Journal of Alzheimer's Parkinsonism & Dementia

Research Article

Autobiographical Memory Impairment in Alzheimer Disease and Vascular Dementia

This article was published in the following Scient Open Access Journal:
Journal of Alzheimer's Parkinsonism & Dementia
Received October 17, 2016; **Accepted** November 23, 2016; **Published** December 05, 2016

Paramita Bose[1,2], Atanu Biswas[1], Sandip Pal[3], Jayanti Basu[2] and Shyamal Kumar Das[1]*

[1]*Department of Neurology, Bangur Institute of Neurosciences, Kolkata, India*

[2]*Department of Applied Psychology, University of Calcutta, Kolkata, India*

[3]*Department of Neurology, Calcutta Medical College, Kolkata, India*

Abstract

Background: Autobiographical memory (AM) is a memory system consisting of different kinds of knowledge about oneself. The different subtypes of AM have been studied in Alzheimer disease (AD) and semantic dementia but there are only few studies available in vascular dementia (VaD) despite its high prevalence in Asian countries.

Objectives: To compare the impairment of AM between healthy elderly subjects, AD and VaD patients of eastern India.

Methods: Consecutive AD and VaD patients and healthy elderly relatives of patients attending the institute were recruited for the study. Patients of AD and VaD were matched for age, education, and general levels of cognitive and everyday functioning. The Autobiographical Memory Interview (AMI) Scale was used to assess the AM. General Health Questionnaire (GHQ-12), Bengali Mental State Examination, Clinical Dementia Rating scale and standard definition were used for assessment of each subject in the study.

Results: There were 30 patients each of AD and VaD, and 100 controls for the study. Patients of AD and VaD performed poorly in both semantic and episodic AM relative to controls. Mean scores of VaD were better in all the variables than AD. AD patients showed severe impairments in recent life section autobiographical incident than VaD and controls. VaD patients had problems in expressing their thoughts in a consistent manner.

Conclusions: Patients with dementia exhibited deficits in remembering past events and generating fewer external and internal episodic details than normal controls. Patients of AD exhibit more deficits than VaD in remembering the past events. Most of the VaD patients had problems in expressing their thoughts in a consistent manner.

Keywords: Alzheimer disease, Autobiographical memory, Autobiographical Memory Interview, Vascular dementia, India

Introduction

Autobiographical memory (AM) is a memory system which consists of different kinds of knowledge pertaining to oneself. It has both episodic and semantic components [1,2]. Whereas the episodic AM consists of personal experiences related to specific objects, people and events happened at a particular time and place, the semantic components deals with general knowledge and facts about the world.

Normal aging process is generally associated with change in various cognitive domains including memory. Up to 10% of persons above 70 years and about 20%-40% of individuals above 85 years have clinically identifiable memory problem [3]. The episodic component of AM declines with age, possibly as a result of decline in white matter integrity [4,5]. It has been documented that healthy older adults showed a significant reduction of episodic details of autobiographical memories of past events than younger adult [6,7]. Episodic autobiographical memories deteriorate more with age, regardless of the time periods being tested than did personal semantic memory [6,8]. Rubin (2002) found that in control subjects, autobiographical memories from adolescence and early adulthood were remembered better than autobiographical memories from other time periods, a phenomenon known as the reminiscence bump [9].

Memory impairment is the most common cognitive symptom of dementia. Impairment of AM may vary in different type of dementia depending on the differences of brain pathology [10,11]. This may be due to widespread cortical damage such as

***Corresponding Author:** Shyamal Kumar Das, Department of Neurology, Bangur Institute of Neurosciences 52/1A, S.N. Pandit Street, Kolkata, 700 025, India, Tel: +91 33 2223 7722, Fax: +91 33 2223 6677, Email: das_sk70@hotmail.com

Alzheimer disease (AD), focal damage(s) as in vascular dementia (VaD) or problems with the interconnections as occur in corpus calossal lesion.

Autobiographical memory loss is a prominent feature in AD, which is accompanied by a decrease in episodic memory [12]. In AD, impairments of AM are often associated with lesion in the medial prefrontal, medial and lateral parietal and medial and lateral temporal regions [13]. Most of the studies have accepted that human hippocampus is involved in episodic memory [14-16]. Several studies have documented the AM loss for past experiences in early AD by using different test instruments [17-21]. Some studies have documented certain level of impairment in both semantic and episodic components of AM in AD with the help of Autobiographical Memory Interview (AMI) [22].

