Section: Biochemistry

Original Research Article

OXIDATIVE STRESS MARKERS AND LIPID PROFILE IN PATIENTS WITH AND WITHOUT TYPE II DIABETES MELLITUS WITH REGARD TO CEREBROVASCULAR DISEASES AT A TERTIARY CARE HOSPITAL

Ritam Banerjee[1], Kaji Ashique Firdoush[2], Sandipan Datta[3], Rituparna Maji[4]

[1]Associate professor, Department of Biochemistry, Maharaja Jitendra Narayan Medical College, Coochbehar, India.
[2]Assistant professor, Department of Biochemistry, Maharaja Jitendra Narayan Medical College, [3]Coochbehar, India.
Demonstrator, Department of Biochemistry, Maharaja Jitendra Narayan Medical College, [4]Coochbehar, India.
Assistant Professor, Department of Biochemistry, Calcutta National Medical College, Kolkata, India.

Received : 30/03/2023
Received in revised form : 02/05/2023
Accepted : 14/05/2023

Keywords:
Cerebrovascular disease, dyslipidemia, type 2 DM.

Corresponding Author:
Dr. Ritam Banerjee,
Email: mastermailritam@gmail.com

DOI: 10.47009/jamp.2023.5.3.451

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2023; 5(3); 2298-2302

Abstract

Background: To evaluate lipid profile, fasting blood profile glucose and post prandial blood glucose in patients with cerebrovascular disease and control group. **Materials and Methods:** It was Case control study, Study conducted in the department of Biochemistry, Maharaja Jitendra Narayan Medical College, Coochbehar. A total 56 patients with diagnosed cerebrovascular diseases attending the OPD, emergency, or admitted to the indoor in MJNMC & Hospital during the study period from January 2022 to November 2022 and same number of age and sex matched controls were included in the study. **Results:** The mean age of the patients with CVA taken in this study is 62.66 ± 7.159 and for controls it is 62.42 ± 7.037. P-value for cases and controls. The mean value with standard deviation of FBS of cases and controls are 84.66±24.27 & 75.250±8.120 respectively. The mean value with standard deviation of cases and controls for PPBS are 149.34±65.413 & 119.14±10.29, for serum cholesterol are 157.14±48.85 & 139.77±37.501, for serum triglyceride are127.50± 19.075&124.57±19.34, for serum LDL are 110.2±19.769 & 97.55±12.33, Serum HDL are41.8± 8.067 & 42.88±7.510 ,serum VLDL are 41.46± 10.562 & 41.07±10.33, By comparing the parameters of FBS & PPBS by Mann-Whitney's U t test,its seen to have no significance. However amongst the rest of the normally distributed parameters Total Cholesterol, LDL, when compared by Student unpaired T- test was found to be significant with P-value <0.05.**Conclusion:**We found that there was no significant difference between the two groups in terms of fasting and postprandial blood glucose levels. However, we did observe a significant difference in total cholesterol and LDL levels between the two groups, with patients with cerebrovascular diseases having higher levels than the control group. These findings suggest that dyslipidemia may be a contributing factor to cerebrovascular diseases. Therefore, clinicians should monitor lipid profiles in patients with cerebrovascular diseases and take appropriate measures to manage dyslipidemia to prevent the progression of cerebrovascular diseases. Further studies are needed to explore the association between oxidative stress markers and lipid profile in patients with and without type II diabetes mellitus with regard to cerebrovascular diseases.

INTRODUCTION

Everyone from the affluent to the impoverished has been impacted by cerebrovascular accidents. Many influential people in the fields of science, medicine, and politics have had their careers cut short by stroke. The microscopic anatomy of the lungs, kidneys, and spleen were all discovered by Marcello Malpighi before his death from apoplectic right hemiplegia.[1] At the age of 46, Louis Pasteur

ISSN(O): 2687-5365; ISSN(P): 2753-6556

suffered a stroke that left him with left hemiparesis; he continued to make significant contributions, however, until successive strokes severely limited his abilities at the age of 65.One) Generalized Knowledge of Acute dysarthria in President Dwight Eisenhower, the death of Richard Nixon from a massive embolic cerebral hemisphere infarction, and the unconsciousness of Israeli Prime Minister Ariel Sharon after a series of cerebrovascular episodes all contributed to a major increase in the incidence of stroke. If stroke hadn't killed or incapacitated such stalwarts, the course of stroke history would have been different.

