Clinico-radiological Risk Factors Associated with Post Stroke Vascular Cognitive Impairment

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ABSTRACT

Introduction: Cognitive impairment due to cerebrovascular disease is termed "Vascular Cognitive Impairment" (VCI) and forms a spectrum that includes Vascular Dementia and milder forms of cognitive impairment referred to as Vascular Mild Cognitive Impairment. The aim of this study was to determine the clinical, neuro-imaging and laboratory predictors of post stroke cognitive impairment.

Material and methods: We prospectively evaluated 100 stroke patients for 3 months after incident stroke for development of VCI. Patients with VCI comprised of those with Vascular mild cognitive impairment (VMCI) and vascular dementia (VaD).

Results: Out of 100 patients, 54 patients (54%) had VCI, out of which 36 patients(36 %) had VMCI and 18 patients (18%) had VaD. The risk factors which were significantly associated with VCI was hypertension, diabetes mellitus, prior stroke, dyslipidemia, urinary Incontinence, baseline stroke severity score, high LDL level, strategic site lesion and higher ARWMC score. Post stroke VCI was unrelated to type and location of stroke, there was no difference by sex. The VaD and VMCI group did not differ on any specific cerebrovascular risk factor.

Conclusion: Cognitive decline is common after stroke. Post stroke VCI is related to various clinical, radiological and laboratory risk factors. Better knowledge of these risk factors will increase the effectiveness of preventive and therapeutic strategies.

Keywords: Vascular cognitive impairment, stroke, risk factors.

INTRODUCTION

Vascular Cognitive Impairment (VCI) includes Vascular Dementia (VaD) and Vascular Mild Cognitive Impairment (VMCI), [1] and it is the impairment in cognition due to cerebrovascular diseases. VaD is one of the most common cause of dementia, but VMCI is much more prevalent. Many patient's of VMCI convert to VaD after some years.[2] Vascular cognitive disorders causes increase in mortality, morbidity, and decreased quality of life.[3]

VCI is a complex disorder that occurs due to interaction between various risk factors such as hypertension, diabetes, obesity, dyslipidemia, and brain parenchymal changes. Since VCI can be prevented, there is a pressing need to identify factors that protect or predispose to it.[4]

Post stroke dementia(PSD) has been an emerging field of research over the last decade.[5-10] The frequency of post stroke dementia has been found to be higher than previously expected, stoke increases the risk of dementia 4-10 times.[8-12] Reasons. All individuals with stroke do not develop dementia, therefore, it is important to determine the risk factors. Some studies have investigated these risk factors, but there has not been a consensus about them.[6-8, 10] Demographic, clinical, stroke related, and lesion related radiological factors have been reported to predict dementia in stroke patients. The aim of this study was to determine the clinical, neuro-imaging and laboratory predictors of post stroke cognitive impairment.

MATERIAL AND METHODS

This study was a prospective observational study conducted in Medicine Department of Gandhi Medical College and Hamidia Hospital Bhopal from November 2014 to October 2015 after taking ethical clearance from ethical committee and informed consent was taken from the patients before participating.

Inclusion criteria

Patients who were consecutive acute stroke patients either ischemic or hemorrhagic admitted in hamidia hospital.

Exclusion criteria

1) Patients with aphasia 2)Patients with reduced level of consciousness 3) Patients with stroke associated with tumors, trauma, subarachnoid hemorrhage 4) Patients with transient ischemic attack 5) Patients with severe hearing and visual impairment 6) Previously diagnosed case of Dementia/cognitive impairment Mental Retardation 7) Patients with history of psychosis or other psychiatric and neurological disorder 8) Brain ischemia due to cardiorespiratory arrest 9) History of any neurosurgical operation 10) Patients not willing to participate in study.

We prospectively evaluated 100 consecutive stroke patients for 3 months after incident stroke for development of VCI. Patients with VCI comprised of those with Vascular mild cognitive impairment(VMCI) and vascular dementia (VaD).

Methods

A standard assessment was done at admission and 3 months after stroke; this included clinical, and cognitive assessments, blood investigations, ECG, MRI/CT, 2D ECHO, Carotid Doppler and MMSE (mini mental state examination). Association Internationale pour Recherche et l'Enseignement en Neurologie (NINDS-AIREN) criteria was used for vascular dementia.