While majority of the studies on AM impairment focused on AD and semantic dementia, only few studies have attempted to explore this in VaD [23-25]. One study documented that episodic memory impairment was severe in AD whereas subjects with subcortical VaD were more impaired in semantic memory and executive/attentional functioning, and visuospatial and perceptual skills [23]. Using Positron Emission Tomography, Reed, et al. (2000) found that episodic memory failure in patients with subcortical cerebrovascular disease was associated with the prefrontal lobe mechanism, whereas memory performance in patients with AD was correlated with left hippocampal and left temporal lobe mechanism [26]. Patients with subcortical VaD showed widespread diffuse changes in brain, including myelin loss in the frontal lobe white matter [27]. Baddeley and Wilson (1986) had noted that such patients can access lifetime period and general events, but cannot recall specific and detailed autobiographical memories [28]. Additionally, these individuals may produce incorrect memories. Budson and Price (2001) noted that VaD could cause episodic memory loss by impairment of connection with the frontal lobe [29]. If the frontal lobe is damaged, the circuit fails with the medial temporal lobes and the memories become distorted and inaccurate. Two studies have shown that the frontal lobes are particularly, though not exclusively, susceptible to the effects of vascular lesions [30]. In VaD, the patients may lack consistency while describing the events but they rarely lack their personal identity. They remember things without sequence or logic.

The autobiographical memory recall test is more revealing than MMSE in assessing the clinical memory function, a key factor in determining the definitive evaluation of dementia [31]. The study from Washington shows that AM test correlates significantly with the dementia severity rating scale (Clinical Dementia Rating scale) [32].

Cultural factors also play an important role in brain functions [33-35]. There are certain societies or ethnic groups having a significant variation in types of dementia.

AD may be more common in Western Europe and North America, with the exception of American Indians [36]. However, Russia, India, Japan and China may have a less AD and more VaD compared to Western Europe and North America [37]. Despite a huge burden of VaD there is dearth of studies of AM in VaD in the literature. High prevalence and incidence of stroke and consequent increase burden of VaD in India [38] encouraged us to conduct this study.

Thus we plan to conduct this study with a view to compare the Autobiographical Memory impairment in AD and VaD patients relative to healthy elderly people in a neurological institute of eastern India. This may help clinicians in differentiating the two major subtypes of dementia in view of overlapping radiological findings and lack of autopsy validation especially in resource-poor countries.

Methods

The participants in this study were Bengali speaking subjects of middle class background. Each patient was seen by a neurologist (AB or SP), along with neuropsychological assessment (done by PB) at the Cognitive Clinic, Bangur Institute of Neurosciences, Kolkata and each had a MRI scan. Patients were recruited consecutively attending the clinic. Thirty AD patients were included following the National Institute of Neurological and Communicative Disorders and Stroke (NINCDS) and the Alzheimer's Disease and Related Disorders Association (ADRDA) criteria [39]. The VaD patients were selected from the clinic using NINDS-AIREN (National Institute for Neurological Diseases and Stroke Association –Association International pour la Recherche, et al. Enseignement en Neurosciences) criteria [40]. Those with substantial subcortical white matter pathology on T2 weighted magnetic resonance imaging (MRI) together with vascular risk factors plus a history of transient ischemic attacks (TIA) or focal neurological signs on examination were diagnosed as subcortical VaD. A total 30 VaD were recruited for the study, of which 22 had subcortical VaD and 8 had multi-infarct variety.

The inclusion criteria were as follows: (i) Age range of 50 years and above, (ii) a minimum of Class VI education, (iii) Clinical dementia rating scale (CDR) range 0.5 to 2, (iv) Able to read and write Bengali, (v) Bengali Mental State Examination Score (BMSE) ≤ 26 [41]. Subjects were excluded for the following criteria: (i) a history of co-morbid psychiatric and/or neurological disorder, (ii) history of head injury or central nervous system infection, (iii) history of alcohol or other substance abuse, (iv) presenting with medical conditions such as hepatic, renal and pulmonary disease, systemic infection or metabolic encephalopathy, (v) significant language, visual and hearing impairment.

Healthy elderly subjects were recruited from the healthy relatives of patients attending the outpatient department of the Institute. Individuals scoring above the cut-off point of 2 on the General Health Questionnaire (GHQ) were excluded from the study population.

We recorded the demographic profile of the patients including the age of the subjects, gender, education, address, income, occupation, marital status. We used the Clinical Dementia Rating Scale (CDR) [42] to classify the stage of dementia as well as the level of everyday impairment. We have experience of using CDR in assessing patient of dementia in Bengali-speaking population [43]. The "Everyday Abilities Scale for India" (EASI) was applied to assess overall abilities like toileting, maintaining dress, communication, and decision-making required for day-to-day functioning [43].

