear	12d	1w	unclear	NA	unclear
Buccione et al., “Retrograde Episodic and Semantic Memory Impairment Correlates with Side of Temporal Lobe Damage.”	AS	encephalitis	53	M	Combined	Italy	malaise, confusion, disoriented in time and space	none	1m	unclear	unclear	NA	WAIS, Autobiographical Memory Interview, Digit Span, Corsi Span, 15-word list and Short Story for verbal episodic memory, Rey’s Figure, Crovitz Test, Italian Questionnaire for Remote Events, New Words Test

Cachia et al., "Selective Cognitive Patterns Resulting from Bilateral Hippocampal Ischemia."	A	ischaemia	54	M	Anterograde	US	emotional, psychological distress	type 2 diabetes, hypertension, hypercholesterolemia, moderate-severe obstructive sleep apnea, depression	acute	10d	12m	stable	Wechsler Adult Intelligence Scale-III, Wechsler Memory Scale-III, Rey Auditory Verbal Learning Test, Rey Complex Figure,
Caglio et al., "Virtual Navigation for Memory Rehabilitation in a Traumatic Brain Injured Patient."	WP	TBI, hemorrhage	24	M	Combined	Italy	unclear	none	12m	0d	24m	stable	Corsi Block-Tapping Test, Corsi Block-Tapping Test, Backward Digit Span, Rey Auditory Verbal Learning Test, Trail Making Test TMT A-B, Phonemic fluency, Alzheimer's Disease Assessment Scale, The Rivermead Behavioural Memory Test,
Calabrese et al., "Right Temporofrontal Cortex as Critical Locus for the Ecphory of Old Episodic Memories."	A	encephalitis	54	F	Retrograde	Germany	nausea, tiredness, disoriented, visual hallucinations, drowsiness	left sided mastectomy for breast cancer, hysterectomy	24m	3m	24m	unclear	WMS-R, AMI, Crovitz Form Test, Rey Auditory Verbal Learning Test, Famous Faces Test, Semantic General Knowledge Test
Carlesimo et al., "ANALYSIS OF THE MEMORY IMPAIRMENT IN A POST-ENCEPHALITIC PATIENT WITH FOCAL RETROGRADE AMNESIA."	AV	encephalitis	29	F	Retrograde	Italy	depressed mood, social isolation, temporo-spatial disorientation, misidentification of people, agitation alternating with lethargy	unclear	10m	2w	14m	stable	WAIS, WMS, Semantically Related Word List, Semantically Unrelated Word List, Autobiographical Memory, Famous Events Recognition test, Famous Face and Famous Name Tests,
Carrasco et al., "Spontaneous Acute Hemorrhage within a Subependymoma of the Lateral Ventricle."	A	hemorrhage	71	M	Combined	Spain	disorientation, confabulation	arterial hypertension, chronic atrial fibrillation, biventricular obstructive hydrocephalus	unclear	1w	9m	improve	unclear
Caulo et al., "Functional MRI Study of Diencephalic Amnesia in Wernicke-Korsakoff Syndrome."	A	Wernicke's encephalopathy	34	M	Combined	Italy	persistent vomiting, severe malnutrition, confusional state	oesophageal stenosis after cancer surgery	4w	1w	4w	improve	MMSE, Prose Memory test, Rey Complex Figure, Crovitz test, the Wechsler Adult Intelligence Scale (WAIS)
Chan et al., "Extensive and Temporally Ungraded Retrograde Amnesia in Encephalitis Associated With Antibodies to Voltage-Gated Potassium Channels."	KC2	encephalitis	43	M	Combined	UK	confabulate	unclear	12m	12m	17m	improve	Recognition Memory Test scores, Public Events Questionnaire, Paired Associate Learning scores, Memory for Public Events, Memory for Famous Faces
Chen, Zayas, and Gold, "Anterograde Amnesia and Fornix Infarction."	A	stroke	72	F	Anterograde	US	unclear	diabetes, hypercholesterolemia, hypertension, coronary artery disease	unclear	unclear	unclear	NA	unclear
Clarke et al., "Pure Amnesia after Unilateral Left Polar Thalamic Infarct: Topographic and Sequential Neuropsychological and Metabolic (PET) Correlations."	A	stroke	54	F	Combined	Switzerland	unclear	unclear	7-19d	6d	8m	improve	Boston naming, Token test, Corsi test, Wisconsin Card Sorting, Progressive Matrices, Autobiographical memory (autobiographical and public events), Famous Faces
Coffey, "Hypothalamic and Basal Forebrain Germinoma Presenting with Amnesia and Hyperphagia."	A	tumor	24	F	Combined	US	photophobia, visual obscurations, disoriented to time, papilledema	hydrocephalus	39m	39m	50m	decline	unclear
Collinson, Meyyappan, and Rosenfeld, "Injury and Recovery."	DD	TBI, hemorrhage	26	M	Combined	Singapore	disorientation to place	unclear	3m	24h	4m	improve	WTAR, Rey complex figure test, Word list memory, Logical memory I/II, Face memory I/II, CVMT, Wisconsin card sorting test (WSCT-64)
Conesa et al., "ACUTE IMPAIRMENT OF SHORT-TERM MEMORY", "ESO-WSO 2020 Joint Meeting Abstracts", page 295	A	stroke	43	M	Anterograde	Spain	unclear	unclear	unclear	2m	NA	NA	unclear

Di Gennaro et al., "Severe Amnesia Following Bilateral Medial Temporal Lobe Damage Occurring on Two Distinct Occasions."	MV	lobectomy and tumour	38	F	Combined	Italy	depression	post-surgery right temporal lobectomy state, chronic epilepsy	3y	3y	37m	decline	WAIS, RAVLT, Story recall, Figure of Rey, Raven's Coloured Progressive Matrices
Dromerick et al., "Simultaneous Bilateral Thalamic Hemorrhages Following the Administration of Intravenous Tissue Plasminogen Activator."	A	stroke	73	F	Combined	US	inattention, disturbance of visual perception, confabulation, dysnomia	acute myocardial infarction	acute	2d	9m	stable	MMSE, unclear
Edelstyn et al., "Contribution of the Left Dorsomedial Thalamus to Recognition Memory: A Neuropsychological Case Study."	QX	stroke	55	M	Anterograde	UK	disinhibited behaviour, reduced motivation	unclear	unclear	unclear	unclear	NA	WAIS-R, WCST, Facial processing, visual processing, WMS, Rey Complex Figure, AMI
Ernst et al., "Autobiographical Memory and the Self in a Single-Case of Chronic Unilateral Spatial Neglect."	DR	hemorrhage	59	F	Combined	France	unilateral spatial neglect (USN)	unclear	4w-15w	15d	unclear	NA	Autobiographical memory: test episodique de la mémoire du passé autobiographique (TEMPau), Hopkins verbal learning test, form 1 (number of words)
Fertl et al., "Persistent Amnesic Syndrome as Long-Term Outcome of Cognitive Function after Whipple's Disease."	A	Whipple's disease, infection	51	M	Combined	Austria	disorientation in time and space, confabulation, alert, apathetic, reduced attention and motivation	none	30m	7w	42m	stable	Pair-Associate-Learning: 5 Faces-Names, 5 Words-Colours, 3 German-Turkish words; Digit span, Logical memory RBMT, Faces RBMT, Objects RBMT
Fujii et al., "DISPROPORTIONATE RETROGRADE AMNESIA IN A PATIENT WITH HERPES SIMPLEX ENCEPHALITIS."	A	encephalitis	51	F	Combined	Japan	none	lung tuberculosis, uterine cancer surgery, controlled intermittent complex partial and generalized seizures	28d-52d	35d	unclear	NA	WAIS-R, Raven Test, Kohs Cube Test, 100 Pictures Naming, Wisconsin Card Sorting Test, Corsi Block Tapping Test, Lag 1 Digit Span, Corsi" Type Tapping Test, Wechsler MemoryScale – Revised, Rey Auditory Verbal Learning Test, Rey Complex Figure, Recognition Memory Test, Autobiographical Memory Interview, Public Events, Dead or Alive Test
Futamura et al., "Singular Case of the Driving Instructor."	A	hemorrhage	39	M	Anterograde	Japan	unclear	unclear	8y	unclear	unclear	NA	MMSE, WAIS-III, WMS-R, ROCFT and autobiographical memory test (unclear)
Gainotti et al., "Retrograde Amnesia in a Patient with Retrosplenial Tumour."	AP	tumor	43	F	Combined	Italy	mental confusion, difficulty in maintaining attention and concentration, occasional episodes of headache	unclear	16m	17m	18m	stable	Rey's 15 Words Auditory Learning Test, Rey's complex figure, WMS, Rey's Auditory Verbal Learning Test, Autobiographical Incident Schedule, Corsi's test, Picture Recognition test
Gentilini, De Renzi, and Crisi, "Bilateral Paramedian Thalamic Artery Infarcts."	3	stroke	35	M	Combined	Italy	apathetic, disoriented to time and place, hypersomnolent, irritable, confusion, confabulation, bulimia	unclear	15d	4d-3m	3y	stable	WAIS, Immediate and Delayed Recall of a Story, Learning a 10 Word List and 10 Verbal Paired-Associates
Goldenberg et al., "Basal Forebrain Amnesia."	A	stroke	55	M	Combined	Germany	disoriented to time, somnolent, confused, loss of libido, flattening of emotional reactions	hypertension	unclear	unclear	unclear	NA	WMS- R, Rivermead behavioural memory battery, Berlin Amnesia Test z Scores, Recognition memory, CVLT, Learning of Eight Paired Associates (words, objects, face-name), Story Recall (16 and 24 units of information), Taylor figure recall, German WAIS-R, Famous Faces, AMI, modified Crovitz