Demographic and clinical characteristics- Included was age, sex, educational level, socioeconomic status, occupation, family history of dementia, smoking habits, hypertension, diabetes mellitus, hypercholesterolemia, atrial fibrillation [AF], ischemic heart disease [IHD], history of alcohol intake, transient ischemic attacks, prior stroke and any other systemic

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illness. All patients were subjected to cardiac examination included an electrocardiogram (ECG) and echocardiography of the heart. Clinical features like urinary incontinence, sensory abnormality, gait abnormality, bulbar features, peripheral signs of atherosclerosis and blood pressure was noted.Stroke severity was assessed by the national institute of health stroke scale(NIHSS).

Laboratory measurements included was blood Sugar on admission, renal and liver functions and lipogram (serum total cholesterol [TC], triglycerides [TG], low-density lipoprotein cholesterol [LDL-c], highdensity lipoprotein cholesterol [HDL-c]), complete blood picture.

Neuroimaging characteristics: A noncontrast CT brain / MRI was done for all patients. The following radiological data were collected: Presence of hemorrhage, infarct subtypes, number, laterality of lesions and strategic site of the lesion that was defined as the lesions involving areas like hippocampus, thalamus, caudate, globus pallidus, anterior limb of internal capsule. Age related white matter changes (ARWMC) were evaluated in all the patients on CT based upon ARWMC scale.

Cognitive assessment: Higher mental functions was clinically evaluated, for which Mini-Mental State Examination (MMSE), a widely used scale for the screening test for dementia is used. It consists of a variety of questions grouped into seven categories, each representing a different cognitive domain or function (orientation to time, orientation to place, repetition of words, attention, calculation, recall of words, language, visual construction).Memory assessment was done by asking questions (immediate-same as attention, recent-same as recall, remote- previous life events). To determine whether patient had pre-stroke cognitive decline, a reliable proxy accompanying the patient was interviewed, retrospectively, as to whether patient exhibited any signs of cognitive impairment in the form of memory impairment, apraxia, aphasia, agnosias, executive dysfunction before stroke and interference with daily activities because of them. Cognitive assessment was again done at follow up after 3 months to study cognitive impairment.

STATISTICAL ANALYSIS

All statistical analysis were done using the statistical package for social sciences for windows and Microsoft excel. P value ≤0.05 was considered to be statistically significant. Categorical data was analysed by chi-square test and student t test was used to compare means of two different groups.

RESULTS

In this study, the frequency of patient's having post stroke

		Patient group				Significance	
		NOVCI(n=46)		VCI(n=54)			
		Count	Row N %	Count	Row N %	Chi square	P value
Sex	Female	15	40.5%	22	59.5%	0.70	0.401
	Male	31	49.2%	32	50.8%		
Low education	Absent	24	55.8%	17	41.5%	4.397	0.037
	Present	22	38.6%	37	62.7%		
Socio economic status	Low	26	41.9%	36	58.1%	1.08	0.298
	Middle	20	52.6%	18	47.4%		
Handedness	Left	1	14.3%	6	85.7%	3.05	0.081
	Right	45	48.4%	48	51.6%		
Hypertension	Absent	18	64.3%	10	35.7%	5.23	0.022
	Present	28	38.9%	44	61.1%		
Diabetesmellitus	Absent	30	55.6%	24	44.4%	4.32	0.038
	Present	16	34.8%	30	65.2%		
Alcohol	Absent	36	43.4%	47	56.6%	1.36	0.244
	Present	10	58.8%	7	41.2%		
Smoking	No	31	43.7%	40	56.3%	0.54	0.463
	Yes	15	51.7%	14	48.3%		
Tobaccochewer	No	31	47.7%	34	52.3%	0.21	0.644
	Yes	15	42.9%	20	57.1%		
Ischemic heart disease	Absent	42	48.3%	45	51.7%	1.40	0.237
	Present	4	30.8%	9	69.2%		
Dyslipidemia	Absent	31	55.4%	25	44.6%	4.486	0.034
	Present	15	34.1%	29	65.9%		
Prior stroke	No	38	52.1%	35	47.9	3.99	0.046
	Yes	8	29.6%	19	70.4%		
Familydementia	No	43	47.3%	48	52.7%	0.64	0.424
	Yes	3	33.3%	6	66.7%		
Atrial fibrillation	Absent	33	47.8%	36	52.2%	0.30	0.585
	Present	13	41.9%	18	58.1%		
Urinary incontinence	Absent	43	51.8%	40	48.2%	6.63	0.01
	Present	3	17.6%	14	82.4%		
Sensory abnormality	Absent	36	43.9%	46	56.1%	0.81	0.369
	Present	10	55.6%	8	44.4%		