According to the World Health Organisation, stroke accounts for 11.8% of all fatalities and 4.5% of all disability-adjusted life years (DALYs).Regardless of age, sex, or ethnicity, the incidence of cerebrovascular accidents is rising. The Global Burden of Disease study found that between 1990 and 2010, the global mortality toll from stroke rose from 4.66 million to 5.7 million, an increase of 26%. The age-adjusted incidence rate of stroke in India increased from 13 per 100,000 in 1970 to 105 per 100,000 in 2001.[2] From a public health perspective, it is increasingly important to track the number of strokes around the world and see how they compare across age groups, sexes, and ethnicities in order to better understand how to stop them from happening in the first place, alter their course once they do, and lessen the chance of permanent damage or disability. About 795,000 people in the United States have a stroke each year, according to statistics. About 60% are one-time occurrences, whereas the remaining 40% are repeat attacks. However, according to the WHO's assessment on noncommunicable diseases, by the middle of this century, around 80% of the world's burden will be emanating from India and China. Pathogenesis of stroke, prevalence, mortality, and disability-adjusted life years (DALY) have all been documented by the neuroepidemiologic research undertaken so far in relation to the burden of stroke. These studies provided conclusive evidence that CVA is a major global health problem that requires urgent attention in order to lessen the disease's prevalence, severity, and impact on those who have survived a stroke.[3,4]

MATERIALS AND METHODS

It was Case control study, Study conducted in the department of Biochemistry, Maharaja Jitendra Narayan Medical College, Coochbehar. A total 56 patients with diagnosed cerebrovascular diseases attending the OPD, emergency, or admitted to the indoor in MJNMC & Hospital during the study period from January 2022 to November 2022 and same number of age and sex matched controls were included in the study.

Inclusion Criteria

1. Patients with Diagnosis of ischemic/hemorrhagic stroke based on clinical and imaging causing neurological deficit with or without diabetes mellitus .
2. Aged ≥18 years
3. Age and sex matched individuals without any major illness and not on any medications as controls

Exclusion Criteria

1. Significant head trauma in previous 3 months
2. Intracranial neoplasm, arteriovenous malformation, or aneurysm
3. Recent intracranial or intraspinal surgery
4. History of previous coagulation abnormality.
5. Patients with any major renal, hepatic disease or any endocrine disorders.
6. Patients on antioxidant (vit Ecapsules) or other medications which may affect the study parameters.

Sample Size

56 cases and 56 age and sex matched controls were taken for the study

Method of collection of data (including sampling procedure):

Information were collected from the patients on the basis of predesigned data sheet and findings of relevant clinical examination were recorded. About 10cc of venous blood was drawn from each subjects (from large peripheral veins) under aseptic precautions in a sterile bulb. Serum was separated by centrifugation and used for analysis of lipid profile, LFT, RFT. Blood was collected in vials containing sodium fluoride for estimation of FBS and PPBS.

Estimation of lipid profile (triglyceride, total cholesterol, HDL, LDL) liver function test (total bilirubin, direct bilirubin, SGOT, SGPT, Albumin, Total protein), renal function test (Na+, K+, urea, creatinine) by auto-analyzer.

Estimation of fasting and post prandial blood glucose by Glucose oxidase peroxidase method.

Control 56 age and sex matched controls were recruited.

Statistical Analysis: Suitable statistical analysis of the study was performed by Statistica version 26 &MedCalc version 15.8 [Mariakerke, Belgium: MedCalc Software 2020] softwares after obtaining the data, at the end of study.

ISSN(O): 2687-5365; ISSN(P): 2753-6556

RESULTS

Table 1: Age comparison of case and control groups

PARAMETER	CASES (n=56)	CONTROLS(n=56)	P VALUE
AGE (MEAN &SD)	62.66 ± 7.159	62.42 ± 7.037	0.698

The mean age of the patients with CVA taken in this study is 62.66 ± 7.159 and for controls it is 62.42 ± 7.037. P-value for cases and controls for age is 0.698 So there is no statistically significant difference.