Graff-Radford, Tranel, and Van, "DIENCEPHALIC AMNESIA."	A	stroke	68	F	Combined	US	confused, obtunded, somnolent	borderline diabetes	5y3m	5y3m	5y3m	stable	WAIS-R, Copy of the Rey-Osterreith Complex Figure, Facial Discrimination Test, Judgement of Line Orientation Test, WCST, Rey Auditory Verbal Learning Test with 30 min Delayed Recall and Recognition, WMS (subtests logical memory, paired associates) and 30 min delayed recall, Craik Tulving Encoding, Release from proactive interference, Warrington Recognition Memory Test (words), Rey-Osterreith Figure Recall (30 min delay), Warrington Recognition Memory Test (faces), Autobiographical Construction and Interview, Recall of US Presidents, Boston Famous Faces Test, Boston Recognition of Events Test, Boston Recall of Events Test, Squire Recall and Recognition of Past Events (forms A and B)
Graff-Radford, Tranel, and Van, "DIENCEPHALIC AMNESIA."	B	stroke	19	F	Anterograde	US	confusion, intermittently drowsy	none	6m	6m	15m	unclear	WAIS-R, Copy of the Rey-Osterreith Complex Figure, Facial Discrimination Test, Judgement of Line Orientation Test, WCST, Rey Auditory Verbal Learning Test with 30 min Delayed Recall and Recognition, WMS (subtests logical memory, paired associates) and 30 min delayed recall, Craik Tulving Encoding, Release from proactive interference, Warrington Recognition Memory Test (words), Rey-Osterreith Figure Recall (30 min delay), Warrington Recognition Memory Test (faces), Autobiographical Construction and Interview, Recall of US presidents, Boston Famous Faces Test, Boston Recognition of Events Test, Boston Recall of Events Test, Squire Recall and Recognition of Past Events (forms A and B)
Grewal, "Severe Amnesia Following a Unilateral Temporal Lobe Stroke."	A	stroke	60	M	Combined	US	none	diabetes mellitus, hypercholesterolemia and hypertension	unclear	unclear	unclear	NA	A Rey's Auditory-Verbal Learning Test (RVLT), public facts, events and famous faces, Autobiographical Memory Interview
Grilli et al., "The Contribution of the Left Anterior Ventrolateral Temporal Lobe to the Retrieval of Personal Semantics."	MK	post-surgery	51	M	Combined	US	unclear	controlled epilepsy	unclear	unclear	unclear	NA	WAIS-IV, WMS-IV, RAVLT, Rey Complex Figure Copy, Autobiographical Memory Interview, Boston Naming Test and Animal Fluency, Cambridge Naming Test
Grilli et al., "The Contribution of the Left Anterior Ventrolateral Temporal Lobe to the Retrieval of Personal Semantics."	DW	post-surgery	48	F	Combined	US	unclear	unclear	unclear	unclear	unclear	NA	WAIS-IV, WMS-IV, RAVLT, Rey Complex Figure Copy, Autobiographical Memory Interview, Boston Naming Test and Animal Fluency, Cambridge Naming Test
Guberman and Stuss, "The Syndrome of Bilateral Paramedian Thalamic Infarction."	I	stroke	54	M	Combined	Canada	disoriented to time and space, hypokinetic, apathetic, perseveration, confabulation, hypersomnolent	hypertension, mild obesity	3w	10d	1y	improve	Boston Naming Test, Rey-Osterreith Figure, Digit Span, Trail Making Test, Stroop Test, WMS, Benton Visual Retention, WAIS
Hashimoto, Tanaka, and Nakano, "Amnesic Confabulatory Syndrome after Focal Basal Forebrain Damage."	A	hemorrhage	73	F	Anterograde	Japan	disorientation, confabulation	unclear	1m	10d	3m	stable	WAIS-R, WMS-R (Japanese version), AVLT(Japanese version), Rey-Osterreith Complex Figure Test (R-O CFT), the Public Event Test and Autobiographical Memory Questionnaire, New Modified Wisconsin Card Sorting Test, Trail making test part B
Hirayama, "Limbic Encephalitis Presenting with Topographical Disorientation and Amnesia."	A	encephalitis	70	F	Combined	Japan	attentional disturbance, disorientation	unclear	unclear	unclear	unclear	NA	WAIS-R, Digit Span, Spatial Span, Paired Associate Task, Benton Visual Retention Test, Autobiographical Memory (unclear), Public Event Test

