GLOBAL PSYCHIATRY ARCHIVES

GLOBAL PSYCHIATRY ARCHIVES — Vol 6 | Issue 2 | 2023

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Impaired subjective organisation of memory in psychogenic amnesia

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Received: 2023-07-20; Accepted: 2023-08-29
DOI: 10.52095/gpa.2023.7027.1073

Abstract

Objectives: Psychogenic or dissociative amnesia is a rare condition which involves primarily impairment in episodic autobiographical memory. Why such impairment occurs in such patients has always perplexed researchers and multiple theories have been proposed. This paper proposes a novel hypothesis to explain psychogenic amnesia through a mechanism associated with impairment in the ability to subjectively organise and bring memory to conscious awareness.
Methods: The present paper presents a case study through careful investigation of a patient with psychogenic amnesia using extensive neuropsychological evaluation encompassing intellectual functioning, executive functions, and memory.
Results: The neuropsychological findings established that the patient suffered an autobiographical memory impairment which was more pronounced for events of the previous 5 years. On tests of episodic memory, the patient showed impairment in subjective organisation in recall of the memory. The patient's intellectual functioning and new learning were intact. Recognition memory for faces and words were also not impaired.
Conclusion: We propose that patients with psychogenic amnesia may have selective difficulty in bringing materials for retrieval into their subjective awareness. Such an impairment is observed in the subjective organisation of materials for memory retrieval. This case study will add to the understanding, assessment, and management of patients with psychogenic amnesia.

Keywords

Dissociative amnesia, Memory disorder, Dissociative disorder, Fugue, Autobiographical memory, Episodic memory

INTRODUCTION

Psychogenic amnesia (also called dissociative amnesia) is characterized by severe memory impairment in the absence of overt brain damage or a known neurological etiology. It has a sudden onset precipitated by traumatic and/or stressful life events (Markowitsch, 2003; Reinhold & Markowitsch, 2007). Such trauma or stressful life events induce changes in brain metabolic processes which leads to an inability to retrieve materials from long term memory (Lupien et al., 2005). Evans and Kihlstrom (1973) suggested that at the cognitive level, psychogenic amnesia is the result of a disruption of memory retrieval, stemming from a disorganisation of memory search processes. According to Evans and Kihlstrom (1979), the organisation of recall draws upon several features of memory, which could be person specific (e.g. familiarity, emotional valence, spatio-temporal context, and personal experience of the event), or material specific (e.g. semantics, orthography, visual- and acoustic cues). One of the hallmarks of psychogenic amnesia is the impairment of episodic autobiographical memory (Markowitsch, 2003; Mesulam, 2000) with relative sparing of new learning and memory (Harrison et al., 2017). In episodic autobiographical memory, vivid recollection of personal episodes are related to formerly experienced emotional states (Fujiwara & Markowitsch, 2006). Furthermore, studies have shown that autobiographical recall relies on subjectively reliving those events (Moscovitch, Cabeza, Winocur, & Nadel, 2016). This is achieved through activation of two different functional brain networks associated with a) self-generated conceptual/schematic representation and b) self-generated

perceptual-imagery information supported by dorsal medial and medial temporal systems of the brain (Sheldon, Fenerci, & Gurguryan, 2019). Functional abnormalities of the right prefrontal cortex have been observed in patients with functional amnesia. The right prefrontal cortex is particularly involved with synchronising personal factual and emotional components associated with an event and a sense of self-awareness in successful recall (Brand et al., 2009). In a functional neuroimaging study, a patient with psychogenic amnesia showed left hemisphere fronto-temporal activation in autobiographical memory retrieval whereas healthy individuals showed right hemisphere activation suggesting that patients with psychogenic amnesia are emotionally detached from their personal memory (Markowitsch, Fink, Thone, Kessler, & Heiss, 1997). Abnormal cerebral metabolism in the right medial frontal brain region has been observed in a Positron Emission Tomography (PET) investigation of a patient with psychogenic amnesia (Yasuno et al., 2000). These findings suggest that brain areas associated with self-awareness and self-referential processing are critically involved in psychogenic amnesia. Furthermore, we know that the frontal lobes are crucial for autonoetic consciousness (Markowitsch, 2002). Similarly, Kopelman (2000) proposes that the inability to retrieve personal information in psychogenic amnesia is associated with an increased inhibitory process of the prefrontal cortex. This line of argument is also supported by Fujiwara and Markowitsch (2006): the executive control processes supported by the prefrontal cortex are overloaded with holding stressful memories out of self-awareness or autonoetic experience. Indeed, in psychogenic amnesia, autonoetic experiences and self-related integration in memory have been found to be dysfunctional (see Staniloiu and Markowitsch [2012] for a review). Autonoetic experiences are useful in organising memory in a person specific, subjective way (Tulving, 1985, 2002). In the current paper, we propose to investigate how self-related subjective organisation of materials in psychogenic amnesia might be affected. This paper will aim to understand the cognitive mechanisms of memory failure in individuals with dissociative amnesia via the in-depth analysis of a single-case study.