Table 2: Sex Distribution of Case and Control Groups

PARAMETER	CASE	CONTROL	p-value
SEX (FEMALE %)	41.1 %	41.1%	1.o

Table 3: Type of Stroke in Our Study Population with Their Frequencies

Type of stroke	Frequency	Percentage %
Hemorrhagic	30	53.6
Ischemic	26	46.4

Table 4: Frequency of type II Diabetes Mellitus in the study population

Presence of Diabetes Mellitus	Males	Females	Total	Percentage
yes	8	7	15	26.8%
No	25	16	41	73.2%

Table 5: Biochemical Parameters in Case and Control Groups

PARAMETER	CASE	CONTROL	P VALUE
FASTING BLOOD GLUCOSE	84.66±24.27	75.250±8.120	0.656
POST PRANDIAL BLOOD GLUCOSE	149.34±65.413	119.14±10.29	0.827
SERUM CHOLESTROL	157.14±48.85	139.77±37.501	0.037
SERUM TRIGLYCERIDE	127.50± 19.075	124.57±19.34	0.422
SERUM HDL	41.8± 8.067	42.88±7.510	0.468
SERUM LDL	110.2±19.769	97.55±12.33	<0.0001
SERUM VLDL	41.46± 10.562	41.07±10.33	0.843
SERUM MALONALDEHYDE	34.45± 10.060	16.98 ± 6.57	<0.0001
SERUM PON1	73.48± 16.248	73.48± 16.248	<0.0001

The mean value with standard deviation of FBS of cases and controls are 84.66±24.27 & 75.250±8.120 respectively. The mean value with standard deviation of cases and controls for PPBS are 149.34±65.413 & 119.14±10.29, for serum cholesterol are 157.14±48.85 & 139.77±37.501, for serum triglyceride are127.50± 19.075&124.57±19.34, for serum LDL are 110.2±19.769 & 97.55±12.33, Serum HDL are41.8± 8.067 & 42.88±7.510 ,serum VLDL are 41.46± 10.562 & 41.07±10.33, respectively.

Table 6: Comparing means of statistical data between CVA Patients with Type II Diabetes Mellitus & CVA patients without Type II diabetes Mellitus

Biochemical parameters	Cva patients with type ii diabetes mellitus	Cva patients without type ii diabetes mellitus	P-value
FBS	122.8± 6.01	70.68± 7.066	<0.0001
PPBS	241.5 ±58.77	115.61± 17.91	<0.0001
TOTAL CHOLESTEROL	187.07±38.07	146.20± 47.949	0.005
TRIGLYCERIDE	141.07± 22.07	122.46 ±15.255	0.001
HDL	42.47± 7.97	41.56± 8.186	0.713
LDL	121.00± 18.22	106.24 ±19.01	0.012
VLDL	44.40 ±11.83	40.39± 10.00	0.211
MALONDIALDEHYDE	44.60± 6.27	30.74 ±8.72	<0.0001
PON1	57.81± 7.40	79.21 ±14.76	<0.0001

The mean value with standard deviation of FBS of CVA Patients with type II diabetes mellitus (1)&CVA patients without type II diabetes mellitus (2) are &122.8± 6.01 and 70.68± 7.066 respectively.The mean value with standard deviation of (1) & (2)for PPBS are 241.5 ±58.77 and 115.61± 17.91, for serum cholesterol are187.07±38.07& 146.20± 47.949, for serum triglyceride are 141.07± 22.07& 122.46 ±15.255for serum LDL are 121.00± 18.22& 106.24 ±19.01, Serum HDL are 42.47± 7.97& 41.56± 8.186,serum VLDL are 44.40 ±11.83&, 40.39± 10.00 serum Malondialdehyde are 44.60± 6.27&30.74 ±8.72, and serum PON 1 are57.81± 7.40& 79.21 ±14.76 respectively.

By comparing the parameters of FBS & PPBS by Mann-Whitney's U t test,its seen to have significance, P value <0.0001 for both.However amongst the rest of the normally distributed parameters Total Cholesterol,

ISSN(O): 2687-5365; ISSN(P): 2753-6556

triglyceride, LDL,Malondialdehyde & PON 1 when compared by Student unpaired T- test was found to be significant with P-value <0.05.

