ORIGINAL ARTICLE

Prevalence of Vitamin D Deficiency in Critically ill Patients of Cerebrovascular Accidents

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Abstract

The aim of current study was to estimate the prevalence of vitamin D deficiency in critical ill patients of acute cerebrovascular accident. This is a prospective observational cross-sectional study carried out in subjects of both sexes consistuting two groups. Group -1, 66 patients of acute cerebrovascular strokes (ischemic and haemorrhagic) with any comorbid profile presenting in medical emergency of tertiary care Medical College Jammu and group -2, age matched 66 apparently healthy subjects without known history of surgery, hospitalisation or major medical illness with past one year were included. Whole control group was undergone for cerebrovascular screening before included in study. Vitamin D levels were measured by radioimmunoassay and compared statistically to find out any possible correlation. In the current study vitamin D deficiency was recorded in 34(51.5%) and insufficiency in 32(48.5%) of total patients of strokes on taking total account of 100% whereas control group 83.3% healthy individuals have low levels of vitamin D and about 16.7% have adequate levels. High prevalence of vitamin D deficiency is existing in general population including critically ill patients of Cerebrovascular accidents.

Key Words

Vit D deficiency, Cerebrovascular, Acute Cerebrovascular accidents

Introduction

A poor vitamin D status is now recognized as a public health problem affecting almost every 2nd person worldwide(1). Evidence from many prospective population based studies have indicated that poor vitamin D status is predictive for future strokes (2,3,4,5,6,7). A meta analysis on S.25 OH D3 LEVELS and symptomatic ischemic stroke has found stepwise increasing risk of symptomatic ischemic stroke with decreasing concentration of plasma 25 OH D3 levels (2-10)

Studies from INDIA have uniformly pointed to low S. 25 OH D3 levels in Indian population in all age groups and in all regions , despite plenty of sunshine (11).

Indian epidemiological data also reveals high age standardized prevalence and annual incidence rates of 1st ever stroke in Indian as compared to non -asian population hence it was interesting to explore the association between two. Vitamin D deficiency is also reported to be associated with substantial increase in the incidence of C.V.risk factors like hypertension, dyslipidemia , myocardial infarction, as well as in diseases such as chronic kidney disease, type 1 and type 2 diabetes mellitus.

This study aimed at determining the association of vitamin D. deficiency /insufficiency between ischemic/ haemorrhagic strokes and their risk factors.

Materials and Methods

This cross-sectional descriptive one point analysis was carried out for 66 cases of stroke and same number of healthy controls in medicine department of government medical college jammu with the objective to assess the risk factors of stroke, with special focus on vitamin D levels. The controls were chosen from among healthy matched 66 apparently healthy subjects . Patients with

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history of surgery, hospitalization, or major medical illness within the past one year were excluded from the study. Patients on hormone replacement therapy, glucocorticoids,

biophosphonates, teriparatide and other drugs affecting bone metabolism were excluded as well. Surgical and other iatrogenic causes of menopause were also excluded from the current study. Intake of conventional calcium/ vitamin D supplements was not considered an exclusion criterion. The cases and controls were matched for age (± 2 years) and sex.

Both the cases and the controls were explained the purpose of the study and from those who volunteered to participate a written consent was taken .They were administered a pre tested and semistructured questionnaire gauging demographic profile, history of various risk factors and further investigated them for different conditions viz alcoholic liver disease, hypercholestremia and obesity. Using competitive radioimmunoassay the 25(OH) D concentrations were measured with a minimal detectable limit of 1.5 ng/ mL.The cases were grouped as having deficiency,insufficiency or sufficiency based on 25(OH) D concentrations of < 20 ng/mL, 20-30 ng/mL or > 30 ng/mL respectively.

Statistical analysis

Appropriate statistical tools were used for analyzing the data. SPSS (ver 20.0) was used to calculate cross tap chi square and two tailed t test p-values <0.05 were considered significant.

Results

A total of 66 cases and same number of controls were analysed. The Mean age of cases of stroke was 59.17± 11.67 (Range=30-85 years) . 33 males and 33 females were included in both the groups. A significant association was found for Hypertension Chai Square(1, N = 132)= 11.55, p=.001, smoking Chai Square (1, N = 132)= 10.94,p=.001,Hypercholestremia Chai Square (1, N = 132)=5.179,p=.023.Significant associations was found between vitamin D3 status and stroke present or absent, Chai Square (2, N = 132)= 13.283, p=0.001. Also the value of Cramer's V was found to be .371, which reflect moderate effect size of the association.(*Table-1*)

When the data was further analysed for 41 cases of ischemic and 25 cases of haemorrhagic stroke, no significant association was found for sex, place of residence, presence or absence of hypertension, diabetes, alcoholic liver disease, hypercholestolemia and vitamin

