



A STUDY OF SERUM MAGNESIUM LEVELS IN CEREBROVASCULAR ACCIDENTS

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ABSTRACT **BACKGROUND :** Cerebral Stroke is a major cause of mortality worldwide and commonly occurs among elderly. It is third major cause of death in developed countries after cardiovascular disease and cancer. Magnesium is 4th most abundant cation in the body and its deficiency triggers vasoconstriction, enhances vascular endothelial injury and leads to atherosclerosis. Prophylactic use of magnesium can inhibit the disability in patients due to ischemic stroke in future and can reduce social, emotional and economical losses among them.

AIM : To study the association of serum magnesium levels in patients with cerebrovascular accidents.

MATERIALS AND METHODS: A Hospital based Prospective study was conducted in Department of Medicine, Santhiram medical college & general hospital for a 1 year period. Total 100 subjects, 50 cases of cerebrovascular accidents and 50 age and sex matched controls without CVA's attending the medicine department satisfying the inclusion criteria were included for the study. Diagnosis of stroke was confirmed by CT brain or MRI. Then approximately 2ml of venous sample was collected from subjects and Serum magnesium levels were estimated by CALMAGITE method, and results were compared between cases and controls.

RESULTS: In our study, 50 controls and 50 cases were taken. Out of 50 cases, 36 were ischemic(72%), 10 were hemorrhagic(20%) and 4 were TIA(8%). Out of 50 cases, 34 were males(68%) and 16 were females(32%). More number of cases were in the age group of 61-70 years(38%). Mortality has been observed in the age group of 80 to 90 years(85%) with their mean serum magnesium level less than 1.0mg%(85%). Mortality is more observed in males (71.5%), than females(28.5%). Mean serum magnesium level of control and cases were calculated, and p-value was extremely significant (<0.0001).

CONCLUSION: There was significant low serum magnesium level noted in the patients who presented to emergency department with stroke. Mortality has been observed in the age group of 80 to 90 years (85%) with their mean serum magnesium level less than 1.0 mg% (85%). Mean Serum magnesium level of control and cases were calculated, and p value was extremely significant (<.0001). Hence cerebrovascular accidents are more commonly associated in patients with low serum magnesium levels.

KEYWORDS : Ischaemic Stroke, Haemorrhagic Stroke, Magnesium Level, Neurological Disability

INTRODUCTION :

Stroke was defined by the World Health Organization (WHO) as "rapidly developing clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin⁽¹⁾". Worldwide, cerebrovascular accidents are second leading cause of death and third leading cause of disability. About 13.5 million people suffer from stroke each year⁽²⁾, of which five and half million will die as a consequence, and of those who survive 5 million will be disabled by their stroke. Globally, one in four people over age 25 will have a stroke in their lifetime⁽³⁾. Cerebral infarction is responsible for about 80% of all first ever in a lifetime strokes. Primary intracerebral hemorrhage accounts for 10% and subarachnoid hemorrhage for 5%. Serum magnesium is the second most abundant intracellular cation and also a natural calcium antagonist. Magnesium plays a significant role in multiple biological systems and acts as a cofactor in hundreds of enzymatic reactions in the human body. Magnesium ions have a physiological role in multiple processes related to ischaemia. Magnesium ions are known to block glutamatergic n-methyl-D-aspartate (NMDA) receptors in the central nervous system during instances of glutamate neurotoxicity⁽⁴⁾ such as acute ischemic stroke. Low Mg(2+) at the time of stroke may accelerate penumbral compromise and result in more severe stroke presentations⁽⁵⁾ or early neurologic deterioration if not replaced with magnesium therapy⁽⁶⁾. Hence this study is taken up to know the association of serum magnesium levels in patients with cerebrovascular accidents.

AIM AND OBJECTIVES :

To study the association of serum magnesium levels in patients with cerebrovascular accidents.

MATERIAL AND METHODS :

A Hospital based observational study was conducted in Department of General Medicine, Santhiram Medical College and General Hospital for a 1 year period after taking approval from Hospital Ethics and

Research Committee.

SAMPLING TECHNIQUE AND SAMPLE SIZE:

Total 100 subjects, 50 cases of cerebrovascular accidents and 50 age and sex matched controls without CVA's attending the medicine department satisfying the inclusion criteria were included in the study. Informed written consent was taken from all the subjects. A pre-structured proforma was used to collect the baseline data. Detailed clinical history, clinical examination and relevant investigations were done on the participating subjects. Diagnosis was confirmed by initial CT brain or delayed CT brain or MRI if first CT scans were normal and in necessary cases. Then blood samples were collected from subjects after overnight fasting. In cases of TIA samples were drawn as and when patients come to hospital. Approximately 2ml of venous sample was collected and Serum magnesium levels were estimated by CALMAGITE method, and results were compared between cases and controls.

INCLUSION CRITERIA

1. Diagnosis of stroke based on history, physical examination and initial computed tomography (CT) of brain or delayed CT scan of brain or MRI where first scans were normal and in necessary cases
2. Age greater than 40 years and without Diabetes

EXCLUSION CRITERIA

1. Patients with associated diseases like Diabetes Mellitus, Renal failure, Gout, Acute myocardial infarction, Thyroid disorders, Malignant diseases, neurodegenerative disorders, Seizures, Sepsis and patients on diuretics.