Table 7: Comparing means of the statistical data between CVA type hemorrhage (3) and CVA type ischemic (4)

Biochemical Parameters	CVA Type Hemorrhage	CVA Type Ischemic	P-Value
FBS	81.23 ±21.66	88.62 ±24.83	0.085
PPBS	144.93± 68.94	154.42 ±62.04	0.349
TOTAL CHOLESTEROL	145.70± 48.31	170.35± 46.96	0.059
TRIGLYCERIDE	122.43 ±16.71	133.35± 20.25	0.03
HDL	43.40± 7.21	39.96± 8.72	0.11
LDL	112.5± 19.68	107.54± 19.91	0.35
VLDL	40.70 ±10.13	42.25± 11.17	0.56
MALONDIALDEHYDE	33.37± 9.21	35.70 ± 11.00	0.39
PON1	76.13 ±16.85	70.42± 15.66	0.19

By comparing the parameters between the CVA patients with hemorrhagic stroke and CVA patients with ischemic, no significance was found except for serum triglyceride where P-value came to be <0.005 (by Students Unpaired T test).

DISCUSSION

The purpose of this research was to determine if atherosclerosis, as measured by the patients' lipid profiles, plays a role in the development of stroke. In addition, the purpose of this research was to determine whether or not dyslipidemia and the development of oxidative stress play a similar role in the pathogenesis of stroke. As was already mentioned, type II diabetes mellitus is related with elevated oxidative stress and stands as a separate risk factor for stroke. This study aims to determine if there is a correlation between the two in people who had suffered a stroke.

Thirty patients with hemorrhagic CVA and twenty-six patients with ischemic CVA were recruited, along with age- and sex-matched healthy controls. The study population included 15 people with diabetes and 41 people who did not have diabetes.

The average age of the participants in the study was 62.6 years, with a standard deviation of 7.15 years. Participants' ages 50–60 make up the bulk of the sample. The total population was 58.9% male and 41.1% female.

Fifty patients ranging in age from 51 to 69 (34% female) were included in the studies conducted by Leonardo Lorente L et al.[5] One hundred patients with ischemic stroke, with a mean age of 70.77.5 and a 70% male preponderance, were selected for a separate study by Sarkar MK et al.[6]

The WHO reports that strokes are the main cause of death for people over the age of 60. In men, the average age of a first stroke was 68.6 years, whereas in women, it was 72 years and 9 months. Stroke prevalence was 41% higher in men than women overall, with wide differences among age groups and populations. Therefore, there is some congruence between the results from the present research population and the global statistics.

Total cholesterol in the current study group averaged 157.14 mmol/L, with a standard deviation of 48.85 mmol/L. The other parameters have the following means and standard deviations: Serum HDL 41.8 8.067; Serum LDL 110.2 19.769; triglyceride 127.50 19.075; very low density lipoprotein (VLDL) 41.46 10.562. When total and low-density lipoprotein (LDL) serum levels were examined between patients and controls, there were statistically significant differences (p 0.05).Patients with ischemic CVA were found to have higher serum triglycerides than those with hemorrhagic CVA, but no other parameters in the lipid profile panel were significantly different between the two groups (P value > 0.05).

In their cross-sectional analysis, Al- Rawi NH et al. enrolled 258 patients, 193 of whom had ischemic stroke and 65 who had hemorrhagic stroke. Ischemic stroke patients had mean values of total cholesterol 226.5 55.8, triglyceride 164.9 86.1, HDL 46.8 16.2, and LDL 146.8 42.5, while hemorrhagic stroke patients had mean values of total cholesterol 214.7 55.8, triglyceride 168.4 65.7, HDL 49.4 14.1, and LDL 146.1 57.6. Total cholesterol was 210.138.8, triglycerides were 168.465.7, good cholesterol (HDL) was 49.112.3, and bad cholesterol (LDL) was 124.238.3 in the control group. Total cholesterol, HDL, and LDL levels in ischemic patients were significantly different from those in the control group (p value 0.001), as were triglyceride levels in hemorrhagic patients compared to the control group (p value 0.001). Except for triglyceride levels, there was no discernible difference between the hemorrhagic and ischemic groups.They reasoned that a combination of a high LDL and low HDL is a risk factor for both ischemic and hemorrhagic CVA.[7]