Table 1. Characteristics of Cases and Controls

Parameters	Stroke Cases(N=66)	Healthy control cases(N=66)	t/Chi square, p
Residence			Chai Square = .129,
Urban	R=26(39.4%)	R=24(36.4%)	*p* =.72
Rural	U=40(60.6%)	U=42(63.6%)	
Hypertension	NO=3(4.5%)	NO=17(25.8%)	Chai Square (1, N =
	YES=63(95.5%)	YES=49(74.2%)	132)= 11.55,
			p=.001
Smokers	NO=42(63.6%)	NO=23(34.8%)	Chai Square (1, N =
	YES=24(36.4%)	YES=43(65.2%)	132)= 10.94,
			p=.001
Alcoholics	NO=47(71.2%)	NO=50(75.8%)	Chai Square (1, N =
	YES=19(28.8%)	YES=16(24.2%)	132)=.350 , *p*=.554
Hypercholestremia	NO=23(34.8%)	NO=36(54.5%)	Chai Square (1, N =
	YES=43(65.2%)	YES=30(45.5%)	132)=5.179 ,
			p=.023
Obesity	NO=21(31.8%)	NO=29(43.9%)	Chai Square (1, N =
	YES=45(68.2%)	YES=37(56.1%)	132)=2.06 ,*p*=.151
Vit D Status of the study Population			
Adequacy >30 ng/ml	A=0(0%)	A=11(16.7%)	Chai Square = 13.283,
Insufficiency 20-30ng/ml	I=32(48.5%)	I=21(31.8%)	*p* =.001
Deficiency <20ng/ml	D=34(51.5%)	D=34(51.5%)	

D status (p=0.447,0.264,0.868.0,185,0.881,0.878 and 0.144 respectively). History of smoking and alcohol intake also did not show any statistically significant association in the causation of different types of stroke.(Table-2) There was a statistically significant difference in the mean age among two types of stroke(p=0.014).82.9% of cases of ischemic stroke and 44% of cases of haemorrhagic stroke had obesity, a statistically significant association was found between obesity and type of stroke(p=0.001) (Table-3)

Mean vitamin D levels were less in cases as compared to controls and this difference was statistically significant (p=0.026). Mean vitamin D levels failed to show any statistically significant difference between two types of stroke(p=0.28)

Table 2: Base line characteristic of different types of stroke

Parameters	Ischaemic Stroke Cases(N=41)	Haemmorrhagic Stroke 1 cases(N=25)	t/Chi square, p
Age	M= 57.53 SD=12.14	M=57.77, SD=12.24	t=2.54*, p=0.014
Mean, SD	Range= 25years-85years	Range=25years-85years	
Range			
Sex		M=14(56%)	Chai Square(1, N = 66)=
Male	M=19(46.3%)	F=11(44%)	.58,
Female	F=22(53.7%)		*p*=.447
Residence		R=12(48%)	Chai Square(1, N =
Urban	R=14(34.1%)	U=13(52%)	66)=1.24 ,
Rural	U=27(65.9%)		*p*=.264
Hypertension	NO=2(4.9%)	NO=1(4%)	Chai Square(1, N =
	YES=39(95.1%)	YES=24(96%)	66)=.028 ,
			p=.868
Diabetes	NO=6(14.6%)	NO=7(28%)	Chai Square(1, N = 66)=
	YES=35(85.4%)	YES=18(72%)	1.75,
			p=.185
Smokers	NO=27(65.9%)	NO=15(60%)	Chai Square(1, N = 66)=
	YES=14(34.1%)	YES=10(40%)	.23,
			p=.632
Alcoholics	NO=31(71.6%)	NO=16(64%)	Chai Square(1, N =
	YES=10(24.4%)	YES=9(36%)	66)=1.02 ,
			p=.312
ALD	NO=35(85.4%)	NO=21(84%)	Chai Square(1, N = 66)=
	YES=6(14.6%)	YES=4(16%)	.023,
			p=.881
Hypercholestrolemia	NO=14(34.1%)	NO=9(36%)	Chai Square(1, N = 66)=
	YES=27(65.9%)	YES=16(64%)	.024,
			p=.878
Obesity	NO=7(17.1%)	NO=14(56%)	Chai Square(1, N = 66)=
	YES=34(82.9%)	YES=11(44%)	10.85,
			p=.001
Vit D Status of the study			Chai Square(1, N =
Population	A=0(0%)	A=0(0%)	66)=2.13 ,
Adequacy >30 ng/ml	I=17(41.5%)	I=15(60%)	*p*=.144
Insufficiency 20-30ng/ml	D=24(58.5%)	D=10(40%)	
Deficiency <20ng/ml			