Hodges and Carpenter, "Anterograde Amnesia with Fornix Damage Following Removal of Illrd Ventricle Colloid Cyst."	1	post-surgery	45	F	Anterograde	UK	disorientated in time	unclear	1m	days	24m	improve	IQ verbal, NART, Digits Forward and Backward, Verbal memory (paragraph immed, delayed), PALT, Warrington RMT, Words, Faces, Non-verbal Memory Form, Rey Figure Copy Recall, Corsi Block Span, Spatial Memory Test, Famous Faces
Hodges and Carpenter, "Anterograde Amnesia with Fornix Damage Following Removal of Illrd Ventricle Colloid Cyst."	2	post-surgery	33	M	Combined	UK	none	unclear	8w	unclear	12m	improve	IQ verbal, NART, Digits Forward and Backward, Verbal memory (paragraph immed, delayed), PALT, Warrington RMT, Words, Faces, Non-verbal Memory Form, Rey Figure Copy Recall, Corsi Block Span, Spatial Memory Test, Famous Faces
Hodges and McCarthy, "Autobiographical Amnesia Resulting from Bilateral Paramedian Thalamic Infarction. A Case Study in Cognitive Neurobiology."	PS	stroke	67	M	Combined	UK	severe confused, disorientated in time and place, apathetic, lethargic	none	13m-29m	4m	unclear	NA	Recognition Memory Test, WMS, Rey-Osterrieth Figure, WAIS-R Subsets Age Scale, Digits Forwards and Backwards, Corsi Block Tapping Forwards/Backwards, Paragraph Recall (WMS), Paired Associate Learning (WMS), WRMT(words, faces), WCST, Free Recall, Cued Recall (Galton-Crovitz), Autobiographical Memory Interview, Family Photograph Identification, Cued Recall of Family Events, Famous Faces Test, Famous Events Test
Honda et al., "P300 Abnormalities in Patients with Selective Impairment of Recent Memory."	4	encephalitis	69	F	Combined	Japan	unclear	well controlled epilepsy	unclear	unclear	NA	NA	Digit Span, Miyake's Retention Test, Benton Visual Retention Test
Honda et al., "P300 Abnormalities in Patients with Selective Impairment of Recent Memory."	6	anoxia	32	F	Combined	Japan	unclear	dermatomyositis, central pontine and extra-pontine myelinolysis, generalized seizure	8m	7m	8m	improve	Digit Span, Miyake's Retention Test, Benton Visual Retention Test
Honda et al., "P300 Abnormalities in Patients with Selective Impairment of Recent Memory."	7	post-surgery	31	F	Combined	Japan	confabulation, disorientation in time and place	amenorrhea, galactorrhea syndrome, bilateral frontal craniotomy and total resection of craniopharyngioma and pituitary stalk, panhypopituitarism, diabetes, insipidus, anosmia	2m	unclear	unclear	NA	Digit Span, Miyake's Retention Test, Benton Visual Retention Test
Iizuka, Suzuki, and Mori, "Severe Amnesic Syndrome and Collecting Behavior After Surgery for Craniopharyngioma."	A	stroke	50	M	Anterograde	Japan	behavioral changes(hyperphagia and affective incontinence)	craniopharyngioma surgery, panhypopituitarism	13m	unclear	unclear	NA	Wechsler Memory Scale—Revised, Autobiographical Memory Interview, Recognition Memory Test (Words,Faces), Wisconsin Card Sorting Test, Verbal Fluency
Jamjoom et al., "Autobiographical Memory Loss Following a Right Prefrontal Lobe Tumour Resection."	VF	post-surgery	18	F	Retrograde	UK	unclear	unclear	18m	3m	18m	almost stable	unclear
Kapur and Brooks, "Temporally-Specific Retrograde Amnesia in Two Cases of Discrete Bilateral Hippocampal Pathology."	BE	encephalitis	46	M	Anterograde	UK	odd sense of smell, episodes of de'j'a vu	possible rheumatoid arthritis	months	1y	unclear	NA	Wechsler Adult Intelligence Scale-Revised, National Adult Reading Test-NART, Wechsler Memory Scale-Revised, Adult Memory and Information Processing Battery, Recognition Memory Test, Autobiographical Memory Interview, Shared Experiences Test, Dead-or-Alive Test
Kapur and Brooks, "Temporally-Specific Retrograde Amnesia in Two Cases of Discrete Bilateral Hippocampal Pathology."	LC	encephalitis	36	M	Anterograde	UK	confabulation	chronic myelocytic leukaemia, bone-marrow transplant	about 3w	within 1 month	died in one month	unclear	Wechsler Memory Scale-Revised, Dead-or-Alive Test, a short form of the Verbal News Events Test, Adult Reading Test, Wechsler Adult Intelligence Scale-Revised

Kapur et al., “Anterograde but Not Retrograde Memory Loss Following Combined Mammillary Body and Medial Thalamic Lesions.”	KK	Wernicke’s encephalopathy	57	M	Anterograde	UK	none	diabetes insipidus	days	days	unclear but died 4 months later	NA	Wechsler Adult Intelligence Scale–Revised, FAS, Rey Figure, Real Fictitious public events test, Dead-or-Alive test, Autobiographical Memory Interview, Recognition Memory Test
Kapur et al., “FOCAL RETROGRADE AMNESIA FOLLOWING BILATERAL TEMPORAL LOBE PATHOLOGY.”	LT	TBI, hemorrhage	26	F	Retrograde	UK	unclear	unclear	18m-19m	1.5y	unclear	NA	Wechsler Adult Intelligence Scale (Revised), modified Wisconsin Card Sorting Test, Revised Wechsler Memory Scale, Autobiographical Cued Recall Test, Identification of Famous Scene, Famous Faces Test, the Dead/Alive Test, Famous Names Test
Kartsounis, Rudge, and Stevens, “Bilateral Lesions of CA1 and CA2 Fields of the Hippocampus Are Sufficient to Cause a Severe Amnesic Syndrome in Humans.”	A	ischaemia	67	M	Combined	UK	a major convulsion	chronic obstructive airways disease, migraine, supraventricular tachycardia	unclear	unclear	unclear	NA	Wechsler Adult Intelligence Scale (WAIS-R), Recognition Test (words, faces), Recall Test, Autobiographical Memory Interview, Public Remote Memory (famous faces, major events), Galton-Crovitz Technique
Kataoka, Furiya, and Ueno, “Limbic Encephalitis With Involvement of Prefrontal Cortices and Persistent Amnesia.”	A	encephalitis	64	F	Combined	Japan	disoriented to time, place and age	unclear	days to weeks	7d	5y	stable	Hasegawa Dementia Scale, Mini-Mental Status Examination, Miyake Memory Test
Koll et al., “Acute Amnesic Syndrome with Hippocampal Lesion Due to Influenza B-Associated Encephalopathy.”	A	encephalitis	77	F	Combined	Austria	respiratory infection, confusion	right sphenoid ridge meningioma surgery, arterial hypertension, hyperlipidemia, type 2 diabetes mellitus	days	1w	22m	improve	unclear
Korematsu et al., “Memory Impairment Due to a Small Unilateral Infarction of the Fornix.”	A	stroke	52	M	Combined	Japan	unclear	unclear	acute	4d	3m	slightly improve	Wechsler Memory Scale-Revised test, Wechsler Adult Intelligent Scale-Third Edition, Hasegawa Dementia Scale-Revised, Mini Mental State Examination, Miyake Paired Verbal Association Learning Test
Kroll, Markowitsch, and Knight, “Retrieval of Old Memories: The Temporofrontal Hypothesis.”	AA	TBI	44	M	Retrograde	US	disorientated	unclear	unclear	18y	unclear	NA	WMS-R, Wechsler Adult Intelligence Scale—Revised, Wisconsin Card Sorting Test, Boston Naming Test, Sentence Comprehension Test, Controlled Oral Fluency Test, Incomplete Pictures test, Subjective Memory Questionnaire, paired associate learning, California Verbal Learning test, Picture Recognition test, Rey–Osterrieth Figure, Rivermead Behavioural Memory Test, a headlines memory test, Time magazine news test, Transient events test, General knowledge of the world, Famous faces test, Headlines memory test, Old Memories, a Crovitz-form test, Twelve Significant Events, Autobiographical Events and an Autobiographical Memory Interview
Kroll, Markowitsch, and Knight, “Retrieval of Old Memories: The Temporofrontal Hypothesis.”	BB	TBI	49	M	Retrograde	US	unclear	unclear	unclear	18y	unclear	NA	WMS-R, Wechsler Adult Intelligence Scale—Revised, Wisconsin Card Sorting Test, Boston Naming Test, Sentence Comprehension Test, Controlled Oral Fluency Test, Incomplete Pictures Test, Subjective Memory Questionnaire, Paired Associate Learning, California Verbal Learning test, Picture Recognition test, Rey–Osterrieth Figure, Rivermead Behavioural Memory Test, a Headlines Memory Test, Time Magazine News Test, Transient Events Test, General Knowledge of the World, Famous Faces Test, Headlines Memory Test, Old Memories, a Crovitz-form Test, Twelve Significant Events, Autobiographical Events and an Autobiographical Memory Interview