Materials Used

Apart from CDR and EASI, we used following instruments to evaluate our patients.

General Health Questionnaire (GHQ-12)

The General Health Questionnaire (GHQ-12), a self-administering screening questionnaire consists of 12 items. This questionnaire has 100% sensitivity and 88% specificity, respectively [44,45]. It is widely used internationally to measure the mental health status of the individual. It measures the severity of a mental problem over the past few weeks using a 4 point Likert type scale (from 0 to 3). There is no time limit to complete it. Each item has four response possibilities (0 - not at all, 1 - no more than usual, 2 - rather more than usual, 3 - much more than usual). Total score ranging from 0 to 36. A score of below 2 signifies the subject does not have any cognitive or psychiatric disorder. There was no difficulty in its applicability in Bengali culture. It is quite easy to administer and the scoring procedure is also very simple.

Bengali Validated Mini Mental State Examination (BMSE) and Kolkata Cognitive Screening Battery (KCSB)

BMSE and KCSB are validated instruments to assess adults for cognitive impairment. We used these instruments for both patients and control groups for assessing cognitive impairment [41].

Autobiographical Memory Interview Scale (AMI)

The semi structured autobiographical questionnaire assesses each participant's ability to recall both general information (semantic component) and detailed specific events situated in time and space (episodic component) from between three time periods [22].

In the personal semantic schedule, subjects were asked to recall facts from their past life, relating to childhood, early adult life and more recent facts.

In the autobiographical incident schedule, the participants were asked to recall autobiographical memories from same three time periods which were relevant to their personal lives (Childhood [referred to as Section A], Early adult life [Section B], Recent life [Section C]). As the study was conducted in a Bengali speaking population, original question information related to the last Christmas or Thanksgiving was replaced by Durga Puja or Bijoya greetings in the recent life section of Personal semantic.

The inter-rater reliability was determined by applying the AMI scale on 10 randomly selected normal subjects by two neuropsychologists. The inter-rater reliability measures for semi structured autobiographical questionnaire were ranged from 0.75 to 0.92.

In the present study, we administered AMI to both patient and control groups for assessing autobiographical memory impairment.

Procedures

A total of 60 patients comprising of 30 each with AD and VaD and 100 normal subjects were included in the study.

An informed consent was obtained from each participant and their family members for participating the study. The study was approved by the institutional ethics committee.

Analyses

The differences between the groups were analysed using one way analysis of variance (ANOVA). Post hoc comparison was performed using Scheffe's test to explore the significant group effects.

Results

Out of 136 normal subjects initially recruited, 28 subjects were excluded as they fell above the cutoff point in the GHQ-12. Another 8 were rejected because they could not complete all the subtests. Thus, a total 100 normal subjects were finally available for analysis.

The demographic characteristics of patients and normal subjects are shown in Table 1. There were more men in AD group than women. The probable reason for this can be that the illness of women in Indian society is not given due importance as compared to that of men.

Neuroimaging features of the patients are given in Table 2.

One way analyses of variance revealed no significant difference between AD, VaD and control groups for age or years of education (both F values <2.5, p values >0.1). Statistical tests comparing AD and VaD on the BMSE, CDR, and EASI indicated no significant differences (*t* values <1, p values >0.1).

Table 3 presents the means and standard deviations of the Autobiographical Memory Interview Scale for subjects with AD, VaD and normal controls. Dementia group i.e. patients of AD and VaD performed poorly as compared to normal control group in all the subcategories of AMI that includes semantic as well as autobiographical incidents. Mean scores of VaD were better in all the subcategories than AD. AD patients showed severe impairments in recent life section autobiographical incident than VaD and normal control subjects. Although VaD patients performed better than AD, most of them (80%) had difficulty in recalling the events and expressing their thoughts in a consistent manner.

In subgroup analysis we found subcortical VaD performed better than AD and multi-infarct variety of VaD in all aspects of autographical memory testing. However, their responses were inconsistent while recalling autographical incidents and semantics. While all VaD patients had preserved self-identity about 30% of patients with AD had loss of it.