A way to measure the subjective organisation in memory is via analysing the recall of a subject and seeing if the recollected items are consistently recalled in clusters. Individuals establish a unique organisation in memory based on their personal experiences (Bjorklund, Ornstein, & Haig, 1977). This subjective organisation facilitates encoding and retrieval processes. Therefore, the analysis of subjective organisation processes in free recall in individuals with psychogenic amnesia might provide understanding of memory failure in these individuals. Typically, the analysis of verbal learning in these individuals is confined to the amount (quantitative analysis) of individual recall. Whereas the analysis of subjective organisation focuses on the qualitative nature of the material learnt or forgotten. The organisation of recalled material could be based on the associative nature of the recalled items (such as semantic organisation) or could be without any obvious external criteria which, in a free recall task, is called subjective organisation (Kurtz & Zimprich, 2014). Tulving (1962, 1964) suggests that subjective organisation is associated with higher order units in memory storage which facilitate memory by forming a higher order cognitive representation of the words on a list.

The question could be asked if the amnesia of a retrograde type has any similarity between episodic autobiographical memory and episodic memory for new events. The theoretical assumption is that the recollections of items from a list is analogous to the autobiographical re-experience. A significant body of research suggests that similar brain structures (such as the hippocampus and limbic system) are involved in episodic and autobiographical memory (Burianova, McIntosh, & Grady, 2010; Moscovitch et al., 2005). Therefore, understanding the mechanisms of episodic memory could be useful to understand the mechanism of episodic autobiographical memory that is typically impaired in psychogenic amnesia. A similar approach has been extensively used by Markowitsch et al. (1997). The authors investigated the brain mechanism associated with new learning in a probable case of psychogenic amnesia, who had preserved episodic memory and other cognitive functions. Their findings showed that in patients with retrograde amnesia, activity of the anterolateral temporal and possibly infero-lateral prefrontal cortices is blocked, thus preventing access to pre-psychogenic fugue memories. In the current case report, we focused on understanding the cognitive mechanisms in memory processes that might be altered in patients with psychogenic amnesia. Especially considering the role of the frontal lobes in subjective organisation and experiences of memory content, we sought to understand subjective organisation of memory in psychogenic

amnesia patients. Such an understanding is critical to advancing our knowledge of the cognitive mechanisms involved in memory impairment in psychogenic amnesia. Literature review shows no study of the process of subjective organisation in psychogenic amnesia.

THE CASE

The patient gave written informed consent for the assessment and publication of the report. Ethical approval to report the case was not required as of National guidance for this case report. To protect the identity of the patient no specific detail of the person or place is given here.

A 53-year-old right handed, high school educated, low skilled factory worker, unmarried gentleman was brought to an NHS psychiatric facility by the police. The police were informed by a member of public that the patient was wandering around a bus station about 2pm. The patient had a ticket to go to a different city which was approximately 200 miles away from where he lived. On enquiry by the police, the patient could not remember why or when he had purchased the bus ticket. Neither was he aware of who he was or where he lived. The police were able to identify him by his work identification card and contacted his family. On psychiatric examination by a consultant psychiatrist, the patient was found to be conscious, attentive, oriented to time, place and person and had fluent spontaneous speech. However, he had no recollection of any events of the past five years. He could not recognize his mother or siblings. A mental status examination showed he was fidgety and of sad mood. No thought disorders, hallucinations or delusions were reported. There was no history of head trauma or seizure. A physical examination revealed no abnormalities. A structural MRI scan of the brain also revealed no abnormality (Figure 1).