Kwan et al., "Dissociations in Future Thinking Following Hippocampal Damage."	KC	TBI	57	M	Combined	Canada	unclear	unclear	unclear	unclear	unclear	NA	WAIS-R, WMS-R, Boston Naming, Semantic Fluency, Letter Fluency, CVLT, ROCF, WCST, Adapted Autobiographical Interview, Delay Discounting Task, Probability Discounting Task, Each Time Perspective
Kwan et al., "Dissociations in Future Thinking Following Hippocampal Damage."	DA	encephalitis	59	M	Combined	Canada	unclear	unclear	unclear	unclear	unclear	NA	WAIS-R, WMS-R, Boston Naming, Semantic Fluency, Letter Fluency, CVLT, ROCF, WCST, Adapted Autobiographical Interview, Delay Discounting Task, Probability Discounting Task, Each Time Perspective
Levine et al., "Episodic Memory and the Self in a Case of Isolated Retrograde Amnesia."	ML	TBI	36	M	Retrograde	Canada	unclear	none	14m	2.4y	unclear	NA	Galveston Orientation and Amnesia Test, Autobiographical Memory Interview, WAIS-R, NAART-R, WMS-R, Word List Learning, Crovitz Cue-Word Test, Boston Naming Test, Verbal Fluency, Trail Making, Stroop Interference Procedure, Wisconsin Card Sorting Test (WCST), Conditional Associative Learning, Recall and recognition performance, Remember/Know responses
Maeshima et al., "Memory Impairment Caused by Cerebral Hematoma in the Left Medial Temporal Lobe Due to Ruptured Posterior Cerebral Artery Aneurysm."	A	hemorrhage	56	M	Anterograde	Japan	disorientation of time and place	unclear	1w	10d	10w	improve	MMSE, Digit Span, Raven's Progressive Matrices, Wechsler Adult Intelligence Scale 3rd edition, Auditory Verbal Learning Test, Wechsler Memory Scale-Revised, Rivermead Behavioural Memory Test
Malamut et al., "Memory in a Case of Bilateral Thalamic Infarction."	MP	stroke	31	M	Anterograde	US	abulia, lack of initiative	none	3y	3y	3y	improve	Benton Orientation, WAIS-R, Modified Card Sorting, Wisconsin Card Sorting, Continuous Performance Test and Stroop, Finger tapping, Controlled Word Association, Animal naming, Boston Naming, WMS, CVLT, RAVLT, Rey Osterrieth, Facial Memory, Spatial Learning, Tactual Performance Test, Corsi Spatial Block Learning
Male and Zand, "Isolated Mammillary Body Infarct Causing Global Amnesia."	A	stroke	53	M	Anterograde	US	confusion	hypertension, anosognosia	acute	acute	3m	unclear	unclear
Marín Conesa et al. "Non transitory global amnesia", European Journal of Neurology 2020;27:802	A	stroke	43	M	Anterograde	Spain	unclear	unclear	3d	3d	unclear	NA	unclear
Markowitsch and Ewald, "Right-Hemispheric Fronto-Temporal Injury Leading to Severe Autobiographical Retrograde and Moderate Anterograde Episodic Amnesia-Implications for the Anatomy of Memory."	DD	TBI	53	M	Retrograde	Germany	severe vision impairment, depressed	porencephalic cyst, obsessive compulsive tendencies, depression, moderate anxiety, mild phobic anxiety, paranoid ideation, moderate psychoticism	3y	3y	unclear	NA	WAIS-R, Rey Auditory Verbal Learning Test, RAVLT, WMS-R, Verbal Fluency Test, Buschke Selective Reminding Test, Motor-Free Visual Perception Test, Draw-a-Clock Test, Inhibitory Hand Tapping, WCST, Crovitz test, Autobiographical Memory Interview
Markowitsch et al., "Retrograde Amnesia after Traumatic Injury of the Fronto-Temporal Cortex."	D	TBI	45	M	Retrograde	Germany	unclear	unclear	about 4y	unclear	unclear	NA	Wechsler Memory-Scale-R, Rivermead Behavioural Memory Test, Corsi-block-tapping; Digit span, WCST, Tower of Hanoi, Word stem completion, Mirror Image Reading, Famous Faces Test, Famous names, Semantic Knowledge Test, Autobiographical Memory Interview, Personal Objects Test, Verbal Recognition Test, Rey-Osterrieth-Figure, Verbal Learning of New Facts
Markowitsch et al., "Verbal Memory Deterioration After Unilateral Infarct of the Internal Capsule in an Adolescent."	C	stroke	15	M	Combined	Germany	none	left eye-lids inflammation	9m	4y	unclear	NA	Wechsler Intelligence Scale, Rivermead Behavioural Memory Test battery, Tests of Remote Memory (a questionnaire and the Crovitz-type remote memory test), Paired-Associate Learning, Prose Text composed of 23 logical units, Selective Reminding Task, Muramoto Task, Tower of Hanoi Problem, Buschke's Verbal List Learning Task

Markowitsch, von Cramon, and Schuri, "Mnemonic Performance Profile of a Bilateral Diencephalic Infarct Patient with Preserved Intelligence and Severe Amnesic Disturbances."	AB	stroke	67	M	Combined	Germany	none	TIA	unclear	16m	unclear	NA	Revised Wechsler Memory Scale, Rivermead Behavioural Memory Test, Incomplete Pictures Test, Famous Faces Test, Subjective Memory Questionnaire, Rivermead Behavioural Memory Test, Recurring Figures and Words Tests, Nonverbal Selective Reminding Task, Mirror Drawing Task, CVLT, Block Tapping (Corsi), Benton Test (recognition), Face Recognition Test, Rey-Osterrieth Complex Figure, Word Paired Associates, Auditory Verbal Learning Test (Rey), Face/Name Paired Associates, Object Paired Associates, Recurring Figures Test, Recurring Figures Test, Wisconsin Card Sorting Test, Famous Names, Free Recall of a 57-unit Story after 48-hr delay, Recognition of 10 Faces after 48-hr delay, WAIS, Autobiographical Memory Test
Masuo et al., "A Case of Amnesic Syndrome Caused by a Subcortical Haematoma in the Right Occipital Lobe."	A	post-surgery	62	M	Anterograde	Japan	left homonymous hemianopsia, disorientation	subcortical haematoma	10d	6m	6m	stable	Digit Span, MMSE, Wechsler Adult Intelligence Scale-Revised, Benton Visual Recognition Test, Auditory Verbal Learning Test, Raven's CPM, Wechsler Memory Scale, Auditory Verbal Learning Test, Miyake's Associate Learning Test
Mccarthy and Warrington, "ACTORS BUT NOT SCRIPTS: THE DISSOCIATION OF PEOPLE AND EVENTS IN RETROGRADE AMNESIA."	RFR	encephalitis	54	M	Combined	UK	panic attack	unclear	unclear	unclear	unclear	NA	WAIS, Recognition Memory Test, National Adult Reading Test, Famous Faces Test, Famous Names Test, Tests of Knowledge of Friends, Who and What Questions: Examples of stimuli
Miller et al., "Right Medial Thalamic Lesion Causes Isolated Retrograde Amnesia."	JG	stroke	33	M	Retrograde	Australia	disorientation	mildly depressed	12m	7m	18m	stable	Autobiographical Memory Interview, Major Life Events, Recognition of Friends and Relatives, Famous People Tests, Famous Events Test, Boston Naming Test, Pyramids and Palm Trees, Animal Fluency, WMS-R, Rey Complex Figure, Rey Auditory Verbal Learning Test, WAIS-R, Wisconsin Card Sorting Test, Benton Facial Recognition
Mori, Yamadori, and Mitani, "Left Thalamic Infarction and Disturbance of Verbal Memory."	A	stroke	41	M	Anterograde	Japan	diplopia, slightly euphoric, deficits unconcerned, hypersomnia, inattention, disoriented for time and place	unclear	1-2m	2m	5m	stable	WAIS, SLTA, Token test, WMS, AVLT, BVRT, ROCF, WCS, Miyake's Reaction Test, Benton Visual Retention Test, Wisconsin Card Sorting Test
Morris et al., "AMNESIA FOLLOWING A DISCRETE BASAL FOREBRAIN LESION."	SJ	post-surgery	51	M	Combined	US	alternating periods of agitation and lethargy, irritability, emotional lability, inappropriate jocularity, diminished initiative and motivation, aggressive outbursts, self-destructive threats, apathy	history of poorly controlled complex partial seizures before surgery, low-grade astrocytoma surgery, hypertension, two closed head injuries	2ws during hospitalization	days? Post surgery MRI	18m	stable	WAIS-R, Rey-Osterrieth-Copy, Cancellation Task, Boston Naming, Finger Tapping, Grooved Pegboard, Digit Span, Auditory Consonant Trigrams, Wisconsin Card Sorting Test, Booklet Category Test, Word Fluency, Wechsler Memory Scale California Verbal Learning, Continuous Visual Memory, Boston Remote Recall/Recognition/Faces, Remote Autobiographical Recall/Recognition, Verbal levels of processing, Verbal rate of forgetting, Boston Retrograde Amnesia Examination
Mosimann et al., "Fornix Infarction and Korsakoff Dementia after Coiling of a Large Anterior Communicating Artery Aneurysm."	A	post-surgery	47	M	Combined	France	unclear	subcortical hemorrhage, dysphoria	unclear	unclear	24m	minor improve	unclear

