

Original Research Article

# Serum enzymes in cerebrovascular accident

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## Abstract

**Background:** Brain is a rich source of a variety of enzymes and any injury like stroke to brain tissue could similarly result in an increase in activity of these enzymes in cerebrospinal fluid and serum. It was in this context that the present study was done to assess the levels of enzymes like aspartate aminotransferase (AST), creatine kinase (CK) and Isoenzyme of creatine kinase (CK-MB) in serum. Evaluation of enzyme levels in serum has involved keen interest as a simple, economical, reliable and easily available method for the evaluation of severity, course, prognosis, and to some extent in the differential diagnosis of various types of cerebrovascular accidents.

**Aim:** To study the serum enzymes in cerebrovascular accidents.

**Materials and methods:** The present study was done in Fathima Institute of Medical Sciences, Kadapa, by taking 50 of samples and 30 are controls. Creatine Kinase (Total), Creatine Kinase-MB, Aspartate Transaminase, lipid profile, Fasting Blood Sugar were estimated in patients and control group also.

**Results:** The biochemical parameters studied were fasting blood glucose, total cholesterol, triglycerides, LDL, VLDL, HDL, SGOT, CPK and CPK-MB. Serum CPK was grossly elevated in patients with stroke compared to controls which is statistically significant (P Value < 0.001).

**Conclusion:** In the present study, all the parameters were elevated, for better understanding of serum enzymes in cerebrovascular accidents further investigations are needed.

## Key words

Creatine Kinase (Total), Creatine Kinase-MB, Cerebrovascular stroke, Lipid profile.

## **Introduction**

The word “stroke” is used to refer to a clinical syndrome of presumed vascular origin, typified by rapidly developing signs of focal or global disturbance of cerebral functions lasting more than twenty four hours or leading to death [1] (World Health Organization 1978).

A stroke may also be called a cerebrovascular accident or CVA. Stroke is the most common clinical presentation in hospital admission out of which cerebral infarction accounts for 69% of stroke, primary hemorrhage for 13%, subarachnoid hemorrhage for 6% and 12% are of unknown type [1].

Diseases of the cerebral blood vessels are the third most common cause of death in the developed world after cancer and ischemic heart disease and are responsible for a large proportion of physical disability becoming more frequent with increasing age. Several epidemiological studies have been carried out in the literature regarding ischemic strokes. Conventional risk factors were widely studied. They are hypertension, diabetes mellitus, hyperlipidemias, smoking, overweight, family history, endocarditis, sleep apnea, sickle cell anemia and cocaine use. Research has identified metabolic syndrome as the factor doubling the risk of stroke. This is also known as syndrome X [2, 3].

### **Biochemical basis of stroke**

The incidence of stroke increases with age thus the disability affects many people in their “Golden Years” a segment of population that is growing rapidly in western countries [2].

Blood is prevented from reaching brain tissue when a blood vessel leading to the brain becomes blocked or ruptures. They are several types of strokes [2, 4].

### **Clinical classification of focal stroke**

A stroke is defined as:

- Complete if the focal deficit is persistent and not worsening

- Transient if the deficit recovers within 24 hours
- Evolving if the focal deficit continues to worsen after about 6 hours from onset.

The clinical manifestations of stroke are highly variable because of the complex anatomy of the brain and its vasculature. Cerebral ischemia is caused by the reduction in the blood flow that lasts longer than several seconds. Neurological symptoms manifest within seconds of ischemia because neurons lack glycogen, so energy failure is rapid. When blood flow is quickly restored brain tissue can recover fully. When the symptoms are only transient, it is called transient ischemic attacks (TIA) [5-9].

Brain is a rich source of a variety of enzymes and any injury like stroke to brain tissue could similarly result in an increase in activity of these enzymes in cerebrospinal fluid and serum [10-19]. It was in this context that the present study was done to assess the levels of enzymes like aspartate aminotransferase (AST), creatine kinase (CK) and Isoenzyme of creatine kinase (CK-MB) in serum. Evaluation of enzyme levels in serum has involved keen interest as a simple, economical, reliable and easily available method for the evaluation of severity, course, prognosis, and to some extent in the differential diagnosis of various types of cerebrovascular accidents [5-9]. Serum creatine kinase, creatine kinase-MB and Aspartate aminotransferase levels were raised above normal in stroke patients [20-32]. The values of CPK and CPK-MB were well above normal limits in 72%, and 54% of patients respectively on day 1. Aspartate aminotransferase levels were marginally raised [10]. The present study aimed to estimate serum SGOT, CK (Total) and CK-MB. In addition, other parameters estimated are Fasting plasma glucose, cholesterol, triglycerides serum HDL cholesterol, serum LDL cholesterol, serum VLDL cholesterol [11].