Post-hoc analysis of Scheffe's test (Table 4) reveals that the patient groups (AD and VaD) differ from the normal group and

Subjects	n	Gender Men: Women	Mean age (±SD)	Mean education (±SD)	Mean BMSE score (±SD)
AD	30	22:8	64.36 ± 8.27	10.93 ± 1.99	20.5 ± 4.5
VaD	30	18:12	64 ± 8.93	10.13 ± 1.85	22.4 ± 3.4
Normal groups	100	50:50	64.55 ± 7.66	10.97 ± 1.96	29.0 ± 2.0

Abbreviations: AD=Alzheimer disease, VaD=Vascular dementia, BMSE=Bengali mental state examination, SD=standard deviation, n=Number of subjects

Table 1: Demographic characteristics of the final sample

Dementia type	Findings in MRI scan of brain
AD (n=30)	Normal – 6
	Diffuse cerebral atrophy – 8
	Hippocampal atrophy with or without parietal atrophy – 10
	Mixed atrophy and leucoariosis (Fazekas score 1) – 6
VaD (n=30)	
(a) Subcortical VaD	Ischemic changes in subcortical white matter in T2 weighted MRI (Fazekas score 2 or 3) – 22
(b) Multi-infarct variety	Multiple cortical or subcortical infarcts or gliosis with or without subcortical ischemic changes – 8

Abbreviations: MRI=magnetic resonance imaging scan, AD=Alzheimer disease, VaD=Vascular dementia

Table 2: Neuroimaging findings of patients

Autobiographical Memory Interview Scale	Groups	n	Mean	Std. Deviation
Childhood Personal Semantic (CPS)	AD	30	10.65	3.209
	VaD	30	13.58	3.000
	Control	100	17.71	2.172
Childhood Autobiographical Incident (CAI)	AD	30	3.13	1.756
	VaD	30	4.20	1.562
	Control	100	7.71	1.008
Early Adult Life Personal Semantic (EAL PS)	AD	30	12.58	3.138
	VaD	30	15.48	2.045
	Control	100	20.27	.796
Early Adult Life Autobiographical Incident (EAL AI)	AD	30	3.22	1.179
	VaD	30	4.63	.850
	Control	100	8.68	.457
Recent Life Section Personal Semantic (RLS PS)	AD	30	11.57	3.579
	VaD	30	15.88	2.473
	Control	100	20.73	.534
Recent Life Section Autobiographical Incident (RLS AI)	AD	30	2.57	1.731
	VaD	30	4.45	1.434
	Control	100	8.87	.358

Abbreviations: AD=Alzheimer disease, VaD=Vascular dementia

Table 3: Means and Standard deviations of the Autobiographical Memory Interview Scale are presented separately for the AD, VaD and control group

also differ between them in terms of Autobiographical Memory variables.

The results reveal that both the patient groups differ from the normal group and also differ between them in terms of all AM variables in most cases.

Discussion

Autobiographical Memory is the important feature of memory system because of its recollection of personally experienced past events. It helps in developing one's self or individual identity and to remain oriented in the world and to follow goals effectively in the light of past problem solving and interpersonal goals. The different lifetime periods tapped in the AM are childhood personal semantic and autobiographical incident, early adult life personal semantic and autobiographical incident and recent life section personal semantic and autobiographical incident.

In this study, AD and VaD patients showed significant impairment in both personal semantic and personal autobiographical incidents memory as compared to healthy older subjects. It is known that the hippocampus and the area surrounded by it are affected in AD. This area plays an important role in forming memories. AM impairment in AD is consistent with previous studies [17,21]. The AD group performed significantly poorer in Autobiographical memory than VaD and control groups (Table 4). Autobiographical episodic memory is believed to be the most vulnerable in AD, and is often impaired from the early stages [46]. We also observed that AD patients consistently recalled unclear narrations of the past. Even in personal semantic aspects, subjects with AD showed significantly poor performance than VaD and control subjects. This is probably due to significant lesions in the lateral temporal cortex in patients of AD [47]. Normally while describing the past events, subjects typically used both episodic and semantic forms of information, which are knitted together to form a meaningful narrative speech. In AD patients, with the