Table-1: Comparison of risk factor profile in VCI and NO-VCI group

vascular cognitive impairment (VCI) is 54% (54/100), 18% (18/100) of the patients had VaD(vascular dementia), 36% (36/100) of the patients had VMCI (vascular mild cognitive impairment), 46 % (46/100) of the patients had NO VCI (no vascular cognitive impairment) (Table-1).

In our study, out of 100 patient there are 63 males and 37 females, although the VCI (Vascular cognitive impairment) occurred more frequently in females, the difference was not statistically significant. In our study mean age of patients having no vascular cognitive impairment is 62 ± 5 years, mean age of patients having mild vascular cognitive impairment is 63 ± 6 years, mean age of patients having vascular dementia (VaD) is 65 ± 6 years.

The percentage of the patient's having low socioeconomic status is more in patient's having vascular cognitive impairment (VCI) as compared to those who don't have any cognitive impairment but the difference is not statistically significant (p=0.298). In our study, patients with vascular cognitive impairment (VCI) had significantly lower educational status (p=0.036), in terms of years of formal education, as compared to those who did not develop vascular cognitive impairment (VCI).

Amongst the various risk factors hypertension, diabetes mellitus, prior stroke, dyslipidemia, ischemic heart disease, tobacco chewing, smoking and family history of dementia were more frequently seen in VCI (vascular cognitive impairment) group than NO-VCI group. However only Hypertension (p=0.022), diabetes mellitus (p=0.038), dyslipidemia (p=0.034), prior stroke (p=0.046) were significantly associated with development of Vascular cognitive impairment.

In this study, after statistical analysis the clinical parameters which were significantly associated with development of vascular cognitive impairment are urinary incontinence (p=0.01), systolic blood pressure (p=0.049), and baseline stroke severity score (p=<0.001). Though the clinical parameters like gait

		Patient group				Significance	
		NOVCI (N=46)		VCI			
		Count	Row N %	Count	Row N %	Chi square	P value
Gait abnormality	Absent	39	45.9%	46	54.1%	0.003	0.955
	Present	7	46.7%	8	53.3%		
Bulbar features	Absent	40	44.4%	50	55.6%	0.88	0.349
	Present	6	60.0%	4	40.0%		
Peripheral signs atherosclerosis	Absent	36	50.7%	35	49.3%	2.18	0.14
	Present	10	34.5%	19	65.5%		
ECG	Normal	31	55.4%	25	44.6%	4.486	0.034
	Abnormal	15	34.1%	29	65.9%		
Echo2d	Normal	22	50.0%	22	50.0%	0.51	0.477
	Abnormal	24	42.9%	32	57.1%		
Typestroke	Ischemic	44	47.8%	48	52.2%	1.54	0.214
	Hemorrhagic	2	25.0%	6	75.0%		
Hemisphere involved	Non-dominant	17	51.5%	16	48.5%	1.33	0.515
	Dominant	22	40.7%	32	59.3%		
	Both	7	53.8%	6	46.2%		
Type of lesion	Single	28	53.8%	24	46.2%	2.68	0.101
	Multiple	18	37.5%	30	62.5%		
Strategic site lesion	Absent	39	56.5%	30	43.5%	9.92	0.002
	Present	7	22.6%	24	77.4%		
Age	Upto 60 yrs	23	51.1%	22	48.9%	2.52	0.283
	61-70 Yrs	21	45.7%	25	54.3%		
	71-80 Yrs	2	22.2%	7	77.8%		

Table-2: Comparison of mean of various risk factors in two groups.