### **Materials and methods**

The present study was conducted on Fifty (50) patients of ischemic stroke admitted in Medical

Wards and casualty of Fathima Institute of Medical Sciences and Hospital, Kadapa (with mean age 56.5 years) during the period of 2016. Out of Fifty (50) cases, Thirty Three (33) are men and Seventeen (17) were women.

The study included Thirty (30) healthy control subjects who are age matched and sex matched with patients. Out of Thirty (30), Twenty (20) were men and Ten (10) were women.

Blood samples for serum enzymes were taken within 24-72 hours of admission and serum enzymes were estimated. Fasting blood sample collected for lipid profile and blood sugar on the next day of admission. Blood Pressure recorded in Right Upper limb in supine position with Hg Sphygmomanometer.

Creatine Kinase (Total), Creatine Kinase-MB, Aspartate Transaminase, lipid profile, Fasting Blood Sugar were estimated in control group also.

A detailed history was taken considering various risk factors for stroke like hypertension, smoking, Diabetes Mellitus, alcoholism and previous stroke from study group.

Parameters were analyzed immediately after collection of sample.

**Inclusion criteria**

Patients clinically diagnosed to have ischemic stroke and Hemorrhagic stroke were selected for the study.

**Exclusion criteria**

Traumatic and space occupying lesions of Cerebraovascular disease are excluded form study by history and Computed Tomography Scan impression. Patients with previous Myocardial Infarction or present Myocardial Infarction and patients with recent infections, liver disease and renal failures are excluded.

**The following investigations are performed**

- Estimation of Fasting Blood Sugar.

- Serum Total Cholesterol, Triglycerides, HDL, LDL and VLDL cholesterol
- Creatine Kinase (CK)- Total
- Creatine Kinase - MB (CPK-MB)
- Serum Glutamate Oxaloacetate transaminase (SGOT)
- Also E.C.G. and C.T. Scan brain were considered for study

**Results**

The present study comprised of fifty (50) cases of ischemic stroke and thirty (30) healthy controls. The split up of study cases with age group in both sexes was given as per **Table - 1**. In the study group, males constitute 66% and females 34% and in controls, males were 66.7% and females were 33.3% (**Table - 2**).

**Table – 1:** Age distribution.

| Age in years | Males | Females | Total |
|--------------|-------|---------|-------|
| 41-50        | 9     | 6       | 15    |
| 51-60        | 16    | 6       | 22    |
| 61-70        | 8     | 5       | 13    |
| <b>Total</b> | 33    | 17      | 50    |

In the present study, mean value of creatine kinase among cases (average) was  $227.5 \text{ IU / l} \pm 240.54$  (Mean  $\pm$  SD) with range of 70 – 1075 IU / l and that of controls was  $70.43 \pm 35.803$  with range of 30-160 IU / l. The increase in serum creatine kinase among cases was highly significant with a p value of  $< 0.001$  (**Table - 3**).

In the present study, mean value of CPK – MB among cases (average) was  $49.56 \pm 35.15$  (Mean  $\pm$  SD) with range of 11 – 200 IU / l and that of controls is  $10.3 \pm 4.90$  with range of 3 – 22 IU / l. The increase in serum CPK – MB among cases was highly significant with a p value of  $< 0.001$  (**Table - 4**).

In the present study, mean value of serum SGOT among cases (average) was  $45.42 \text{ IU/l} \pm 25.47$  (mean  $\pm$  SD) with range of 18-129 IU / l and that of controls was  $27.77 \pm 3.682$  with range of 19-35 IU / l. The increase in SGOT among cases was highly significant with a p value of  $< 0.001$

(Table – 5). The mean value of serum CPK in males was 248.53 IU / l and in females was 186.29 IU / l, though males showed apparently elevated value the difference is not statistically highly significant (Table – 6).

**Table – 2:** Gender distribution of cases and controls.

| Sex     | No. of cases | Percentage | Controls | Percentage |
|---------|--------------|------------|----------|------------|
| Males   | 33           | 66%        | 20       | 66.7%      |
| Females | 17           | 34%        | 10       | 33.3%      |
| Total   | 50           | 100%       | 30       | 100%       |

**Table – 3:** Serum creatine kinase levels in cases and controls.

|               | Range   | Mean  | SD     | SEM   |
|---------------|---------|-------|--------|-------|
| Cases n=50    | 70-1075 | 227.5 | 240.54 | 34.17 |
| Controls n=30 | 30-160  | 70.43 | 35.803 | 6.53  |

(T value: 4.490 , P value: < 0.001)

**Table – 4:** Serum creatine kinase –MB levels of cases and controls.

|               | Range IV/I | Mean  | SD    | SEM   |
|---------------|------------|-------|-------|-------|
| Cases n=50    | 11-200     | 49.56 | 35.15 | 4.97  |
| Controls n=30 | 3-22       | 10.3  | 4.90  | 0.895 |

(T value = 7.774, P value = < 0.001)