Autobiographical Memory Interview Scale	*Comparison groups*	*Mean difference*	*Standard error*	*significance value*
Childhood Personal semantic (CPS)	AD vs VaD	-2.933(*)	.727	**.001**
	AD vs Normal	-7.060(*)	.586	**.000**
	VaD vs Normal	-4.127(*)	.586	**.000**
Childhood Autobiographical Incident (CAI)	AD vs VaD	-1.067(*)	.359	**.035**
	AD vs Normal	-4.577(*)	.290	**.000**
	VaD vs Normal	-3.510(*)	.290	**.000**
Early Adult Life Personal Semantic (EAL PS)	AD vs VaD	-2.900(*)	.522	**.000**
	AD vs Normal	-7.682(*)	.421	**.000**
	VaD vs Normal	-4.782(*)	.421	**.000**
Early Adult Life Autobiographical Incident (EAL AI)	AD vs VaD	-1.417(*)	.212	**.000**
	AD vs Normal	-5.458(*)	.171	**.000**
	VaD vs Normal	-4.042(*)	.171	**.000**
Recent Life Section Personal Semantic (RLS PS)	AD vs VaD	-4.317(*)	.576	**.000**
	AD vs Normal	-9.158(*)	.464	**.000**
	VaD vs Normal	-4.842(*)	.464	**.000**
Recent Life Section Autobiographical Incident (RLS AI)	AD vs VaD	-1.883(*)	.334	**.000**
	AD vs Normal	-6.308(*)	.270	**.000**
	VaD vs Normal	-4.425(*)	.270	**.000**

Abbreviations: AD=Alzheimer disease, VaD=Vascular dementia. * The mean difference is significant at the .05 levels.

Table 4: Results of the post-hoc analysis by Scheffe's test for the Autobiographical Memory variables

passage of time, the episodic components of AM are likely faded away from semantic memory [48] showing deficits in expressing their thought process. Autobiographical memory impairments in AD are often observed at the very early stage due to neuronal loss of medial temporal lobes and the hippocampus [15] but when the degeneration spreads in the lateral temporal cortex, semantic memory starts declining [47].

Personal episodic and personal semantic memories are the important contributors of identity of an individual. AD patients generally have impaired capacity to imagine his personal life events [2] and this possibly hampers their identity. Loss of identity influences their narration of their life events [17]. Thirty percent of our AD subjects had loss of personal identity. In advanced AD, family members frequently report that AD persons no longer recognize themselves and forget the identity of a person who was once his spouse or daughter. This apparent change of personality may be due to loss of identity and poor retrieval of AM.

Patients with VaD showed significant deterioration in AM. This was more marked in multi-infarct than subcortical variety of VaD. Though there were inadequate data regarding the autobiographical memory impairment in VaD, Looi and Sachdev (1999) reviewed eighteen studies and found that episodic memory impairment is more striking in AD than VaD [49]. The majority of the studies on Autobiographical memory impairment focused on AD and semantic dementia and their relation to normal aged adults. It is known that VaD patients with a lesion of hippocampus, prefrontal cortex and related medial temporal lobe may lead to episodic memory loss [47,50-54]. Budson and Price (2001) noted that VaD could cause episodic memory loss, not due to damage to the Papez circuit, but rather damage to the frontal lobes [29]. If the frontal lobe gets damaged, the circuit fails and gets disrupted with the medial temporal lobes. Thus the memories became distorted and inaccurate. Our VaD group showed poor performance in childhood semantic section. They could not recall specifics and could not describe detail of their episodic autobiographical memories. Chronic ischemia of white matters in subcortical VaD patients results in disturbances in networking of various parts of cortical and subcortical neurons. This probably interrupts the retrieval of autobiographical memories in a consistent manner as we have observed. However, as cortical neurons get damaged in multi-infarct variety, the severity of impairment was higher in this subgroup than subcortical VaD. Other researchers have also reported that subcortical VaD patients with widespread diffuse changes cannot recall specific and detailed autobiographical memories [28]. Shimamura (2003) noted that the location of the brain lesion is not the most important feature, but the size of the lesion, determines the severity of the impairment [55]. VaD patients showed slower responses in recalling a specific task than AD, but the memory impairment was significantly lesser than AD [56].

It is widely accepted that with increasing age, most of the individual experience some degree of cognitive change. Autobiographical incident memory (episodic) declines with age, possibly as a result of declines in white matter integrity, the argument accepted by many researchers [4,5,57,58]. When normal subjects were compared with degenerative dementia, it was observed that the autobiographical incident memories in normal group showed elevated response from childhood, early adulthood to recent years, whereas, the distribution in AD group was more uneven [59]. Several studies revealed that normal group displayed a significant reduction of remote episodic details, but was compensated by an increase in semantic information [6,12]. It is also observed that normal individual usually have preserved adulthood memories in their original vividness and detail because more often they tend to dwell in the past and probably a sense of identity develops from this period. Identity develops from adulthood since life events are more memorable because of career, marriage, or the birth of a child and these are encoded more strongly. Memories of specific events were energizers, motivator and give inspiration to life. Memories from childhood and early adulthood periods are distinctly self-defining [17,60,61]. Contrarily, in dementia most of the patients recall unclear memory, irrespective of time. Control subjects have more thoughts and feelings, but they have difficulty in remembering specific perceptual and contextual information [62,63].