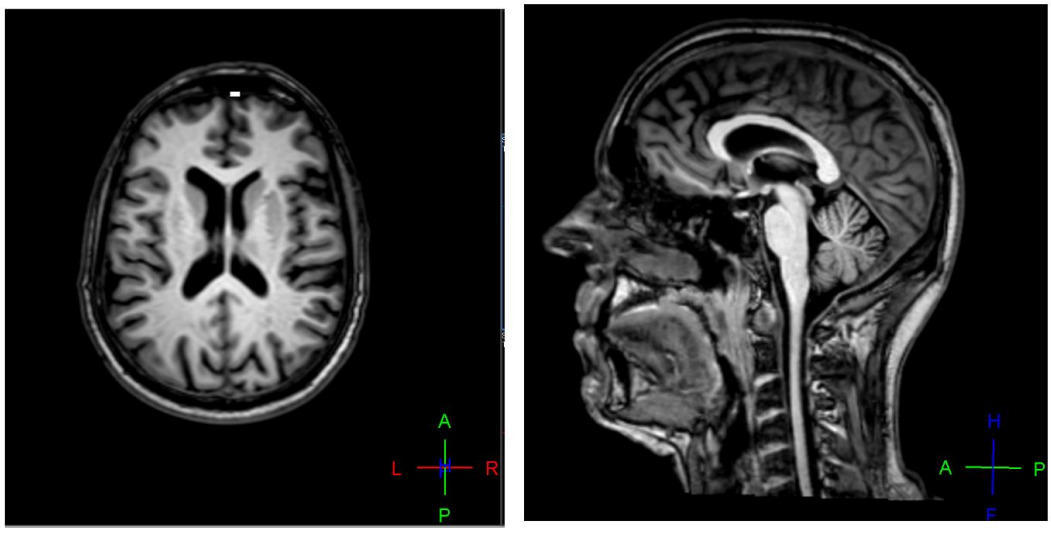

Figure 1. The structural magnetic resonance image (MRI) of the patient's brain shows no brain structure abnormality. A= anterior, F= foot, H= head, L= left, P= posterior, R= right

All blood investigations to evaluate liver functions, renal functions, full blood count and other inflammatory markers were not remarkable. There were no focal neurological signs apart from the memory impairment encompassing the past five years of his life. The day before the index event, the patient was sent a letter from a bank to recover their debt. Upon receiving the letter, he became agitated and could not sleep during the night. On the morning of the index event, he left for work without having breakfast. The travel distance to his work place by bus was approximately one hour. On the way to work, he withdrew money from an automated teller machine (ATM) at several bus stops, and did not report to work: instead he went to a betting shop. The patient had a history of several episodes of depression and was in severe debt because of his gambling habit. He had responded well to antidepressant treatments in the past and had not been on any psychiatric medication for over a year prior to the index event. The patient used to live with his mother. The nature of his amnesia suggests a

pattern of fugue to focal retrograde amnesia (fugue to FRA; see Harrision et al. [2017] for categorisation of different types of psychogenic amnesia). No evidence of malingering could be established clinically and on neuropsychological tests based on De Renzi et al. (1997) criteria.

RESULTS

A neuropsychological assessment was carried out between 1-2 weeks after the index event. At the time of neuropsychological assessment, the patient was alert, conscious and had spontaneous speech. He was able to recognise his mother and siblings (a change from initial presentation to the psychiatric service). However, he continued to have difficulty remembering anything from the last five years of his life. Neuropsychological functions were assessed for intelligence on the Raven's Standard Progressive Matrices (SPM) test (Raven, Court, & Raven, 1996). Memory was assessed with the California Verbal Learning Test -2 (CVLT 2; Delis, Kramer, Kaplan, & Ober, 2000), Rey's Auditory Verbal Learning Test (RAVLT; Schmidt, 1996), Recognition Memory Test (Warrington, 1984), Logical memory, Digit Forward and Digit Backward subtests of Wechsler's Memory Scale (WMS-III; Wechsler, 1997). Autobiographical memory was assessed using the Test of Autobiographical Fluency (Dritschel, Williams, Baddeley, & Nimmo-Smith, 1992). Executive function was assessed with the Wisconsin's Card Sorting Test (WCST; Kongs, Thompson, Iverson, & Heaton, 2000).