CONTROLS:

50 age & sex matched subjects who had no prior history of cerebrovascular accidents and who meets the above exclusion criteria were taken as controls.

DATA ANALYSIS

All table results of the demographics like age, sex, number of diseased subjects are expressed in descriptive statistics i.e percentages. The collected data was analysed with SPSS 16.0 version, mean SEM. The valves are subjected through ANOVA, and two tailed, unpaired t test (student t test) with 95% confidence interval is employed as post-test.

RESULTS :

The present study included a total of 100 patients, 50 cases and 50 controls. The observations noted in the present study are as follows

Table 1: Age distribution in the study

Age in years	No of patients	Percentage
40-50	06	12%
51-60	11	22%
61-70	19	38%
71-80	09	18%
>80yrs	05	10%

In this study Out of 50 cases, Majority of the study group were in the age between 61 to 70 years contributing about 38%.

Table 2: sex distribution in the study

Sex	No of cases	Percentage
Male	34	68%
FeMale	16	32%

In this study majority of cases were males about 68%, when compare to females 32%

Table 3: Types of CVA in study group

Type of stroke	No of patients	Percentage
Ischemic	36	72%
Hemorrhagic	10	20%
TIA	04	8%

In this study among 50 cases majority of them had ischemic stroke constituting 72%, TIA were seen in only 4 cases constituting 8%.

Table 4: Serum Magnesium levels in Ischemia, Hemorrhage and control group

Groups	Serum Mg (mg/dl)	P- Value
Control (50 cases)	2.279 ± 0.04603	
Ischemia (36 cases)	1.436 ± 0.04403	P ≤ 0.0001(0.0001) ES
Hemorrhage (10 cases)	0.980 ± 0.05735	P ≤ 0.0001(0.0001) ES

In this study comparison of mean serum magnesium levels between cases and control, serum magnesium levels in both ischemic and hemorrhagic stroke were lower than controls and p value was extremely significant (P ≤ 0.0001).

DISCUSSION :

The present study evaluated the role of serum magnesium level in Stroke. The relationship of magnesium deficiency and cerebrovascular disease is well established. The deficiency of magnesium result in atherogenic alteration in blood lipid composition and predisposes to atherosclerosis. Diabetes mellitus, Renal failure. Gout, Acute myocardial infarction, Thyroid disorders, Malignant diseases, seizures, sepsis, and patients on diuretics are associated with magnesium deficiency and therefore those patients with above conditions are excluded in our study. In this study CT scan was done in all the cases and repeat CT and MRI scan was done in selected cases to know the type of stroke. The prevalence of serum magnesium deficiency in cerebrovascular accidents was studied and found that there was a significant correlation between serum magnesium levels and the stroke. The mean serum magnesium levels were significantly lower in the cases than the controls (p ≤ 0.0001). The maximum incidence of deficiency in the cases occurred in the sixth decade(38%). This study shows a male predominance(68%) of cerebrovascular accidents, which is in consensus with the previous studies. This may be because most of the risk factors for stroke such as hypertension, dyslipidemia, stress, and smoking etc are more common in males and elderly. In a case control study on serum magnesium in ischemic cerebrovascular disorders done by Kaur et al⁽⁷⁾, a total of 120 subjects, with 60cases and 60 controls and in which 50 cases are stroke and 10 cases are transient ischemic attack, results showed serum magnesium levels in stroke cases were significantly lower when compared with

controls and p value was extremely significant (P < 0.0001). These results were similar to results in our study. Larsson et al study⁽⁸⁾ conducted a meta-analysis to summarize the evidence regarding the association between magnesium intake and stroke risk. They observed a statistically significant inverse association between magnesium intake and risk of stroke. An intake increment of 100mg/day was associated with an 8% reduction in risk of total stroke (combined RR: 0.92; 95% CI: 0.88, 0.97), without heterogeneity among studies (P = 0.66, 1 (2) = 0%). Magnesium intake is inversely associated with risk of ischemic stroke (RR: 0.91; 95% CI: 0.87, 0.96) but not intracerebral hemorrhage (RR: 0.96; 95% CI: 0.84, 1.10) or subarachnoid hemorrhage (RR: 1.01; 95% CI: 0.90, 1.14). In our study among 50 cases, 7 cases expired, of which majority number of cases had serum magnesium levels less than 1mg%(6 out of 7 cases) constituting for about 85.7%. The present study contains small sample size, and it is not an interventional study, which were limitations of the present study.

CONCLUSION:

In this study, More number of cases were in the age group of 61-70years (38%). There was significant low serum magnesium level noted in the patients who presented to emergency department with stroke. Mortality has been observed in the age group of 80 to 90 years (85%) with their mean serum magnesium level less than 1.0 mg% (85%). Mortality is more observed in males (71.5%) when compared to female (28.5%) (m > f). Mean Serum magnesium level of control and cases were calculated, and p value was extremely significant (< 0.0001). Hence cerebrovascular accidents are more commonly associated in patients with low serum magnesium levels.

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