Limitations

There are few limitations in this study, which are worth mentioning. Firstly, the research sample was not large enough and involved only Bengali speaking, middle class participants with minimum class V educational background. Secondly, our VaD cohort was heterogeneous group, subgroup comparison would have given important insight. Thirdly, we have not correlated the autobiographical memory function with radiological findings of the subjects, namely volumetric assessment of hippocampus or by functional imaging study. Moreover, considering the diversity of our culture, it is apparent that inclusion of individuals from other language speaking groups or subjects with no formal education would have yielded different pattern of results. Undoubtedly, this would have enriched the methodology and enhanced the meaningfulness of the findings.

Conclusion

This is the first study from Indian subcontinent to evaluate autobiographical memory in subjects with major dementia. The present study reveals that patients with dementia exhibited deficits in remembering past events and generating fewer external and internal episodic details than normal controls. The major finding of this study is that patients with AD exhibit more deficits than VaD in remembering the past events. VaD patients mostly have problems in expressing their thoughts in a consistent manner. These observations might be helpful in evaluating patients with major subtypes of dementia.

References

1. Tulving E. Episodic memory and common sense: how far apart? *Philos Trans R Soc Lond B Biol Sc.* 2001;356(1413):1505-15.
2. Tulving E. Episodic memory: from mind to brain. *Annu Rev Psychol.* 2002;53:1-25.
3. Bird TD, Miller BL. Alzheimer's Disease and other Dementias. *In*: Hauser SL, Josephson SA. (Eds.) 2nd Ed. Harrison's Neurology in Clinical Medicine, McGraw-Hill Medical. 2010;298-319.
4. Addis DR, Wong AT, Schacter DL. Age-related changes in the episodic simulation of future events. *Psychol Sci*. 2008;19(1):33-41.
5. Andrews-Hanna JR, Snyder AZ, Vincent JL, et al. Disruption of large-scale brain systems in advanced aging. *Neuron.* 2007;56(5):924-35.
6. Levine B, Svoboda E, Hay JF, Winocur G, Moscovitch M. Aging and autobiographical memory: dissociating episodic from semantic retrieval. *Psychol Aging.* 2002;17(4):677-89.

7. Addis DR, Schacter DL. Constructive episodic simulation: Temporal distance and detail of past and future events modulate hippocampal engagement. *Hippocampus.* 2008;18:227-237.

8. Piolino P, Desgranges B, Benali K, Eustache F. Episodic and semantic remote autobiographical memory in ageing. *Memory.* 2002;10:239-257.

9. Rubin DC. Autobiographical memory across the lifespan. In: Lifespan development of human memory. Graph P and Ohuta N (Eds). A Bradford Book, MIT Press, Cambridge 2002;159-84.

10. Cohen NJ, Squire LR. Retrograde amnesia and remote memory impairment. *Neuropsychologia* 1981;19(3):337-356.

11. Sagar HJ. Aging and age-related neurological disease remote memory. *In*: Handbook of neuropsychology Boiler F & Grafman J(Eds). Elsevier: New York 1990;4:311-324.

12. Addis DR, Pan L, Vu M-A, Laiser N, Schacter DL. Constructive episodic simulation of the future and the past: Distinct subsystems of a core brain network mediate imagining and remembering. *Neuropsychologia*. 2009;47(11):2222-2238.

13. Buckner RL, Snyder AZ, Shannon BJ, et al. Molecular, structural and functional characterization of Alzheimer's disease: Evidence for a relationship between default activity, amyloid, and memory. *Journal of Neurosci.* 2005;25(34):7709-7717.

14. Eichenbaum H, Cohen NJ. From Conditioning to Conscious Recollection. *Oxford University Press*. 2004.

15. Squire L, Zola-Morgan. The medial temporal lobe memory system. *Science.* 1991;253:1380-1386.

16. Vargha-Khadem F, Gadian DG, Watkins KE, Connelly A, Van Paesschen W, Mishkin M. Differential effects of early hippocampal pathology on episodic and semantic memory. *Science.* 1997;277(5324):376-80.

17. Addis DR, Tippett LJ. Memory of myself: Autobiographical memory and identity in Alzheimer's disease. *Memory*. 2004;12(1):56-74.

18. Dorrego MF, Sabe L, Cuerva AG, et al. Remote memory in Alzheimer's disease. *J Neuropsychiatry Clin Neurosci.* 1999;11(4):490-497.