**Table – 5:** Serum SGOT levels of cases and controls.

|               | Range IU/1 | Mean  | SD    | SEM   |
|---------------|------------|-------|-------|-------|
| Cases n=50    | 18-129     | 45.42 | 25.47 | 3.603 |
| Controls n=30 | 19-35      | 27.77 | 3.682 | 0.672 |

(T value = 4.822, P value = < 0.001)

**Table – 6:** Plasma CPK levels in males and females cases.

|              | Range IU/1 | Mean IU/1 | SD  |
|--------------|------------|-----------|-----|
| Males n=33   | 70-1045    | 248.53    | 275 |
| Females n=17 | 19-434     | 186.29    | 153 |

The mean value of serum CPK—MB in males was 55.15 IU / l and in females was 38.70 IU / l. Though males showed apparently elevated value the difference was not statistically significant (Table – 7). The mean value of serum SGOT in males was 46.03 IU / l and in females was 44.23 IU / l. Though males showed apparently elevated value the difference was not statistically significant (Table – 8).

In the study, it was shown that hypercholesterolemia constituted 8%, LDL 74%, HTN 70%, Smoking 56% and DM 10%. So it had been inferred that ischemic stroke was associated positively with HTN, Hypercholesterolemia, LDL, smoking and DM as shown above (Table – 9). Serum cholesterol and triglycerides levels in cases and controls were as per Table – 10.

**Table – 7:** Serum CPK –MB levels in male and female cases.

|              | Range  | Mean IU/1 | SD |
|--------------|--------|-----------|----|
| Males n=33   | 10-200 | 55.15     | 40 |
| Females n=17 | 17-76  | 38.70     | 18 |

**Table – 8:** Serum SGOT levels in male and female cases.

|              | Range IU/1 | Mean IU/1 | SD |
|--------------|------------|-----------|----|
| Males n=33   | 18-128     | 46.03     | 25 |
| Females n=17 | 18-129     | 44.23     | 27 |

**Table – 9:** Risk factors in ischemic stroke.

| Risk factor         | Patients<br>N=50 | %  | Male<br>N=33 | %    | Females<br>N=17 | %    |
|---------------------|------------------|----|--------------|------|-----------------|------|
| Hypertension        | 35               | 70 | 24           | 72   | 11              | 64   |
| Smoking             | 28               | 56 | 27           | 96.4 | 1               | 6    |
| Hypercholestrolemia | 39               | 78 | 28           | 84   | 11              | 64   |
| DM                  | 5                | 10 | 1            | 3    | 4               | 23   |
| LDL                 | 37               | 74 | 28           | 84   | 9               | 52   |
| No risk factor      | 5                | 10 | 1            | 3    | 4               | 23.5 |

**Table – 10:** Serum cholesterol and triglycerides levels in cases and controls.

|                 | Cholesterol | Triglycerides |
|-----------------|-------------|---------------|
| Cases n=50      | 215.92      | 146.76        |
| Controls n = 30 | 184.7       | 95.8          |

## Discussion

Fifty (50) Ischemic stroke patients were studied for Serum Enzymes, that is Creatine Kinase, Creatine Kinase-MB and Asparatate Transaminase. Thirty (30) age matched controls were taken for comparison. Present study included thirty three (33) male patients and seventeen (17) female patients. Age group varied from 41-70 years, majority falling between 51-60 years. On observation of isolated risk factors, the following descending order was noted. Hypercholesterolemia (78%), Low Density Lipoprotein (74%), Hypertension (70%), smoking (56%) and diabetes mellitus (10%). Serum enzymes that is Creatine Kinase, Creatine Kinase -MB, Asparatate Transaminase are elevated in cases compared to controls.

The results obtained in the present study were discussed under the following categories.

- Serum CPK levels in stoke patients.
- Serum CPK-MB levels in stroke patients.
- Serum SGOT levels in stroke patients.
- Levels of cholesterol and triglycerides in stroke patients.

## Conclusion

The present study comprises of fifty (50) cases of ischemic stroke admitted to Fathima Institute of Medical Sciences, Kadapa. Thirty (30) healthy controls were taken who were age matched with the cases. All the cases were confirmed with C.T Scan & Presentation of case. The biochemical parameters studied were fasting blood glucose,

total cholesterol, triglycerides, LDL, VLDL, HDL, SGOT, CPK and CPK-MB. Serum CPK is grossly elevated in patients with stroke compared to controls which is statistically significant (P Value < 0.001). Of the 50 patients 44% of patients belong to age group 51-60 years. Of the 50 patients 66% of them are males and 34% were females. There was raise of CPK-MB levels in stroke patients compared to controls which is statistically significant (P Value < 0.001). There was raise of serum SGOT levels in stroke patients compared to controls which was statistically significant (P Value < 0.001). Total cholesterol and triglycerides are raised in patients compared to controls group. These are one of the risk factors for stroke. Further investigations are needed for the study cerebrovascular accidents.

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