Responses on the information and orientation sub-test of the WMS III were interesting. He could give his name, his mother's name and his age correctly. He had good orientation to place and time. However, he could not remember where or when he was born. He could not answer correctly who the current prime minister of the country was, but instead, gave the name of the prime minister from 4 years ago. He could not name the prime minister before that, nor was he aware of the current political situation in the country. On the SPM, which is a test of abstract reasoning and intelligence, his performance was in the normal range (50th percentile). On the WCST, the patient showed problems in forming an initial concept (2-5th percentile on trials to complete first category) and maintaining an established set (6-10th percentile). The patient had poor performance on the Warrington's Recognition Memory Tests for words (5th percentile) and faces (10th percentile). However, these performances were above chance level. The patient showed normal working memory capacity on the digit forward and digit backward tests. His new learning across trials on the CVLT was also normal. His immediate and delayed recall on the CVLT was also adequate. In terms of organising materials in long term memory, his semantic clustering and serial clustering strategy was adequate. However, he had problems in subjective clustering on the CVLT. Word list learning was also assessed using RAVLT. On the RAVLT, his acquisition and learning of verbal material was adequate (16th percentile). No loss of information was observed on the delayed recall on the RAVLT (82nd percentile). His learning on the logical memory test of the WMS-III was also adequate with adequate story theme recalled. He was also assessed for his autobiographical memory using the Test of Autobiographical Fluency, which assesses autobiographical memory from personal semantics and personal incidents (episodes). Personal episodic information refers to single incidents, while personal semantic information is information repeatedly experienced by the subject (e.g., one's name). The patient was asked to give as many names within 90 seconds of individuals he knew from three time periods: childhood, early adult hood and recent adulthood for personal semantic category and to give personally experienced events for the same life periods for the personal episodic category. He showed problems on both the personal semantics and personal episodic facts. He had particular difficulty on personal semantics from late adult life, able to remember names of only two individuals as opposed to five from childhood and nine from his early adult period. His personal episodic was similar across all the three time periods. See Table 1 for neuropsychological functions results.

DISCUSSION

The literature proposes several cognitive and neurobiological mechanisms for understanding the pathophysiological processes underlying psychogenic amnesia. For example, Markowitsch et al. (Markowitsch, 2002; Staniloiu & Markowitsch, 2012a, 2014; Staniloiu, Markowitsch, & Brand, 2010) propose that the release of stress related hormones result in blocked memory, which the authors label as "mnestic block syndrome". A similar hypothesis was proposed by Hodges (2002) as they suggest that the psychogenic factors can lead to acute neurotransmitter changes that shut down medial temporal lobe structures.

Table 1. Shows percentile score of the patient on neuropsychological tests or raw scores where normative data are not available

Intelligence	SPM	50th %ile
Executive Functions	WCST-1st category	2-5th %ile
	WCST- Maintaining set	6-10th %ile
	Digit Forward	6
	Digit Backward	4
Autobiographical Fluency	*Personal Semantics:*	
	Recent Past	2
	Early adulthood	9
	Childhood	5
	Personal Episodic:	
	Recent Past	5
	Early adulthood	4
	Childhood	4
Memory	Logical Memory	15th %ile
	CVLT:	
	Short delay recall	50th %ile
	Long Delay Recall	50th %ile
	Semantic clustering	31st %ile
	Serial clustering	31st %ile
	Subjective clustering	7th %ile
	RAVLT:	
	Subjective clustering	<5th %ile $
	Total Learning	16th %ile
	Retention	82nd %ile
Recognition Memory	Warrington's Face Recognition Memory	10th %ile
	Warrington's Word Recognition Memory	5th %ile

%ile= percentile, $= percentile calculated based on data from Gross et al., (2013)

However, Kopelman et al. (2000) are of the view that an inability to retrieve personal information is due to the increased inhibitory process of the prefrontal cortex. Several neuroimaging studies have also shown abnormal activity in the frontal lobes of patients with psychogenic amnesia (Markowitsch et al., 1997; Yasuno et al., 2000). As mentioned before, the frontal lobes are involved in subjective experience of the memory content (autonoetic experiences). Furthermore, studies have shown that the frontal lobe lesion causes impairment in memory organisation (Gershberg & Shimamura, 1995). This is supported by the findings of Alexander, Stuss & Fansabedian (2003) using the CVLT. The authors found that patients with the frontal lobe lesions had poor subjective organisation, regardless of impaired learning or normalised learning conditions. Similarly, Eslinger and Grattan (1994), and Janowsky, Shimamura, Kritchevsky and Squire (1989) found poor performance on the RAVLT in heterogeneous

groups of patients with frontal injuries. Poor performance of these patients was attributed to poor subjective organisation.