19. Greene JDW, Hodges JR. The fractionation of remote memory: Evidence from a longitudinal study of dementia of Alzheimer type. *Brain.* 1996;119(1):129-142.

20. Greene JDW, Hodges JR, Baddeley AD. Autobiographical memory and executive function in early dementia of Alzheimer type. *Neuropsychologia.* 1995;33(12):1647-1670.

21. Ivanoiu A, Cooper JM, Shanks MF, Venneri A. Patterns of impairment in autobiographical memory in the degenerative dementias constrain models of memory. *Neuropsychologia.* 2006;44(10):1936-1955.

22. Kopelman MD, Wilson BA, Baddeley AD. The Autobiographical Memory Interview: a new assessment of autobiographical and personal semantic memory in amnesic patients. *J Clin Exp Neuropsychology.* 1989;11(5):724-744.

23. Graham NL, Emery T, Hodges JR. Distinctive cognitive profiles in Alzheimer's disease and subcortical vascular dementia. *J Neurol Neurosurg psychiaty.* 2004;75(1):61-71.

24. Kuczynski B, Jagust W, Chui HC, Reed B. An inverse association of cardiovascular risk and frontal lobe glucose metabolism. *Neurology.* 2009;72(8):738-743.

25. Tamashiro-Duran JH, Squarzoni P, de Souza Duran FL, et al. Cardiovascular risk in cognitively preserved elderlies is associated with glucose hypometabolism in the posterior cingulate cortex and precuneus regardless of brain atrophy and apolipoprotein gene variations. *Age (Dordr).* 2013; 35(3):777-92.

26. Reed BR, Eberling JL, Mungas D, Weiner MW, Jagust WJ. Memory failure has different mechanisms in subcortical stroke and Alzheimer's disease. *Ann Neurol*. 2000;48(3):275-284.

27. Ihara M, Polvikoski TM, Hall R, et al. Quantification of myelin loss in frontal lobe white matter in vascular dementia, Alzheimer's disease, and dementia with Lewy bodies. *Acta Neuropathol*. 2010;119(5):579-589.

28. Baddeley AD, Wilson B. Amnesia, autobiographical memory and confabulation. *In*: Rubin D (Ed.), *Autobiographical memory*. 1986;225-252.

29. Budson AE, Price BH. Memory: Clinical Disorders. *Encyclopedia of Life Sciences.* 2001.

30. Tullberg M, Fletcher E, De Carli C, et al. White matter lesions impair frontal lobe function regardless of their locations. *Neurology*. 2004;63(2):246-53.

31. Reed BR, Eberling JL, Mungas D, Weiner M, Kramer JH, Jagust WJ. Effects of white matter lesions and lacunes on cortical function. *Arch Neurol*. 2004;61(10):1545-50.

32. Dreyfus DM, Roe CM, Morris JC. Autobiographical Memory Task in Assessing Dementia. *Arch Neurol.* 2010;67(7):862-866.

33. Ardila A**.** Language representation and working memory with bilinguals. *J Commun Disord.* 2003;36(3):233-40.

34. Miyamoto Y, Nisbett RE, Masuda T**.** Culture and the physical environment. Holistic versus analytic perceptual affordances. *Psychol Sci.* 2006;17(2):113-119.

35. Sakamoto M, Spiers MV. Spatial ability among Japanese and Americans: sex and cultural differences, Unpublished Thesis (M.S.), Drexel University, Philadelphia, PA. *Arch Sex Behav.*2014;43(30):483-491.

36. Jorm AF. The Epidemiology of Alzheimer's disease and Related Disorders. Chapman & Hall, London. *Geriatric Psychiatry.* 1990;234.

37. Henderson JN Dementia in cultural context: Development and decline of a caregiver support group in a Latin population. *In*: Sokolovsky J (ed.). *The cultural context of aging: Worldwide perspectives* 2nd ed. Westport: Bergin & Garvey. 1997;425-442.

38. Das SK, Banerjee TK. Stroke: Indian scenario. *Circulation.* 2008;1189(25):2719–2724.

39. McKhann G, Drachman D, Folstein M, Katzman R, Price D, Stadlan EM. Clinical diagnosis of Alzheimer's disease, Report of the NINCDS□ADRDA Work Group under the auspices of Department of Health and Human Services Task Force on Alzheimer's Disease. *Neurology*. 1984;34(7):939-944.

40. Román GC, Tatemichi TK, Erkinjuntti T,et al. Vascular dementia: Diagnostic criteria for research studies: Report of the NINDS□AIREN International Workshop. *Neurology*. 1993;43(2):250-260.