Table 3. Comparison of Different Groups for Mean Vitamin D3 Levels in Terms of t-value

Groups	Vit D3	t value	t and p value
Cases controls	M=17.95 , SD= 7.11 M=22.21 , SD=13.51	2.258	0.026
Ischaemic Stroke Haemorrhagic stroke	M=19.19, SD=7.34 M=17.22, SD=7.04	1.09	0.28

with past one year are excluded and were included after basic cerebrovascular screening. In the current study vitamin D deficiency was recorded in 34(51.5%) and insufficiency in 32(48.5%) of total patients of strokes on taking total account of 100% whereas control group 83.3% healthy individuals have low levels of vitamin D and about 16.7% have adequate levels.the result of our study showed 100% deficiency of vitamin D in stroke patients whereas in study done by Kenneth ES, *et al* (8) reported 77% patients of stroke had reduced vitamin D level.

Anu gupta *et al* (9) reported in vitamin D status and risk of stroke in north Indians that there is no significant difference in the prevalence of vitamin D deficiency (p=0.25), mean 25-OH D 3 levels (p=0.75) and PTH(p=0.10) between cases and control. However in the current study vitamin D deficiency was recorded in 34(51.5%) and insufficiency in 32(48.5%) taking total account of 100% whereas control group 83.3% healthy individuals have low levels of vitamin D. However association of vitamin D deficiency /insufficiency with ischemic stroke as risk factor is s observed in both the studies .

Witham ,*et al* (10) established that low vitamin D levels are associated with increased incidence of future cerebrovascular events and are common in stroke patients. However they documented that high dose oral vitamin D supplement did not improve but produced short term improvement in endothelial Function in stroke patients with well-controlled baseline blood pressure. However this aspect is not evaluated in our study.

Buell JS (11) reported vitamin D deficiency / insufficiency was associated with all cause dementia , Alzheimer disease , stroke (OR=2.0, 95% CL I.0-4.0) with or without dementia symptoms and MRI indicators of cerebrovascular disease . these findings suggest a potential vasculoprotective role of vitamin D whereas dementia and its types are not evaluated in current study.

Interesting point is noted in current study that vitamin D deficiency is highly prevalent even in control group yet free from apparent cerebrovascular events .this is explained on the high prevalence of vitamin D deficiency existing in general population and may other risk factors contributing for causing the stroke It is found in our study that hypertension, smoking and hypercholesterolemia are the risk factors for stroke but these are not studied simultaneously with vitamin D deficiency in other trials.

Karin A *et al* (12) Low vitamin D levels are highly prevalent in critical illness and linked to higher all-cause and sepsis mortality independent of other important contributors,although these parameters were not evaluated in our study.

Severe deficiency of vitamin D deficiency has been also suggested to be strongly associated with sudden cardiac death, cardiovascular events , borderline association with stroke and fatal infection.severity of vitamin D deficiency is not evaluated in the current study (5).

Wang *et al* (13) pointed out that S. 25(OH)D levels reduce with increasing severity of stroke .S. 25(OH)D levels are the predictor of both severity at admission and favourable functional outcome in patients of acute stroke .

Pilz *et al* (14) established that low levels of S.25(OH)D and 1, 25(OH)D are independently predictive for fatal strokes, suggesting that vitamin D supplementation is a promising approach in the prevention of stroke .

Incomparsion to above trials (13,14.) severity of vitamin d deficiency is not assessed in our study .

Yue *et al* (15) , pointed out an independent relationship between 25(OH)D and post stroke depression .

Kojima *et al* (3) documented that low dietary vitamin D intake was an independent risk factor for 34 yr incidence of all stroke and thromboembolic stroke .

Dubail B *et al* (16) in their study indicated that vitamin

D deficiency at onset of stroke may be associated with higher mortality at one yr in patients less than 75year of old. Accumulating evidence suggests that vitamin D deficiency has a link and is associated with the presence of hypertension, diabetes, atherosclerosis and now with the stroke , thus existing data definitely point towards the relation between vitamin D deficiency and stroke, although indian study failed to establish any relationship . But it is highly warranted to have Indian data on the subject in view of high number of stroke patients presenting to Indian hospitals.

The possible correlation between vitamin d deficiency has been postulated to be associated with metabolic , procoagulant , and inflammatory events that predispose to atherothrombosis . in addiction vitamin d deficiency has been shown to be associated with endothelial dysfunction and subclinical atherosclerosis (17)

Although it is small size study but addressing a major public health problem in indian population which needs specific attension of authority.

Conclusion

Current study showed very high vitamin d deficiency in patients of cerebrovascular accidents with significant correlation between the prevalence of vitamin D deficiency and occurrence of CVA ,in addition to this it is deficient in majority of control healthy individuals . so it is addressing major health issue.

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