Müller et al., “Persistent Klüver-Bucy Syndrome after Bilateral Thalamic Infarction.”	A	stroke	69	F	Anterograde	Switzerland	distractable, affectively dyscontrolled, socially inappropriately, somnolent, confabulation	chronic atrial fibrillation, arterial hypertension	1m	unclear	13m	stable	unclear
Murr et al., “Selective Infarction of the Anterior Genu Fornices Associated with Giant Cell Arteritis.”	A	stroke	60	F	Anterograde	US	confusion	multinodular goiter, hypertension	unclear	unclear	unclear	NA	unclear
O’connor et al., “The Dissociation of Anterograde and Retrograde Amnesia in a Patient with Herpes Encephalitis.” Eslinger et al., “Nonverbal Amnesia and Asymmetric Cerebral Lesions Following Encephalitis.”	LD	encephalitis	26	F	Retrograde	US	visual agnosia	none	8y	3y	8y	improve	Wechsler Adult Intelligence Scale-Revised, National Adult Reading Test, Corsi Blocks, Word List Generation (FAS), Trail-Making Test, Part B, Wisconsin Card Sorting Test, Wisconsin Card Sorting Test, Benton Line Orientation Test, Hooper Visual Organization Test, Keegan Faces, Benton Facial Recognition Test, Map Localization, Rey Osterrieth Complex Figure, Wechsler Memory Scale-Revised, Rey Auditory Verbal Learning Test, Warrington Recognition Memory Test, Continuous Visual Memory Test, Autobiographical Events Questionnaire, Remote Memory Questionnaire, Free Association Test, Transient Events Test, Crovitz and Schiffman’s Technique, Autobiographical Events Schedule
Ogden, “Visual Object Agnosia, Prosopagnosia, Achromatopsia, Loss of Visual Imagery, and Autobiographical Amnesia Following Recovery from Cortical Blindness.”	MH	TBI	30	M	Retrograde	New Zealand	visual object agnosia, prosopagnosia, totally blind	unclear	3y	6y	unclear	NA	WAIS-R, Digit Span, Copeis of Drawing, Category-specific Visual Recognition, Semantic Knowledge of Objects, New Verbal Learning, WMS, Recognition Memory Test, Autobiographical Memory Interview
Oishi et al., “Pure Topographical Disorientation in Novel Environments without Anterograde Amnesia.”	KW	encephalitis	56	F	Combined	Japan	spatio-temporal disorientation	unclear	3m	95d	unclear	NA	Wechsler Adult Intelligence Scale-Third Edition, JART, Wechsler Memory ScaleRevised, Rey Osterrieth Complex Figure Test, Benton Visual Retention Test, Paired Verbal Paired Associate Learning Test, Rivermead Behavioral Memory Test, Trail MakingTest (PartA,PartB) in Japanese, Developmental Test of Visual Perception for Adults, Birmingham Object Recognition Battery, Visual Perception Test for Agnosia, Retrograde Memory Test on Famous landscapes, Faces, and Past Events; Autobiographical Memory Interview, Developmental Test of Visual Perceptual Skills-Adolescent and Adult (DTVP-A)
Osawa et al., “Neuropsychological Deficits Associated with a Tumour in the Posterior Corpus Callosum.”	A	tumor	62	M	Anterograde	Japan	disorientation	Gerstmann’s syndrome	7-9d	within 20d	35d	improve	MMSE, Kana-Hiroi Test, Word Fluency, WAIS-RI, Raven’s Coloured Progressive Matrices, Digit Span, Auditory Verbal Learning Test (AVLT), Benton Visual Retention Test, Rivermead Behavioural Memory Test
Ouellet et al., “Two Routes to Losing One’s Past Life.”	DD	post-surgery	40	M	Retrograde	Canada	fatigability, chronic pain	mild anxiety and depression, implantation of a thalamo-lemniscal electrode for the treatment of pain syndrome	16y	7y9m, 11y6m	unclear	NA	RAVLT, Logical Memory, Rey-Osterrieth Figure, Visual Reproduction,WMS-R, Public Events and Famous People, WAIS-R, Chapman-Cook Test, Benton’s Tests of Facial Recognition and Judgment of Line Orientation, Hooper Visual Organisation, Object Assembly and Block Design, WCST, Trail A & B, Luria’s Graphic Series and Gestual Sequences, Stroop Test