	Patient group				Significance	
	NOVCI		VCI			
	Mean	Standard Deviation	Mean	Standard Deviation	T test	P value
Age	62	5	64	6	1.96	0.052
Systolic BP	148	28	158	29	1.96	0.049
Diastolic BP	83	9	88	16	1.58	0.117
Total cholestrol	135	32	142	50	0.80	0.425
LDL	156	45	173	52	1.98	0.041
HDL	44	3	43	3	1.29	0.20
Triglyceride	179	77	157	49	1.71	0.091
Blood sugar admission	141	45	151	48	1.05	0.297
NIHSS	5	2	7	3	3.55	0.0006
	No VCI		VCI		P Value	
Median arwmc score (range)	1.5 (0-12)		4.5(0- 15)		0.001	

Table-3: Comparison of mean of various risk factors in two groups.

abnormality, peripheral signs of atherosclerosis and atrial fibrillation are more frequently found in VCI group but the difference was not statistically significant.

The laboratory parameters which were significantly associated with VCI group included high LDL level (p =0.041), and abnormal ECG (p =0.034). The parmeters like high blood sugar on admission, high triglyceride level, high cholesterol level were frequently found in VCI group but are not statistically significant (Table-2,3).

DISCUSSION

Vascular Cognitive impairment is commonly seen condition after stroke. Many researches had done on cognitive impairment after stroke, mostly in western countries with relatively scarce data from developing countries. In this study, the frequency of VaD was 18% whereas that of VMCI was 36%.Previous studies revealed similar rates of post stroke dementia, Khedr et al.[11] reporting a rate of 21%. Sachdev et al[12] reporting a rate of 21.3%, Pohjasvaara et al.[13] (31.8%) and Barba et al.[14] (30%). The variations in rates of PSD in might be the result of different criteria which are used for diagnosing VaD. In the present series, patients who developed VCI had lower educational status as compared to patients who did not develop VCI. This may be due to the fact that those with higher level of education have more cognitive reserve. Many other studies have reported similar observations. Patients in VCI group were older than those in No-VCI group, although this difference was not significant. Many previous studies revealed that vascular cognitive impairment commonly develops in patients with higher age. In our study, patients who developed VCI were more likely to have diabetes mellitus, hypertension, prior stroke, urinary incontinence, abnormal ecg, and high systolic blood pressure, LDL levels and more NIHSS score on admission. Pohjasvaara et al.[13] found that total cholesterol, dysphasia, gait impairment, urinary incontinence were significantly associated with post stroke dementia Khedr et al.[11] found that hypertension, ischemic heart disease, and family history of dementia were significantly associated with post stroke dementia. Hebert et al.[15] found that diabetes, hypertension, apolipoprotein E were found to be associated with vascular dementia. They also found that patients with VaD more frequently had higher LDL and lower HDL levels. Amongst the neuroimaging features, presence of strategic site lesion and higher ARWMC scores were significantly associated with development of VCI, but there was no correlation with type of stroke (ischemic) and laterality of stroke with VCI. Sachdev et al.[12] found no significant association between laterality of stroke and VCI. However, they reported that patients with post stroke cognitive impairment had significantly higher load of total as well as periventricular whitemater hyperintensities (WMH). Many other studies supported that dementia occurred more frequently in strokes involving dominant hemisphere On statistical analysis, the parameters which were significantly associated with VCI are low level of education (≤10 years of formal education), hypertension, diabetes mellitus, dyslipidemia, prior stroke, urinary incontinence, abnormal ecg, higher LDL level, higher systolic blood pressure, strategic site lesion, higher ARWMC score and baseline stroke severity (NIHSS) score. Tthe difference between two groups (VMCI and VaD) in various parameters was not statistically significant.This study had several limitations. First, we excluded a fair number of patients for various reasons which may led to underestimation of the prevalence of post stroke cognitive impairment. Secondly, follow-up duration in this study was limited to 3 months.

CONCLUSION

Post-stroke cognitive impairment is commonly seen and is associated with considerable morbidity. Both ischemic and hemorrhagic strokes may result in cognitive impairment. The risk factors for development of Vascular cognitive impairment following stroke in this study are lower educational status, Hypertension, Diabetes Mellitus, Dyslipidemia, Prior stroke, Urinary incontinence, High systolic blood pressure, NIHSS score, LDL level, abnormal ECG, strategic site lesion and greater severity of age related white matter changes.

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