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Serum Calcium Level in acute Ischaemic Stroke and its Association with Clinical Severity

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Abstract

***Background**: Worldwide acute ischemic stroke is a major Public health problem. Calcium (Ca^{2+}) plays an important role in the pathogenesis of ischemic cell damage. Therefore this was undertaken to see the association of some biochemical risk factors of ASI in Bangladesh. **Objective:**To assess the association between Serum calcium level in acute ischemic stroke. **Material and Methods:** A hospital based cross sectional study was performed among 100 patients of acute ischaemic stroke who fulfilled the inclusion criteria. The Study was done from June, 2013 to December, 2013 in Dhaka Medical College Hospital, Dhaka, Bangladesh. After hospitalization presenting complaints, physical findings of the patients were recorded. Severity of stroke was measured by NIHSS scale. Serum calcium level of every patient was measured. Calcium level was divided into 3 groups by weighted average. Statistical analysis was carried out by non-parametric(kruskalwallis) test. **Results:** Among the 100 patients 59% were male. Among all patients 57% of patients were found to be smoker (98% male, 2% female). Among all patients 63% patients were found hypertensive and 21% were diabetic. Mean cholesterol level was 257.98mg/dl with standard deviation 55.49 which is above the reference range suggesting hypercholesterolemia, Triglyceride was borderline and LDL cholesterol was slightly higher and HDL cholesterol was slightly lower. Calcium level was divided into 3 groups and NIHSS score was calculated for every patient in each groups. The median NIHSS score for group1 (calcium level d"8.8 mg/dl) was 9(2-20), for group 2 (calcium level 8.9-9.6 mg/dl) was 6 (1-17) and for group 3 (calcium level e"9.7mg/dl) was 4 (1-16). **Conclusion:** In conclusion, low serum calcium level is significantly associated with increased sevrity of acute ischemic stroke. So, general community should be made aware about these risk factors of stroke and regular assessment of serum calcium in acute ischaemic stroke should be done which may help to reduce the morbidity which may reduce the morbidity of ischemic stroke.*

***Keywords:** Serum Calcium Level, Acute Ischaemic Stroke, Risk Factor.*

Introduction:

Stroke is the leading cause of disability worldwide, the second most common cause of dementia and the third leading cause of death.[1] It has enormous clinical, social, and economic implications and demands a significant effort from both basic scientists and clinicians in the quest for understanding the underlying pathogenic mechanisms and thereby adopting suitable preventive measures and successful therapies, beyond thrombolysis, which is but available to <5% of all patients.[2]Generally, it is recognized that stroke

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is a multifactorial condition. A number of risk factors have been shown to be associated with stroke are age, high blood pressure, hypercholesterolemia, previous history of stroke or, transient ischemic attack, diabetes mellitus, obesity and dietary factors, atrial fibrillation and tobacco smoking.[3]However, unfavorable trends in stroke risk factor profile; lack of awareness among public and medical fraternity; misapplication or underutilization of stroke preventative programs; and lack of emphasis on preventive training in medical school and postgraduate programs throughout the world, have precipitated high stroke rates and culminated into widening the stroke prevention gap.[4]Given the immense burden that ischemic stroke exerts, the need to develop more precise estimates of a stroke severity and survivor's prognosis remains an important goal. Calcium (Ca^{2+}) plays an important role in the pathogenesis of ischemic cell damage. Intracellular Calcium accumulation leads to neuronal damage by triggering the cycle of cytotoxic events.Very few attempts have been made to investigate the impact of serum Ca^{2+} level on clinical outcomes after ischemic stroke.[5-7]This study was conducted in all units of Medicine department of Dhaka Medical College Hospital. Serum Calcium level was measured in all patients within 48 hours of onset of symptoms.

Materials and Methods:

A hospital based cross sectional study was performed among 100 patients of acute ischaemic stroke who fulfilled the inclusion criteria. The Study was done from June, 2013 to December, 2013 in Dhaka Medical College Hospital, Dhaka, Bangladesh. After hospitalization presenting complaints, physical findings of the patients were recorded. Severity of stroke was measured by NIHSS scale. Serum calcium level of every patient was measured. Calcium level was divided into 3 groups by weighted average. Statistical analysis was carried out by non-parametric kruskalwallis test.

Inclusion criteria:

1. Patient of aged >18years.
2. Ischaemic stroke confirmed by brain imaging within 48 hours of onset of Symptoms.

Exclusion criteria:

1. Patient who presented 48 hours after onset of symptoms.
2. Patients who can't give the history properly or no attendant available to give history.
3. Patients who failed to complete the investigations required for the study.
4. Known patient with hypercalcemia.
5. Patients who will refuse to give informed consent.
6. Patients diagnosed as haemorrhagic stroke.
7. Female pregnant patient.

Data Collection Procedure: Patients were selected according to inclusion and exclusion criteria. Detailed history was taken from patients or their attendants. With proper consent clinical examination was done and clinical severity was measured according to NIHSS scale. After that blood was collected with all the precaution for measurement of serum calcium level. All the data were recorded in the data collection sheet.

Data Processing and Analysis:All the data were checked after collection. Then data entered into computer, with the help of SPSS 17 for Windows 7 program version. An analysis plan was developed keeping in view with the objectives of the study. Frequency distribution and normal distribution of all continuous variables was calculated.

Results:

A total of 59% of the patients were Male and rest 41% were female. Large numbers of respondents were businessmen (21%) followed by service holders (14%). A considerable portion of the respondents (13%) were retired from their jobs. Most of the female patients were housewives (39%).

