

The Study of Serum Homocysteine Level in Cerebrovascular Accident

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ABSTRACT

Introduction: Elevated homocysteine has been linked with increased risk of cerebrovascular accidents. This study was designed to evaluate serum homocysteine as a risk factor for cerebrovascular accidents. To study the serum homocysteine level in all cases admitted with ischaemic and haemorrhagic stroke with respect to demographic features. To study correlation of serum homocysteine level in haemorrhagic and ischaemic strokes. This hospital based cross sectional study was carried out in the Department of Medicine, Bharati Vidyapeeth Deemed University Medical College and Hospital, Sangli, Maharashtra from December 2016 to July 2018. A total of 100 patients with cerebrovascular stroke were studied. **Results:** Majority of the patients were males (85%). Most of the patients were aged between 61 to 70 years and 71 to 80 years (22 each). The common risk factor was history of diabetes mellitus (38%) followed by tobacco chewing (35%) patients, with the mean level being 35.11 ± 29.33 $\mu\text{mol/L}$ while median levels were noted as 18.90 $\mu\text{mol/L}$ and ranged between 4.70 to 119 $\mu\text{mol/L}$. Majority of the patients had ischemic stroke (62%) and 20% of the patients had hemorrhagic stroke. Significantly higher number of patients with ischemic stroke (856) had raised serum homocysteine levels ($p < 0.001$). No association was found between serum homocysteine levels with sex ($p = 1.000$) or age ($p = 0.227$). **Conclusion :** Based on the study results it is evident that hyperhomocysteinemia is one of the significant risk factors for cerebrovascular accidents and the risk is more pronounced in patients with hemorrhagic stroke.

Keywords: Cerebrovascular accidents; Hyperhomocysteinemia; Serum homocysteine; Stroke

INTRODUCTION

A cerebrovascular accident (CVA) or stroke is abrupt onset of a neurologic deficit of vascular origin. Majority of cerebrovascular accidents are ischaemic (80%); while others result from primary haemorrhage either intracerebral or into the subarachnoid space.

Numerous risk factors such as hypertension, cigarette smoking, hyperlipidemia and diabetes mellitus are involved in the development of stroke.¹ Hyperhomocysteinemia has been of lately identified as a modifiable risk factor for

cerebrovascular accident.^{2,3} It is defined as an elevated plasma total homocysteine concentration (10 $\mu\text{M/dL}$);

Homocysteine is an amino acid in the blood. It is not derived from the diet and is synthesized biologically from methionine. Hyperhomocysteinemia generates a proatherogenic and prothrombotic environment in the blood vessels,⁵ mainly via endothelial cell injury.

There is limited data showing relationship between serum homocysteine levels and stroke in India. Hence the present study was designed to conjecture the serum homocysteine levels as a risk factor for cerebrovascular accidents.

MATERIAL AND METHODS

The present study was conducted in the Department of Medicine in tertiary care centre.

Study design

The study design was hospital based cross sectional study.

Study period and duration

The present study was conducted for a period of 18 months from December 2016 to July 2018.

Place

This study was conducted in the Department of Medicine, Bharati Visyapeeth (Deemed to be University) Medical College and Hospital, Sangli.

Sample size

Within the stipulated time period of 18 months, a total of 100 patients with cerebrovascular stroke were studied.

Inclusion Criteria

- All the patients above age 18 years, admitted under the Department of Medicine, BVDU MCH, Sangli with cerebrovascular accidents diagnosed by clinical examination and confirmed by CT scan or MRI.

Exclusion Criteria

- Patients with ischaemic heart disease.
- Patients with atrial fibrillation

- Patients with epilepsy.
- Patients with dehydration.

Ethical clearance

Prior to the commencement of the study, approval was taken from the Institutional Ethical and Research Committee.

Method of collection of data

Demographic data like gender and age were collected along with relevant history. A thorough clinical examination was conducted. Further, these patients underwent general and specific neurologic examinations. The diagnosis of ischaemic/haemorrhagic stroke was confirmed on CT scan and/or MRI.

Investigations

Routine investigations

Routine investigations such as blood group, haemogram that is, haemoglobin, total count, differential count, erythrocyte sedimentation rate, peripheral smear and urine routine and microscopy were done.

Other tests

Other tests such as lipid profile, random blood sugar levels, blood urea and serum creatinine, were carried out and ECG was obtained.

Imaging studies

Chest X-ray, Computed tomography scan (plain/contrast), magnetic resonance imaging.

Serum homocysteine

Statistical analysis

Chi-square test was used to analyze the data.

OBSERVATION AND RESULTS

Table 1: Distribution of patients according to the sex

| Distribution (n=100) | | |
|----------------------|--------|------------|
| Sex | | |
| | Number | Percentage |

| | | |
|--------------|------------|---------------|
| Male | 68 | 68.00 |
| Female | 32 | 32.00 |
| Total | 100 | 100.00 |

In the present study majority of the patients were males (68%) and 32% of the patients were females. The male to female ratio was 2.12:1.

Table 2: Distribution of patients according to the age

| Distribution (n=100) | |
|----------------------|------------|
| Age group (Years) | |
| Number | Percentage |

| | | |
|----------|----|-------|
| 18 to 30 | 8 | 8.00 |
| 31 to 40 | 6 | 6.00 |
| 41 to 50 | 15 | 15.00 |
| 51 to 60 | 18 | 18.00 |
| 61 to 70 | 22 | 22.00 |
| 71 to 80 | 22 | 22.00 |
| 81 to 90 | 9 | 9.00 |

| | | |
|--------------|------------|---------------|
| Total | 100 | 100.00 |
|--------------|------------|---------------|

In this study most of the patients were aged between 61 to 70 years and 71 to 80 years (22% each). The mean age was 60.70 ± 16.85 years. The median age was 64 years and ranged between 22 to 90 years.

