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Evaluation and Comparison of Antioxidant status in ischemic and haemorrhagic cases of stroke

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ABSTRACT

Introduction:
The World health organization (WHO) has well-defined stroke as "rapidly progression of clinical signs of focal and at times global disturbances of cerebral function long-lasting > 24 hours or resulting of death, with no apparent reason other than vascular region."

Material and Methods
This case-control study was conducted on an overall population of 200 individuals (58 ischemic strokes and 29 haemorrhagic strokes as the case groups; 58 healthy individuals as the control group).

Diagnosis: The diagnosis of stroke was based on history and clinical examination and brain CT scan were used to confirm and classify ischemic and haemorrhagic stroke cases.

Results:
A total of 200 cases of stroke (58 ischemic stroke, 29 haemorrhagic strokes, and 58 healthy individuals as the control group) were identified during the study follow-up. GPX levels are reduced significantly in ISPs and HSPs equated with control subjects($p<0.001$). Extreme decrease in GPX is seen in ISPs than HSPs($p<0.001$).

Conclusion
Finally, positive direct relationship was seen in MDA along with infarct size. So, it could consider as a bio marker for recognising stroke. This could be valued for improving the dose frequency for improvement of patient health. From these studies, we can conclude that antioxidant defence is reduced in ischemic stroke patients as a significance of inclined oxidative stress.

Key words: Oxidative stress–Antioxidant–Ischemic–Haemorrhagic

1 INTRODUCTION

The World health organization (WHO) has well-defined stroke as "rapidly progression of clinical signs of focal and at times global disturbances of cerebral function long-lasting > 24 hours or resulting of death, with no apparent reason other than vascular region." It is one of the main reasons of adult disability and the second most common reason of death. [1] Stroke is a main reason of morbidity and mortality in an old age people. In the ageing, ischemic stroke accounts for >80% of all stroke cases. [2]

The causes of cellular injury subsequent ischemia are multifactorial, but there is rising indication suggesting the character of reactive oxygen species (ROS) in its pathogenesis. Oxidative stress resultant from generation of ROS is involvement in the neuronal damage produced by ischemia and reperfusion, one of the main goals in stroke treatment because the recanalization of an occluded artery and restoration of the blood flow can save brain tissue. [3] However, reperfusion might have some deleterious effects because oxidative stress can rapidly take place on reoxygena-

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tion. [4] ROS generated during ischemia/reperfusion can react with unsaturated lipids of bio membranes, thereby generating malondialdehyde (MDA), an end-product of lipid peroxidation. MDA could be a biomarker of tissue injury and reflect oxidative damage; indeed, several studies have shown increased MDA concentrations in acute stroke patients. [5]

Natural antioxidants include enzymes and non-enzyme antioxidants. Antioxidant enzymes include SOD, catalase (CAT), peroxidase, glutathione peroxidase (GSH-Px), and NADPH, and enhancing the activities of these can result in antioxidant effects. Non-enzymatic antioxidants are mostly derived from natural plants or their extracts and include vitamin C, vitamin E, glutathione, melatonin, carotenoids, resveratrol, ursolic acid, and microminerals such as copper, zinc, and selenium. These are extremely important in minimizing oxidative stress. [6–9]

Taking into thought of the overhead evidences, this study was done to investigate the correlation of prognostic factors in stroke and haemorrhagic patients with serum malondialdehyde (MDA), Nitric oxide (NO), Glutathione peroxides, Uric acid, Superoxide dismutase (SOD), Catalase, Vitamin C (ascorbic acid) and Vitamin E (α- tocopherol) in patients with ischemic and haemorrhagic stroke cases. Until now there have been few studies that compared the differences between two types of strokes.

Objective of the study

The current research work is planned to study oxidative stress and anti-oxidant status in stroke

and compare it in cases of ischemic and haemorrhagic stroke

2 MATERIAL AND METHODS

Study Design: Prospective, observational study

Study type: Hospital based Case Control study

This case-control study was conducted on an overall population of 200 individual's human participants (58 ischemic strokes and 29 haemorrhagic strokes as the case groups; 58 healthy individuals as control group).

The control group was selected from healthy population, which matched for age and gender with the same exclusion criteria. Blood samples were obtained from the controls at the given time spans.

Sample size: 200

Diagnosis: The diagnosis of stroke was based on history and clinical examination and brain CT scan were used to confirm and classify ischemic and haemorrhagic stroke cases.