One hundred patients (46 with hemorrhagic stroke and 54 with ischemic stroke) were enrolled in the recent observational study by Das A et al. According to the NCEP ATP III recommendation, high levels of cholesterol, triglycerides, and low-density lipoprotein (LDL) were considered to be indicative of an unhealthy lipid profile. Eighty-three percent of those with an ischemic stroke and seventeen percent of those with a hemorrhagic stroke had elevated serum cholesterol levels. Patients with both ischemic and hemorrhagic strokes

ISSN(O): 2687-5365; ISSN(P): 2753-6556

had elevated levels of LDL cholesterol. They found no statistically significant difference in total cholesterol, LDL cholesterol, or triglyceride levels between ischemic and hemorrhagic individuals.[8]
Wieberdink RG et al. found that the average total cholesterol and LDL-c of individuals who had suffered an ischemic stroke were, respectively, 183.7 34.5 and 118 26.7.[9]
As a result, most existing research indicates that CVA patients' lipid profiles fluctuate over time. The lipid disorder known as dyslipidemia has been linked to an increased risk of stroke. In addition, it raises plasma triglyceride and LDL-C levels while lowering HDL-C concentration, making it a risk factor for peripheral vascular disease, stroke, and coronary artery disease. It has been established, however, that stroke itself is linked to alterations in lipid levels, most likely as a result of the stress and subsequent catecholamine overproduction that happens during an acute stroke. According to the literature, stress is linked to a significant drop in lipid profile.

CONCLUSION

In terms of global prevalence, cerebrovascular accidents account for 11.8% of all deaths and 4.5% of all disability-adjusted life years (DALYs). It's a serious issue for people of all ages, genders, and cultures. The stroke incidence rate per 100,000 Indians increased from 13 in 1970 to 105 in 2001 after adjusting for age.
Brain attacks can either be ischemic or hemorrhagic, depending on the underlying cause. Hemorrhagic stroke, whether intracerebral, subarachnoid, subdural, or epidural in nature, is typically caused by leakage from cerebral vessels due to damage caused by atherosclerosis, aneurysm, or other vascular malformation and increased intracranial blood pressure, often as a consequence of increased systemic blood pressure. The disease is terrifying because of its short-term and long-term consequences. Oxidative stress is one of the most critical pathophysiologies of post-stroke outcomes. Lipid, protein, and DNA are all adversely affected by oxidative stress and, by extension, the free radicals that are produced. Large-scale oxidative stress can trigger apoptotic pathways that kill neurons. Therefore, the harmful consequences of OS in CVA patients can be mitigated if the oxidant-antioxidant balance is maintained to manage the growing oxidative stress.

REFERENCES

1. A History of Stroke: Its recognition and treatment . Fields WS, Lemak NA. New York : oxford university press , 1989.
2. A prospective community based study of stroke in kolkata , India. DAS SK, BANERJEE TK,BISWAS A. 2007, Stroke , Vol. 38(3), pp. 906-910.
3. Banarsidas Bhanot, Park K.Epidemiology of chronic non communicable diseases and conditions. 20th. Jabalpur : s.n., 2009. pp. 327,328.
4. Harrison's texi book of Internal Medicine : chapter 370. 19th . Vol. 2.
5. Lorente L, Martín MM, Abreu-González P, Ramos L, Argueso M, Solé-Violán J, Riaño-Ruiz M, Jiménez A. Serum malondialdehyde levels in patients with malignant middle cerebral artery infarction are associated with mortality. PLoS One. 2015 May 1;10(5):e0125893.
6. Sarkar MK, Sil PC. Prevention of tertiary butyl hydroperoxide induced oxidative impairment and cell death by a novel antioxidant protein molecule isolated from the herb, Phyllanthus niruri. Toxicol In Vitro. 2010;24:1711–1719.
7. Al- Rawi NH. Oxidative stress, antioxidant status and lipid profile in the saliva of type 2 diabetics. Diab Vasc Dis Res. 2011;8(1):22- 28.
8. Das A, Sarwar MS, Hossain MS, et al. Elevated serum lipid peroxidation and reduced vitamin C and trace element concentrations are correlated with epilepsy. Clin EEG Neurosci. 2019;50(1):63- 72.
9. Wieberdink RG, Poels MMF, Vernooij MW, et al.. Serum lipid levels and the risk of intracerebral hemorrhage: the Rotterdam Study. Arterioscler Thromb Vasc Biol 2011;31:2982–2989.

ISSN(O): 2687-5365; ISSN(P): 2753-6556