Table 3: Distribution of patients according to the risk factors

| Distribution (n=100) | | |
|-----------------------------|---------------|-------------------|
| Risk factors | | |
| | Number | Percentage |
| Diabetes mellitus | 38 | 38.00 |
| Tobacco chewing | 35 | 35.00 |
| Hypertension | 32 | 32.00 |
| Smoking | 28 | 28.00 |
| Alcohol consumption | 26 | 26.00 |

| | | | | |
|--|--|----|-------|--|
| | Miscellaneous heart disease | 25 | 25.00 | |
| | Family history of stroke | 12 | 12.00 | |
| | History of oral contraceptive Pill consumption | 7 | 7.00 | |

In this study history of diabetes mellitus was reported by 38% of the patients followed by tobacco chewing (35%), hypertension (32%) and alcohol consumption (25%).

Table 4: Distribution of patients according to the serum homocysteine levels

| Distribution (n=100) | | |
|---|---------------|-------------------|
| Serum homocysteine levels ($\mu\text{mol/L}$) | | |
| | Number | Percentage |
| Normal (<15) | 45 | 45.00 |

| | | |
|----------------------|------------|---------------|
| Raised (≥ 15) | 55 | 55.00 |
| Total | 100 | 100.00 |

In the present study serum homocysteine levels were raised in 55% of the patients. The mean serum homocysteine levels were noted as 35.11 ± 29.33 $\mu\text{mol/L}$ while median levels were noted as 18.90 $\mu\text{mol/L}$ and ranged between 4.70 to 119 $\mu\text{mol/L}$.

Table 5: Distribution of patients according to the type of stroke

| Distribution (n=100) | | |
|----------------------|------------|---------------|
| Diagnosis | | |
| | Number | Percentage |
| Ischaemic stroke | 62 | 62.00 |
| IC bleed | 20 | 20.00 |
| Cerebellar stroke | 15 | 15.00 |
| CVST | 3 | 3.00 |
| Total | 100 | 100.00 |

In this study most of the patients were diagnosed to have ischaemic stroke (62%) followed by IC bleed (20%), cerebellar stroke (15%) and CVST (3%).

Table 6: Association of serum homocysteine levels with type of stroke

| Serum homocysteine levels ($\mu\text{mol/L}$) | | | | |
|---|--------------|----------------------|--|-------|
| | | | | Total |
| Type of stroke | Normal (<15) | Raised (≥ 15) | | |

| | No. | % | No | % | No. | % |
|--------------|-----------|--------------|-----------|--------------|------------|---------------|
| Haemorrhagic | 17 | 85.00 | 3 | 15.00 | 20 | 20.00 |
| Ischaemic | 28 | 35.00 | 52 | 65.00 | 80 | 80.00 |
| Total | 45 | 45.00 | 55 | 55.00 | 100 | 100.00 |

$p < 0.001$

In this study significantly higher number of patients with ischaemic stroke (65%) had raised serum homocysteine levels ($p < 0.001$)

Table 7: Comparison of mean serum homocysteine levels in males and females

| Sex | | | | | |
|---|--------------|-------|----------------|-------|---------|
| Variables | Males (n=68) | | Females (n=32) | | p value |
| | Mean | SD | Mean | SD | |
| Serum homocysteine levels ($\mu\text{mol/L}$) | 34.16 | 29.69 | 37.13 | 28.56 | 0.634 |

In the present study serum homocysteine levels were slightly high among females but the difference was statistically not significant ($p=0.634$).

DISCUSSION

This hospital based cross sectional study, was performed in the Department of Medicine at a tertiary care center.

In the present study serum homocysteine levels ranged between 4.70 to 119 $\mu\text{mol/L}$, with the mean levels being 35.11 ± 29.33 $\mu\text{mol/L}$ while median levels were noted as 18.90 $\mu\text{mol/L}$. more than half (55%) of the patients had raised serum homocysteine levels. These inferences suggest that,

hyperhomocysteinemia is a strong risk factor for cerebrovascular stroke.

These findings were correlating with several other studies (4, 6, 7, 9).

In the present study, Most of the patients were diagnosed to have ischaemic stroke (62%) followed by IC bleed (20%), cerebellar stroke (15%) and CSVT (3%). Significantly higher number of patients with ischaemic stroke (65%) had raised serum homocysteine levels as compared to those with haemorrhagic stroke (15%) ($p < 0.001$). Boysen et al.⁸ (2003)¹⁶ also found a significant difference in total

homocysteine levels between patients with ischemic and hemorrhagic stroke.

In this study age ranged between 22 to 90 years and the mean age was 60.70 ± 16.85 years. These findings suggest that, stroke is exceptionally prevalent among elderly population and these findings were comparable with previous epidemiological data (3,10,11)

Overall, the present study showed that, hyperhomocysteinemia is a significant risk factor especially for ischaemic stroke and the risk is independent of age and gender. However, these findings require further validation due to significant limitations of this study. The limitations of this study were relatively smaller sample size, single centre study design and the link between hyperhomocysteinemia and modifiable risk factors of stroke was not elicited. Multicentric studies involving large sample size considering modifiable risk factors may substantiate the true effect of hyperhomocysteinemia in patients with cerebrovascular accidents.

CONCLUSION

Patients presenting with in cerebrovascular accidents are likely to present with raised hyperhomocysteine levels. Furthermore, patients with ischaemic stroke are likely to present with significantly higher hyperhomocysteine levels than those who present with haemorrhagic stroke. Based on the findings of this study it may be concluded that, hyperhomocysteinemia is one of the significant risk factor for cerebrovascular accidents and the risk is more pronounced in patients with ischaemic stroke.

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