Original Article

Correlation Between Serum Calcium and National Institute of Health Stroke Score (NIHSS) in Ischemic Stroke Patients

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ABSTRACT

Objective: To determine correlation between serum Calcium and National Institute of Health Stroke Score (NIHSS) in ischemic stroke patients.

Study Design: Descriptive / Cross-sectional study

Place and Duration of Study: This study was conducted at the Department of Medicine department Fauji foundation Hospital, Rawalpindil from 18th Sep, 2018 to 18th Mar, 2019.

Materials and Methods: The study was conducted after the approval of ethical committee. All the patients were educated and an informed consent was taken. All male and female patients of specified age group presenting to OPD/ emergency room & admitted in wards were evaluated. The diagnosis of acute ischemic stroke was based on symptoms of focal neurologic deficit and computed tomography (CT) brain evidence of ischemic infarct. Severity of stroke was assessed using National Institute of Health Stroke Score (NIHSS).

Results: Total 150 patients were included according to the inclusion criteria of the study. Mean age (years) in the study was 46.42±18.91 whereas there were 66 (44.0) male and 84 (56.0) female patients who were included in the study. There is a positive correlation (r=0.078) noted between serum calcium and NIHSS score in ischemic stroke patients.

Conclusion: There is a positive correlation between serum calcium and National Institute of Health Stroke Score (NIHSS) in ischemic stroke patients. Serum calcium levels may affect the severity of ischaemic injury.

Key Words: Calcium Serum Levels, Computed Tomography Scan, Ischemic Stroke, National Institute of Health Stroke Score, Severity

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INTRODUCTION

Stroke is characterized by acute onset of focal or diffuse impairement of cerebral functions more than 24 hours duration or leading to death secondary to a vacular aetiology with no other obvious cause[1,2]

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Multiple factors predispose towards stroke. Increasing age, high blood pressure, hyperglycemia, hyperlipidemia and artial fibrillations are major risk factors.[3,4] Smoking, raised inflammatory markers, Thrombophilia, metabolic syndrome, insulin resistance, microalbuminuria and serum calcium are increasingly correlated with ischaemic stroke.[5]

Ischemic injury of neurons initiates activation of multiple pathways leading to the loss of cell homeostasis. ischaemic injury catalyzes facilitates increased entry of calcium from the extracellular spaces into the neurons resulting in increased release of cytotoxic enzymes leading to cellular death.[6] Low calcium level at the time of acute ischaemic stroke results in more severe stroke as assessed by the National Institute of Health Stroke Score (NIHSS)[7,8]. Recent study showed patients with lower serum calcium have a correlation coefficient of r= -0.3 than those with high calcium levels[1].Studies also showed raised calcium levels through neuro-protective mechanisms lead to smaller size of infarcts[2,9].Patients found to have high levels of calcium at the time of acute ichaemic stroke tend to develop lesser

complications[10,11]. Other studies indicated that Vitamin D and Calcium replacement in stroke patients leads to better outcome and lessens morbidity and mortality[12,13]. Awareness of the role of Calcium ions in the ischemic stroke has led to the development of such neuroprotective agents that modify the role of this ion in Cerebrovascular accidents[13]. This also helps to investigate further regarding the importance of improving dietary calcium in patients who are at risk of stroke.

Due to the massive burden that ischemic stroke shares, there is a huge need to develop prognostic markers for stroke survivors.[5] Serum calcium level can also be employed as a prognostic marker in patients with stroke. Current study was aimed to find association of calcium level with severity of ischaemic stroke in our population. Results of this study would help in executing better management plan for patients with ischaemic stoke.

MATERIALS AND METHODS

This Descriptive Cross-sectional study was conducted at outpatient department of General Medicine, Fauji Foundation Hospital, Rawalpindi for six months from 18th Sep, 2018 to 18th Mar, 2019 after approval from hospital ethical committee. The sample size was calculated (n=150) with anticipated population proportion of 14.7%, significance Level of 5% and with precision of 6%. Non probability purposive sampling technique was employed. Clinically diagnosed cases of patients having first episode of acute ischemic stroke presenting within 72 hours, with age 18 to 70 years of both genders are included in the study.

Patients with history of recurrent stroke, deranged liver function tests, chronic renal failure, aspiration pneumonia on chest X-ray, any malignancy, any autoimmune disorder determined with the help of ANA, recent trauma/ surgery and patients who were not willing to participate in the study were excluded.

Patients from outpatient department of FFH Rawalpindi who fulfilled criteria was included in the study. Detailed history regarding the illness was obtained from each patient. Complete clinical examination was performed by the trainee researcher. Diagnosis of acute ischaemic stroke was made on the basis of history, physical examination and findings of the CT scan of brain. 5cc blood sample was taken from all patients presenting with acute ischaemic stroke without applying tourniquet and was sent to laboaratory within 72 hours of their symptoms. Serum calcium level, Albumin and Rena function tests in addition to baseline investigations were measured under the supervision of a pathologist in FFH pathology lab. All these information were recorded on a preset Performa.

Data was entered and analyzed in SPSS version 20. Total 150 patients were included according to the inclusion criteria of the study.

RESULTS

Descriptive statistics of age (years) of patient was also calculated in terms of mean and standard deviation. Mean age (years) in the study was 46.42±18.91 with ranges from 18 to 70 years.