Pachalska et al., "A Case of 'Borrowed Identity Syndrome' after Severe Traumatic Brain Injury."	PA	TBI	43	M	Combined	Poland	sleeping problems, bouts of aggressiveness, visuospatial disorientation, inaccurate spatial orientation, confabulation, abrupt changes in personal habits and routines, loss of personal history, social roles, and lifestyle	anosognosia, identity disturbance, prosopagnosia	unclear	4m	unclear	NA	unclear
Park et al., "Amnesic Syndrome in a Mammillothalamic Tract Infarction."	C	stroke	70	M	Combined	Korea	none	hypertension, two times of stroke pre-onset	4d	4d-7d	4m	stable	MMSE, Seoul Neuropsychological Screening Battery, Wechsler Adult Intelligence Scale, Digit Span, Korean version of the Boston Naming Test, Rey-Osterrieth Complex Figure, Seoul Verbal Learning Test, Autobiographical Memory Interview
Park et al., "Memory Deficits after Bilateral Anterior Fornix Infarction."	A	stroke	60	F	Anterograde	Korea	disoriented to time	hypertension, diabetes	7d	3d	4m	slightly improve	Korean Wechsler Adult Intelligence Scale, Digit Span, Pen-Watch-Keys Test, Rey Figure Copy Test, AVLIT, Rey-Osterrieth Complex Figure test, RVDLT, Autobiographical Memory Interview, Corsi Block Tapping
Park, Seo, and Yoon, "Selective Anterograde Amnesia with Thalamus and Hippocampal Lesions in Neuro-Behcet's Disease."	B	Behcet's disease	50	M	Anterograde	Korea	disorientated	neuro-Behcet's disease	7d	5d	5m	modest improve	Rey-Osterrieth Complex Figure test, MMSE, Autobiographical Memory Interview, Korean Famous Events Test, Hopkins Verbal Learning Test
Parkin, "IMPAIRMENT OF MEMORY FOLLOWING DISCRETE THALAMIC INFARCTION."	JR	stroke	48	M	Anterograde	UK	unclear	unclear	unclear	unclear	unclear	NA	WMS, Wechsler Adult Intelligence Scale, National Adult Reading Test, WCST, FAS, Cognitive Estimation Test, Trail Making, Paired Associate Learning, Temporal List Discrimination, Spatial List Discrimination, Scenes Test, Dead or Alive Test
Peru and Fabbro, "Thalamic Amnesia Following Venous Infarction."	DB	stroke	41	M	Combined	Italy	apathetic, confused, disoriented to time and space, hypersomnia, mental slowness	sartteriovenous fistula and urgical embolization	acute	7d	2y	improve	WAIS-R, Raven Progressive Matrices, Verbal Fluency Test, Arithmetic Judgement Test, Bilingual Aphasia Test, Acalculia Test, Recency Effect of the Serial Position Curve, Digit Forward Test, Bisyllabic Word Repetition Test, Corsi's Block Tapping Test, Rey-Osterrieth Complex Figure, Serial Position Curve Recency Effect, Maze Learning Test, Rey-Osterrieth Complex Figure 15 min Picture, Corsi's Block Tapping Supra Span, Rey Memory Test, Story Recall, Serial Position Curve, Word List, Rey Memory Test, MLT '88, Famous Personalities of the Present, Semantic Knowledge (animals, common objects, verbs, famous personalities of the past)
Peters et al., "Postoperative Amnesic State with Impairment of Static Visual Perception."	A	post-surgery, ischemia	60	M	Combined	Germany	visual disturbance	hypertension, coronary artery disease	unclear	2d-1w	unclear	NA	Rivermead Behavioural Memory Test, California Verbal Learning Test
Poreh et al., "Anterograde and Retrograde Amnesia in a Person with Bilateral Fornix Lesions Following Removal of a Colloid Cyst."	AD	post-surgery	45	M	Combined	Canada	confused	colloid cyst surgery, diabetes insipidus, anxiety, moderate depression	3m	2m	9m	stable	Autobiographical Memory Interview, Personal Events, Famous Faces, and Famous Events (Famous Israeli Faces and Famous Israeli Public Events Tests) Wechsler Intelligence Test III, Boston Naming Test, Wisconsin Card Sorting Test, Verbal Fluency Test, RAVLT Learning Curve, Spatial Span, Digit Span, Rey Complex Figure Test, Stroop Test, Wechsler Memory Scale

Reed and Squire, "Retrograde Amnesia for Facts and Events."	EP	encephalitis	74	M	Combined	US	unclear	unclear	unclear	unclear	unclear	NA	WAIS-R, WMS-R, Rey-Osterrieth Figure, Paired Associates, Word Recall, Word Recognition, Words, Faces, Autobiographical Memory Interview, Word Association Test, New Vocabulary, Public Events, Famous Faces, and Famous Names Test
Reed and Squire, "Retrograde Amnesia for Facts and Events."	GT	encephalitis	60	M	Combined	US	unclear	unclear	unclear	unclear	unclear	NA	New Vocabulary (recall and recognition), Public Events (recall and recognition), Famous Faces, Famous Names Completion and Famous Names Recognition, Autobiographical Memory Interview, Rey-Osterrieth Figure, Word Association Test of Autobiographical Memory, Information and Vocabulary subscales and Boston Naming Test, WAIS-R
Richardson et al., "Patients Undergoing High Dose Chemotherapy for Primary CNS Lymphoma Should Receive Prophylactic Thiamine to Prevent Wernicke's Encephalopathy."	A	Wernicke's encephalopathy	62	F	Combined	UK	fluctuating confusion	severe sepsis, mild hypomagnesaemia, recalcitrant thrombocytopenia, multi-organ failure	unclear	17d	unclear	NA	unclear
Ruggeri, "Left Dorsomedial Thalamic Damage Impairs Verbal Recall More Than Recognition."	B	stroke	51	M	Anterograde	Italy	confused, somnolent	unclear	1y	1y	unclear	NA	Visual Search, Trail Making Test Part A, Paced Auditory Serial Addition Test-2 seconds, Digit Span Forward and Backward, Trail Making Test Part B, Raven Progressive Matrices 47, Wechsler Adult Intelligence Scale Revised, Rey-Osterrieth Complex Figure, Phonetic Verbal Fluency 60-seconds, Nouns Oral Naming task of the Batteria per l'Analisi dei Deficit Afasici, Rivermead Behavioural Memory Test, Rey Auditory Verbal Learning Test, Corsi Supra-Span Block-Tapping Test, Rey-Osterrieth Figure, Semantically Related and Unrelated Words Learning test, Paired-Associate Learning test, Short Story
Ruggeri, Guariglia, and Sabatini, "Amnesia after Right Frontal Subcortical Lesion, Following Removal of a Colloid Cyst of the Septum Pellucidum and Third Ventricle."	AA	post-surgery	40	M	Anterograde	Italy	spatial and temporal disorientation	bilateral retinitis	2m	50d	13m	mildly improve	Paced Auditory Serial Addition test, Rivermead Behavioural Memory Test, Stroop Test, Rey's 15-Words, Words-Paired, Short Story, Corsi's Spatial Sequence and Rey's Complex Figure Test, Associated Learning test, Famous Events, Retrograde Memory Questionnaire, Rey Auditory Verbal Learning Test, Words Paired Associated Learning, Supra-Span Spatial Learning, Rey Figure 30sec/20min Recall, Retrograde Memory Social Events, WSCT
Rusconi, Morganti, and Paladino, "Long-Lasting Topographical Disorientation in New Environments."	RG	hemorrhage	22	F	Anterograde	Italy	unclear	ventricular-peritoneal valve derivation, right arteriovenous chorioidea malformation	10y	10y	8y	decline	Gordon's Questionnaire, Vividness Visual Imagery Questionnaire, Drawing from Memory test, WAIS, Short-Story recall, Rey's 15 Words Learning Task — delayed recall, Rey's Figure — delayed recall, Raven Coloured Progressive Matrices, Boston Naming Test, Semantic Word Fluency, Digit Span, Corsi Span, Paired Words Learning, Short-Story Recall, Spatial Learning (Corsi Supraspan), Recurring Faces Test, Behavioural Inattention Test, Poppelreuter Test, Maze Learning Test
Sala, Spinnler, and Venneri, "Persistent Global Amnesia Following Right Thalamic Stroke: An 11-Year Longitudinal Study."	LC	stroke	68	M	Combined	UK	dizziness, disorientation in time and space	stroke, hypertension	7w-11y	2y-11y	11y	stable	Wechsler-Bellevue Intelligence Scale, Digit Span, Corsi Block Visuo-Spatial Span, Prose Memory, Supra-Span Verbal Learning, Supra-Span Spatial Learning, Corsi Block test, Autobiographical memory, Italian Questionnaire for Public Events, Fibonacci Series, Free Word Association, Famous Events Questionnaire, Autobiographical Memory Inquiry, Paired Associated, Mirror-Tracing Test, Wilcoxon Signed Rank Test, Mirror-Reading of Words, Puzzle Task, Motor Skill Task