We carried out an extensive neuropsychological investigation of a patient with psychogenic amnesia. The neuropsychological findings suggested average intellectual ability with preserved anterograde memory and normal executive functions. The patient had dense memory impairment for autobiographical memory reflected during the interview and on the Autobiographical Fluency Test. The impairments were more pronounced for events of the last 5 years.

As the focus of the investigation was to understand the cognitive mechanisms underlying memory problems, we used two tests of word list learning: the CVLT and the RAVLT. The CVLT gives indices of several memory organisation procedures, such as semantic organisation, serial organisation, and subjective organisation. On the other hand, the RAVLT does not give index of semantic organisation but serial and subjective organisation indices can be computed. The patient had normal memory performance and high semantic and serial organisation on the CVLT (see table 1). In contrast, his subjective organisation was poor on the CVLT and on the RAVLT. The poor subjective organisation on the memory tests and the inability to recall information from the past five years may reflect his poor ability to utilise self-referential processing which is critical for autobiographical memory retrieval. Problems in subjectively organising and accessing his memory was also evident on the Autobiographical Fluency Test where performance was poor on both the personal semantics and personal episodic facts.

Subjective organisation is an idiosyncratic process associated with processing information from an egocentric perspective where subjective experiences are used to organise material for better recall. It has been shown that patients with depression who had poor self-schema had poor subjective organisation of memory items (Davis, 1979) and poor self-organisation of memory. Subjective organisation is a higher order active cognitive process, whereas serial or semantic organisation is a passive process (Tulving, 2002). Impaired subjective organisation in the patient may indicate an impairment in conscious self-awareness and active search processes for memory items. Indeed, higher order executive functions have been found to be impaired in cases with retrograde psychogenic amnesia (Fujiwara et al., 2008). Subjective organisation facilitates coherent organisation of memory items (Tulving, 1964). In the absence of coherently organised items, memory might be fragmented and hence difficult to access for personal recollection. Subjective organisation has been found to mediate the recall performance of individuals across the life span (5 to 89 years of age; Davis et al., 2013). As by definition, subjective organisation is an idiosyncratic process, which requires a need to activate a personally relevant strategy based on an individually self-focussed process. Any absence of such organisation may indicate an inability to bring memory material into self-awareness. Subjective organisation strengthens the association between items thus making them more accessible. Following from this, the inability to self-organise and bring materials into self-awareness may, therefore, make memory items less accessible, which in turn, results in amnesia in such patients.

Through careful understanding of the nature of memory organisation in this patient with psychogenic amnesia, we propose that amnesia resulting from a severe stress may dissociate systems responsible for self-awareness and memory. Failure in the subjective organisation of memory in such patients reflects a disconnection between the self-awareness and memory systems. Spiegel et al. (2011) have previously suggested that amnesia of psychological origin should be viewed as disruption of and/or discontinuity of the subjective integration of memory.

RECOMMENDATIONS

Such cases should have a through psychiatric and neurological examination to rule out any organic pathology.

Malingering should be ruled out in such cases.

An earliest neuropsychological assessment should be carried out to understand the nature of cognitive problems. Any change on the neuropsychological functions should also be tracked over a period.

A detailed memory assessment should be considered.

Authors' Contribution: SK and TM conceptualised the study. SK and TM collected data. SK, TM and AV scored and interpreted the data. SK and AV prepared the manuscript. TM provided feedback on the MS. All the authors approved the final version of the manuscript.

Declaration of competing interest: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethical Approval: Ethical approval to report the case was not required as of National guidance for this case report.

Funding: None.

Informed Consent: The patient gave written informed consent for the assessment and publication of the report. To protect the identity of the patient no specific detail of the person or place is given here.

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