Distribution of gender of patient was also calculated in terms of frequency and percentage of male and female patients. There were 66 (44.0) male and 84 (56.0) female patients who were included in the study according to the inclusion criteria.

Descriptive statistics of serum calcium levels was measured in terms of mean and standard deviation. In our study, among acute ischemic stroke patients, mean serum calcium levels was 8.52±0.31, whereas mean NIHSS score was 21.84±5.83.

The objective of the study is to determine correlation between serum calcium and NIHSS score in ischemic stroke patients was r=0.078 as Pearson's correlation, as shown in Table 1.

Effect modifier like age stratification was stratified and compared with correlation between serum calcium and NIHSS score in ischemic stroke patients. Among patients with age 51- 70 years, there is a positive correlation r=0.011 was observed between serum calcium levels and NIHSS score, as shown in Table 2.

Effect modifier like gender stratification was stratified and compared with correlation between serum calcium and NIHSS score in ischemic stroke patients. Among male patients, there is a positive correlation r=0.231 was observed between serum calcium levels and NIHSS score, as shown in Table 3.

Effect modifier like hypertension, diabetes mellitus, hyperlipdemias & smoking stratification was stratified and compared with correlation between serum calcium and NIHSS score in ischemic stroke patients. Our Study findings showed that there is a positive correlation observed between serum calcium levels and NIHSS score among diabetes mellitus (r=0.076), hyperlipidemias (r=0.070) and smoking (r=0.091), as shown in Table IV. Post stratification chi-square test was applied and *P*-value ≤ 0.05 was considered as significant.

Sample Size: Calculated by WHO sample size calculator

Level of confidence	95%
Power of test	80%
Correlation Co-efficient	-0.3 [1]
Sample size:	150

Table No. I: Pearson's Correlation between Serum calcium and NIHSS in ischemic stroke patients (n=150)

		NIHSS score
Serum calcium levels	Pearson Correlation	0.078
	Sig. (2-tailed)	0.342
	N	150

Table. No. 2: Effect modifier like Age stratification with Pearson's Correlation between Serum calcium and NIHSS in ischemic stroke patients(n=150)

Age Groups		Pearson's Correlation (r)
18 – 50 years	Serum Calcium Levels & NIHSS score	0.123
51 – 70 years	Serum Calcium Levels & NIHSS score	0.011

Table. No. 3: Effect modifier like Gender stratification with Pearson's Correlation between Serum calcium and NIHSS in ischemic stroke patients(n=150)

Gender		Pearson's Correlation (r)
Male	Serum Calcium Levels & NIHSS score	0.231
Female	Serum Calcium Levels & NIHSS score	-0.043

Table. No. 4: Effect modifier like HTN, DM, Hyperlipidemias & Smoking stratification with Pearson's Correlation between Serum calcium and NIHSS in ischemic stroke patients (n=150)

Effect Modifiers		Pearson's Correlation (r)
Hypertension	Serum Calcium Levels & NIHSS score	-0.004
Diabetes Mellitus	Serum Calcium Levels & NIHSS score	0.076
Hyper-lipidemias	Serum Calcium Levels & NIHSS score	0.070
Smoking	Serum Calcium Levels & NIHSS score	0.091

DISCUSSION

Millions of stroke occur annually in world and has become one of the leading cause of death in world especially in developed countries.[1,8,12] Incidence of stroke is also increasing in third world countries. Stroke poses a huge ecnomic toll on already week health care system of poor countries but also has grave impact on the patient functional status and their family lives[8]. Stroke is considered to be one of major aetology leading to disability in adult population of the United states.[1,12] Although data about exact prevalance and incidence of stroke is not available but load can be assumed to be high due widely prevalent risk factors in the Pakistani population[8].

Our study was aimed to find correlation of calcium levels with severity of the acute ishaemic stroke. Current studies have shown association of high level of calcium to be associated with lesser severe stroke and improved prognosis[1,6,8,13-17].In our study, mean age in years was 46.42±18.91. Similarly, in a study conducted by Ishfaq et al,[1] mean age in years was 61.09±11.93.

In a study conducted in 2017[1] found that frequency and percentage of male and female patients were 71(51.4%) and 67(48.6%) respectively. Likewise, in our study, there were 66 (44.0) male and 84 (56.0) female patients.

In our study, among acute ischemic stroke patients, mean serum calcium levels was 8.52±0.31. Likewise, in a study conducted by Ishfaq et al,[1] mean serum calcium levels was 8.82±0.69.

In our study, correlation between serum calcium and NIHSS score in ischemic stroke patients was r=0.078 as Pearson's correlation. Consequently, in a study conducted in 2017[1] found that patients with lower serum calcium have a correlation coefficient of r= -0.3. Further prospective trials will be required to clarify the mechanism of this effect and to assess the role of serum calcium level as a prognostic variable and of calcium modulation as part of a strategy for prevention of stroke.

CONCLUSION

There is a positive correlation between serum calcium and NIHSS in ischemic stroke patients. serum calcium levels may affect the severity of ischaemic injury.

Author's Contribution:

Concept & Design of Study:	Bushra Siddiqa
Drafting:	Syed Saif Ur Rehman, Adnan Ghafoor
Data Analysis:	Aisha Aslam, Ayesha Aftab, Maria Sarfraz
Revisiting Critically:	Bushra Siddiqa, Syed Saif Ur Rehman
Final Approval of version:	Bushra Siddiqa

Conflict of Interest: The study has no conflict of interest to declare by any author.

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