Schapiro et al., "The Necessity of the Medial Temporal Lobe for Statistical Learning."	LSJ	encephalitis	57	F	Combined	US	unclear	unclear	unclear	unclear	unclear	NA	Famous Faces, Famous Landmarks, Wechsler Memory Scale II, WAIS-IV, Visual Object and Space Perception Battery, Montreal Battery of Evaluation of Amusia
Schnider et al., "Dissociation of Color From Object in Amnesia."	A	stroke	66	M	Combined	Switzerland	disorientation in time and space	hypertension, myocardial infarctions twice, three aortocoronary bypasses, anterior myocardial aneurysm	unclear	7d	6m	improve	Digit Span, Corsi Cubes, Rey Auditory Verbal Learning Test, Rey Figural Learning Test, copied Rey Complex Figure, Color Naming and Color Recognition, 16 hue Farnsworth Color Perception Test
Siebert and Warrington, "Spared Retrograde Memory with Anterograde Amnesia and Widespread Cognitive Deficits."	TW	TBI, stroke	26	M	Anterograde	UK	unclear	post-meningitis sequelae, left humerus neck impacted fracture	unclear	unclear	6w	stable	Contemporary Famous Faces, WAIS-R, National Adult Reading Test, Graded Naming Test, Visual Object and Space Perception Battery, Object Decision test, Wisconsin Card Sorting Test, Recognition Memory Test, Story Recall, List Learning, Figure Recall parts of the Adult Memory and Information Processing Battery, Wechsler Memory Scale, Paired-Associates Learning test, Famous Faces Test, Autobiographical Memory Interview, Crovitz test
Snyder et al., "Artery of Percheron Infarction with Persistent Amnesia."	A	stroke	40	F	Combined	Canada	alert, disorientation, lack of judgement, some impulsiveness	recurrent deep vein thrombosis (DVT)	4m	1d	1y	stable	unclear
Solcà et al., "Impairment of Semantic Memory after Basal Forebrain and Fornix Lesion."	TW	post-surgery	54	F	Anterograde	Switzerland	none	none	6w	2w	8w	semantic memory improved slightly	Visual Recognition, Copy of Geometrical Figures and Drawings, Verbal Span, Episodic Memory CERAD, Autobiographical Memory Interview, Cambridge Semantic Battery, Word BECS-GRECO, Picture BECS-GRECO
Speedie and Heilman, "Amnesic Disturbance Following Infarction of the Left Dorsomedial Nucleus of the Thalamus."	A	stroke	33	M	Anterograde	US	disorientation and confusion	past psychiatric history	unclear	unclear	unclear	NA	Wechsler Adult Intelligence Test, Boston Naming Test, Wisconsin Card Sorting Test, Wechsler Memory Scale, Rey Auditory Verbal Learning Task, Rey Osterrieth Complex Figure, Kimura's Recurring Figures Technique, Ben Seltzer Retrograde Amnesia Questionnaire, Logical Memory Stories, Paired Associates
Stuss et al., "The Neuropsychology of Paramedian Thalamic Infarction."	RC	stroke	54	M	Combined	Canada	apathetic, unconcerned, disoriented for time	hypertension	6m	unclear	12m	stable	Wechsler Adult Intelligence Scale, Wechsler Memory Scale, Benton Visual Retention Test, Three word Memory, Consonant Trigrams, Retrograde Amnesia Test, Remote Memory Test, Knowledge of Generic Facts, Knowledge of Singular Facts
Takahashi et al., "Amnesia as a Result of Symmetrical Infarction of the Bilateral Fornices."	A	stroke	51	M	Combined	Japan	none	unclear	unclear	0d-2w	8m	improve	Miyake Memory Test, MMSE
Tsukiura et al., "Preserved Ability to Recognize Keywords Related to Remote Events in the Absence of Retrieval of Relevant Knowledge."	EC	encephalitis	52	F	Combined	Japan	mild personality change, disoriented to time and place	none	unclear	about 1m	unclear	NA	Public Event Test, modified version of the Dead or Alive Test, Wechsler Memory Scale-Revised, Rey Complex Figure, Rey Auditory Verbal Learning Test, Digit span, MMSE, Wechsler Adult Intelligent Scale-Revised, Autobiographical Incidents Schedule and the Personal Semantic Memory Test, Public Event Test, Dead or Alive Test, Public Semantic Memory Test
Valenstein et al., "RETROSPLIAL AMNESIA." Tsukiura et al., "Preserved Ability to Recognize Keywords Related to Remote Events in the Absence of Retrieval of Relevant Knowledge."	A	hemorrhage	39	M	Combined	US	confused, somnolent, orientated only for person	AVM	1m-5m	9m	2y	improve	Wechsler Adult Intelligence Scale-Revised, Verbal Fluency, Proverb Interpretations, Stroop, Visual-Verbal Test, Wisconsin Card Sorting test, Albert Remote Memory Battery, Wechsler Memory Scale-I, California Verbal Learning Test, Milner Facial Memory Task, Benton Visual Recognition Task, Rey Osterrieth Figure, Word Lists (California), Peterson-Peterson Words (visual presentation), Peterson-Peterson Words (auditory presentation), Albert Remote Memory, Florida Recent/Remote, Personal Autobiographical