Among 59 male patients 56 patients (95%) were smoker. But among 41 female patients only 1 patient (2.43%) was found to be smoker which is 2.43% of total female. Overall 57% patients were smoker.

This study showed 63% patients were hypertensive (known and newly diagnosed).

Total cholesterol level was much higherischaemic stroke patients.It also showed that LDL cholesterol was high and Tryglyceride was borderline.

About 24% of all male stroke patients were diabetic from DM whereas 17% of the female patients were diabetic.

Relationship of serum calcium level with severity of acute ischaemic stroke as assessed by NIHSS score showed 31% patients with median score of 9 with calcium level below 8.8, 37% patients in 8.9-9.6 serum calcium level with median score of 6 and 32% patients having calcium level above 9.6 had median NIHSS score 4. Comparison was done between groups by non-parametric method (kruskalwallis test). P value was below .05 which is statistically significant.

Table-I

Demographic details patients of acute ischaemic stroke.

	N	%
Sex		
Male	59	59.0%
Female	41	41.0%
Occupational status		
Business	21	21%
Service Holder	14	14%
Retired/Aged person	13	13%
Farmer	5	5%
Daily worker	4	4%
Teacher	2	2%
Housewife	39	39%
Total	100	100

Table-II

Association of smoking with ischaemic stroke

Smoking	Sex				Total	
	Male (59)		Female (41)			
	n	%	n	%	n	%
Positive	56	95%	1	2.43%	57	57%
Negative	3	5%	40	97.57%	43	43%
Total	59	100%	41	100%	100	100%

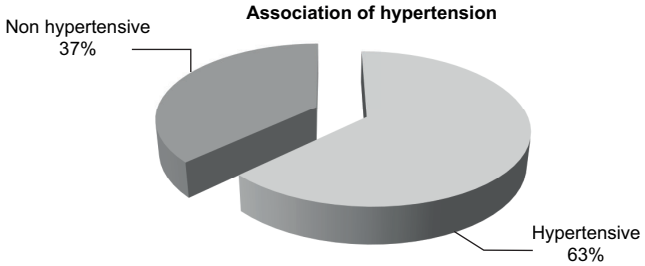

Fig.-1: *Association of hypertension in the study population*

Table-III

Distribution of diabetes mellitus in the studied patients

	Sex				Total	
	Male		Female			
	n	%	n	%	n	%
Positive	14	23.73	7	17.07	21	21
Negative	45	76.27	34	82.93	79	79
Total	59	100	41	100	100	100

Table-IV

Lipid profile of ischaemic stroke patient

Serum Lipid Profile	N	Mean	SD
Total Cholesterol	100	257.98 mg/dl	55.491 mg/dl
TG	100	186.66 mg/dl	45.207 mg/dl
LDL	100	140.08 mg/dl	18.045 mg/dl
HDL	100	37.89 mg/dl	34.79 mg/dl

Table-V

Serum calcium inischaemic stroke patients

Group	n(100)	Serum Calcium	NIHSS score	Significance*
I	31	≤8.8	9(2-20)	<.05
II	37	8.9-9.6	6(1-17)	
III	32	≥9.7	4(1-16)	

*Comparison was done between groups by non-parametric method (kruskalwallis test)

Discussion:

In this study 100 acute stroke patients was undertaken to see the serum calcium level in acute ischaemic stroke. Fifty nine percent of the patients were male and the rests were female. The mean age of the patients was 62.3 years with a SD of 9.078 years. Patients from the age group 51-60 years formed the main bulk followed by 61-70 years group (36% and 33% respectively). These findings were consistent with the fact thatthe incidence of stroke increases rapidly with age.[8]In this study it was found that 57% patients were smoker which is consistent with other study.[9] This study also shows that most of the smokers (95%). Lipid profile done in this study showed that that the Cholesterol level was much higher than normal value, Tryglyceride was borderline, LDL was higher and HDL was slightly below normal (Table IV). These findings are consistent with studies done elsewhere.[10]In this study 63% the patients werefound to be hypertensive (known and newly diagnosed) which matches with study in other parts of the world and in our country.[11,12]The primary goal of this study was to assess serum calcium with severity of acute ischaemic stroke. In this study the highest serum calcium was 10.4 and lowest was 8.1. Calcium levels were divided into three groups byusing weighted average. Severity of ischaemic stroke was assessed clinically by NIHSS score. The patients were divided into three groups according to serum total Ca levels. Patients with Ca d" 8.8mg/dl were included in group I, Ca levels between 8.9 and 9.6 mg/dl were included in group II, and Ca e" 9.7 mg/dl were included in group III. NIHSS scores on admission were higher in group I (median 9) than group II (median 6) and group III (median 4) ($p < 0.05$), and they were found to be higher in group 2 than group 3 ($p<.05$). These results are consistent with a similar study done by guevenet al.[13]Though there are several biomarkers for acute ischaemic stroke there are only few markers for severity of stroke like CRP early CT scan changes, serum S-100.[14] The association of serum calcium and severity of acute ischaemic stroke could not be analyzed along with these factors.There were several studies regarding the association of serum calcium level with hypertension. These studies yield different results. It also indicates that ischemic stroke patients have a lower level of serum calcium as compared to controls.

Conclusion:

In this study majority patients were aged and male. Hypertension was found to be the commonest comorbidities. A significant number of patients were

diabetic and hyperlipidemic. It was found that higher serum calcium level was related with less clinical severity.

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