41. Das SK, Banerjee TK, Mukherjee CS, Roy T. An urban community based study of cognitive functions among non-demented elderly population in India. *Neurology Asia.* 2006;11:37-48.

42. Morris, John C. The Clinical Dementia Rating (CDR): Current version and scoring rules. *Neurology.* 1993; 43(11):2412-2414.

43. Banerjee TK, Dutta S, Das S, et al. Epidemiology of dementia and its burden in the city of Kolkata, India. *Int J Geriatr Psychiatry* 2016. DOI: 10.1002/gps.4499

44. Golderberg D, Williams P. A user's guide to the General Health questionnaire. Windsor, UK: NFER-Nelson 1988.

45. Basu S, & Dasgupta SK. Adapted Bengali version of general health questionnaire-28. Calcutta University Manual. *Department of Applied Psychology*. 1996.

46. Butters N, Cermak LS. A case study of the forgetting of autobiographical knowledge. *In*: Rubin DC (Ed). Remembering Our Past: Studies in *Autobiographical Memory*. 1986.

47. Fujii T, Moscovitch M, Nadel L. Consolidation, retrograde amnesia, and the temporal lobe. *In*: Boller F, Grafman J J, Cermak LS, editors. The Handbook of Neuropsychology. 2nd Edition. Volume 4. Amersterdam, The Netherlands: Elsevier. 2000; pp. 223-250.

48. Murphy KJ, Troyer AK, Levine B, Moscovitch M. Episodic, but not semantic, autobiographical memory is reduced in amnestic mild cognitive impairment. *Neuropsychologia*. 2008; 46(13):3116–3123.

49. Looi JCL and Sachdev PS. Differentiation of vascular dementia from AD on neuropsychological tests. *Neurology.* 1999;53(4):670-678.

50. Cipolotti L, Shallice T, Chan D, et al. Long-term retrograde amnesia… the crucial role of the hippocampus. *Neuropsychologia*. 2001;39(2):151-172

51. Moscovitch M, Winocur G. The Frontal Cortex and Working with Memory. *In*: Principles of Frontal Lobe Functions. Stuss DT and Knight RT (Eds). Oxford 2002. *pp* 188-209.

52. Maguire EA, Woollett K, and Spiers HJ. London Taxi Drivers and Bus Drivers: A Structural MRI and Neuropsychological Analysis. *Hippocampus.* 2006;16(12):1091-1101.

53. Steinvorth S, Levine B, Corkin S. Medial temporal lobe structures are needed to re-experience remote autobiographical memories: evidence from H.M. and W.R. *Neuropsychologia*. 2005;43(4):479-496.

54. Viskontas IV, McAndrews MV, Moscovitch M. Remote episodic memory deficits in patients with unilateral temporal lobe epilepsy and excisions. *Journal of Neurosciences.* 2000;20(15):5853-5857.

55. Shimamura AP. Neural basis of memory: Systems level. *In*: Nadel L (Ed.), Encyclopedia of Cognitive Science. McMillan,2003.

56. Hampstead BM. Dissociation of Vascular Dementia and Alzheimer's Disease using a Sequential Working Memory and Recognition Task. Dissertation for the degree of Doctor of Philosophy, 2006.

57. Nyberg L, Tuvling E. Classifying human long-term memory: evidence from converging dissociations. *European Journal of Cognitive psychology.*1996;8(2): 163-183.

58. Tuvling E. Organization of Memory: Quo Vadis. *In*: *The Cognitive Neurosciences*. Gazzaniga MS (Ed). A Bradford Book, The MIT Press. 1995;839-847.

59. Fromholt P, Larsen SF. Autobiographical memory in normal aging and primary degenerative dementia (dementia of Alzheimer type). *J Gerontol.* 1991; 46(3):85-91.

60. Fitzgerald JM. Intersecting meanings of reminiscence in adult development and aging. In D. C. Rubin (Ed.), Remembering our past: Studies in autobiographical memory Cambridge: Cambridge University Press 1996: *pp* 360-83.

61. Holmes A and Conway MA. Generation Identity and the Reminiscence Bump: Memory for Public and Private Events. *Journal of Adult Development.* 1999;6(1):21-34.

62. Chalfonte BL, Johnson MK. Feature memory and binding in young and older adults. *Memory and Cognition* .1996;24(4):403-416.

63. Spencer WD, Raz N. Differential effects of aging on memory for content and context: a meta-analysis. *Psychol Aging*. 1995; 10(4):527-539.

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