Vann et al., "Memory Loss Resulting from Fornix and Septal Damage."	DN	surgery, hematoma	25	M	Combined	UK	unclear	pre-surgery seizure	8m, 20-21m, 32m, 4-4.5y	26m	4y	stable	Warrington Recognition Memory Test, WMS-III, WAIS-III, WTAR, FAS, RMT-Immediate, Doors and People Test, Adult Memory and Information Processing Battery (AMIPB), Hayling and Brixton Tests of Dysexecutive Syndrome, Remember/Know, RMT-Delayed, Autobiographical Memory Interview, WMS-R, RMT-Delayed, Autobiographical Memory Interview, WMS-R
von Cramon and Schuri, "The Septo-Hippocampal Pathways and Their Relevance to Human Memory."	DC	post-surgery	25	M	Combined	Germany	somnolent, disoriented	moderate meningism, left atrium vascular malformation	3m, 9m	9m	9m	improve	extended German version of part A of the "Trail Making Test", Paced Serial Addition Task, Standard Progressive Matrices, Digit Span, Word Span, Free Recall of a 10-item Word List, Reading Span, Corsi Block Tapping Test, Free Immediate Recall of a Story, Story Recall after 48 hours, Learning of 8 Word Paired Associates, California Verbal Learning Test, Recurring Words Test, LGT-3: Verbal Memory, Complex Figure Test, Figural Selective Reminding Test, Recurring Figures Test, Recognition Memory for Faces, Recognition of 10 Faces after 48 hours, LGT-3: Visual Memory
Von Cramon, Hebel, and Schuri, "A CONTRIBUTION TO THE ANATOMICAL BASIS OF THALAMIC AMNESIA."	B4	stroke	58	F	Anterograde	Germany	unclear	unclear	unclear	unclear	unclear	NA	Free Recall of a Word List, Free Recall of a 57unit Story, Recognition of Ben ton's Figures, Recognition of 10 Faces, Famous Faces, Life Events, Word Paired-Associates, Face/Name Paired-Associates, Object Paired-Associates, Visually Guided Styling Maze, Auditory Verbal Learning
Von Cramon, Hebel, and Schuri, "A CONTRIBUTION TO THE ANATOMICAL BASIS OF THALAMIC AMNESIA."	2	stroke	42	F	Combined	Germany	unclear	unclear	12m	unclear	unclear	NA	Digit Span, Block Span, Free Recall of a Word List, Free Recall of a 57 unit Story, Recognition of Benton's Figure, Free Recall of a 57 unit Story, Recognition of 10 Faces, Famous Faces, Life Events, Word Paired Associates, Face/Name Paired Associates, Object Paired Associates, Visually Guided Styling Maze, Auditory Verbal Learning
Wank et al., "Autobiographical Memory Unknown."	A	stroke	80	M	Combined	US	unclear	prior stroke, hypertension, chronic depression	1.5y	1.5y	unclear	unclear	Autobiographical Memory Interview, Famous Faces Task, Famous Landmarks Task, Social and Non-Social Concepts Task, Personality Trait Self Ratings, WAIS-IV, WMS-IV, Pyramids and Palm Trees, Boston Naming Test-II, Boston Naming Test-II, Verbal Phonemic and Animal Fluency, Trail Making Test A & B, Historical Events performance, Autobiographical Interview, Life Story Task, Self-Defining Memory Task, Tennessee Self-Concept Scale-II, Self-Projection Task
Wheatley and McGrath, "Co-Occurrence of Executive Impairment and Amnesic Syndrome Following Sub Arachnoid Haemorrhage."	PP	hemorrhage	37	M	Combined	UK	disoriented for time and place, withdrawn, confused, impoverished in activity, confabulated	a standard transphenoidal hypophysectomy for non functioning pituitary adenoma	unclear	unclear	unclear	unclear	N.A.R.T., Shipley-Hartford Vocabulary, Shipley-Hartford Vocabulary Matrices, Oldfield Wingfield Object Naming Test, Verbal Fluency (F.A.S.), Rey Osterrieth Complex Figure Copy, WMS-R, Digit span, RBMT, Autobiographical Memory Interview, Dead or Alive Test
Wicklund and Knopman, "Brain MRI Findings in Wernicke Encephalopathy."	A	Wernicke's encephalopathy	71	F	Combined	US	disorientation, fluctuating alertness, diplopia	myelofibrosis, stroke with secondary generalized tonic-clonic seizures	unclear	unclear	unclear	NA	unclear
Yasuda, Watanabe, and Ono, "DISSOCIATION BETWEEN SEMANTIC AND AUTOBIOGRAPHIC MEMORY: A CASE REPORT."	MN	post-surgery	56	F	Combined	Japan	right eye vision blur, diabetes insipidus, nervous, selfish, aggressive, insomnia	meningioma, Lineac radiation	6y	6y	unclear	NA	Paired-Associate Learning Test, WAIS-R, Benton Visual Retention Test, Wechsler Adult Intelligence Scale-Revised, Free Recall of Autobiographic Events, Photograph Description, Portraits Naming, Map Drawing, Public Events, Personally-involved Public Events, Historical Figures, Famous Singers, Famous Entertainers, Map Drawing, City Locations, Famous Monuments, Music, Technical Terms, and Other Memories

Yoon, Na, and Park, "Retrograde Amnesia Associated with Fornix Lymphoma."	A	tumor	65	M	Combined	Korea	personality changes(apathy and indifference), unawareness	stroke, diabetes	unclear	15d	3m (representative observation)	stable	MMSE, Seoul Neuropsychological Screening Battery, Korean version of the Boston Naming Test, Copy of Rey-Osterrieth Complex Figure, Rey-Osterrieth Complex Figure, Seoul Verbal Learning Test, Controlled Oral Word Association and Stroop Color-Word Interference Test, Digit span, Korean Public Event Recall Test
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Summary of Paper 1 and Paper 2 Conclusions

We conducted a systematic review of amnesia case reports with 2D lesion images available in the literature, ultimately analyzing a total of 118 amnesia cases. Focal brain damage usually results in combined anterograde and retrograde amnesia, with predominately anterograde or retrograde amnesia being relatively rare. Patient demographics, lesion etiology, and lesion location may all influence whether new memories or past memories are more affected. We revealed retrograde amnesia was more common in younger patients, with non-stroke lesion etiologies and lesions intersecting the insular cortex, predominantly on the right. Our results showed that the right hippocampus and left parahippocampal gyrus are highly related to the onset of amnesia, which supports the primary role of bilateral MTLs in human memory. We also found that the right middle temporal lobe and right frontal midorbital gyrus were intensely associated with RA, particularly involving the right inferior occipitofrontal fasciculus, right uncinate fasciculus, and right arcuate fasciculus in forming the remote memory network. These findings suggest the essential roles of verbal memory, visual processing, and associative learning in retrieving and storing remote memories. In contrast, the right anterior and superior cerebellum, the left superior frontal lobe, and the left superior and inferior colliculi were more specifically associated with AA, which indicates the participation of auditory and visual processing, overt and inner speech, and motor systems were highly essential in encoding new memories.

Discussion and perspectives

Our study deepened our understanding of amnesia characteristics and investigated brain regions and networks specific to anterograde and retrograde amnesia, which previously had no consensus on human evidence in this field. We employed multimodal analyses, including lesion network mapping of functional and structural connectivity at overall amnesia and anterograde and retrograde amnesia levels. There is a difference between the functional networks and lesion locations in which functional connectivity studies focus on the changes in communication and interactions between different brain regions within networks and how these changes, because of lesions, may lead to memory impairments. On the other hand, lesion location analysis investigates the specific brain structures that are more frequently affected in individuals with predominately retrograde amnesia compared to predominately anterograde amnesia, providing insight into the brain areas critical for two types of memory functioning. The integration of both functional connectivity and lesion location analyses allowed us to explore the underlying networks in remote memory, such as how fiber pathways connect the corresponding functional cortex uniquely involved in RA, and the complementary nature of these two approaches and their importance providing us a more comprehensive understanding of the neurobiological underpinnings of memory impairments and a more nuanced interpretation of the complex relationships between brain regions, networks, and memory. These findings paved the way for the potential targets to treat patients with new or old memory disorders.

Our study has several limitations. First, we restricted our analysis of amnesia cases to those characterized by long-lasting, focal lesion-induced impairments in remote and anterograde memory. Our conclusions may not be generalizable to amnesia cases involving other mechanisms, such as brain atrophy or neuropsychological factors, or those that exclusively

measure either old or new memories. Besides, we traced our lesions in 2D NIfTIs and did not adjust for lesion size in lesion location and network analyses. Lesions undetected by brain scans may also contribute to memory impairment, which could bias the results in an unknown direction. Our analyses inherently have publication and language biases based on the study design. We cannot draw any causal conclusions due to the nature of case reports/series and lesion analysis. Furthermore, some small structures and fiber tracts may require attention due to the current image technique's limitations in resolution and quality. Moreover, in our work, we traced all lesions (the old lesions pre-event and the new ones related to the onset of amnesia) available in the brain scans, which may sometime involve multiple lesions other than those directly related to the onset of amnesia. We consider that the uncertainty of causality in time and space on lesions may complicate our findings' generalizability and exaggerate the actual effect of lesions on amnesia. Also, we understand that non-focal lesions are an important source of amnesia, however, our analysis focused on focal lesions. This may bias our result toward an unknown direction and obscure some important interactions among brain structures causing amnesia. In addition, we did not differentiate between temporally graded and non-temporally graded retrograde amnesia. Although from our experience and published case results, most remote memory loss cases were not temporally graded retrograde amnesia. Future research should answer the differences between these two types of remote memory loss and their supporting brain structures and networks.

In future work, we will use multiple structural and functional connectomes, pipelines, and statistical methods to validate current results in internal and external amnesia and non-amnesia cohorts. We will explore different memory perspectives in amnesia, such as visual, spatial, verbal, and more, along with their respective memory networks and collaborative network

connections. This research will illuminate a better understanding of human memory mechanisms and the future development of memory circuit-targeted interventions.

Bibliography

See the reference under each paper.