Subjects: Patients with acute ischemic stroke and same number of patients with haemorrhagic stroke were recruited within the first 24 hours of their attack who were hospitalized at the emergency Ward of Index Medical College & P.G. Institute, Indore.

Inclusion criteria: Cases of both Ischemic and haemorrhagic stroke

Exclusion criteria: Previous history of a cerebrovascular event

History of a recent infectious or inflammatory disease

Cancer

Autoimmune disorder

Haematological disorder

Renal or hepatic disease

Use of immune-suppressive or anti-inflammatory drugs in the previous two months

Sample collection: Venous blood samples were obtained on admission.

Method: Blood samples were immediately centrifuged and analysed by semi-autoanalyzer following standard operating procedure

Statistics: The Statistical analysis were performed using appropriate methods.

3 RESULTS

A total of 200 cases of stroke (58 ischemic stroke, 29 haemorrhagic strokes, and 58 healthy individuals as the control group) were identified during the study follow-up. Their age varied between 41 and 81 (52.41±9.49 and 54.85±9.57 in IS and HS, respectively) and there was no significant difference of age between two groups. At baseline (Table 1), cases were older, drank more, smoked more, and were more likely than no cases to have hypertension. With the exception of participants with haemorrhagic stroke, cases had also more waist circumference, BMI, and no alcohol energy intake and were less active.

Table 1. Characteristics of the Whole Group of Patients

Characteristics	Control group	Ischemic stroke	Haemorrhagic stroke
	71	67	62
Age, y, Mean±SD	53.64±9.43	52.41±9.49	54.85±9.57
Males	43 (60.5)	37 (55.2)	36 (58)
Female	28 (39.4)	30 (44.7)	26 (41.9)
BMI (kg/m2)	23.4 ±3.3	24.3 ±3.6	22.1±3.4
Hypertension n (%)	31 (43.6)	27 (40.2)	24 (38.7)
Systolic BP (mmHg) Mean±SD	134.6±12.5	141.1±13.4	139.5±14.3
Diastolic BP (mmHg) Mean±SD	82.5±9.35	81.2±9.21	83.1±8.24
Diabetes, n (%)	23 (32.3)	19 (28.3)	17 (27.4)
Current smokers, n (%)	21 (29.5)	16 (23.8)	13 (20.9)
Alcohol intake, n (%)	11 (15.4)	9 (13.4)	7 (11.2)

Table 2. Distribution of the Anti-oxidantsin Patients

Characteristics	Control group Mean±SD	Ischemic stroke Mean±SD	Haemorrhagic stroke Mean±SD
Glutathione peroxides (GPX) (μmol/mg)	9.93 ± 2.31	4.02 ± 1.32 P < 0.001	4.22 ± 1.32 P < 0.001
Uric acid (mg/dl)	4.34 ±0.4	7.16±0.9 P < 0.001	6.23±0.7 P < 0.001
Superoxide dismutase (SOD) (U/mg)	14.3 ±0.3	9.3 ±0.6 P < 0.001	8.9±0.4 P < 0.001
Catalase (IU/mg)	13.3 ±0.6	8.3±0.7 P < 0.001	9.5 ±0.2 P < 0.001

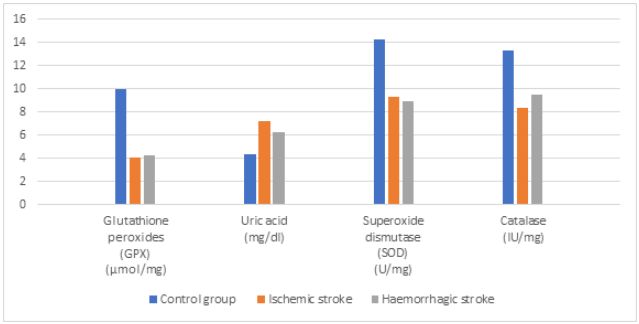

Figure 1. Distribution of the Anti-oxidants in Patients

The GPX levels are reduced significantly in ISPs and HSPs compared to control subjects($p<0.001$). Extreme decrease in GPX is seen in ISPs with HSPs($p<0.001$). The Uric acid levels are considerably inclined in ISPs and HSPs when equated to control subjects($p<0.003$) and the more upsurge seen in ISPs with HSPs (Table 3 and graph 1). The SOD levels are reduced drastically ($p<0.05$) in ISPs and HSPs when equated to control subjects, whereas its levels are marginally reduced in ISPs with HSPs. Similarly, Catalase levels also decreased in both ISPs and HSPs.

Table 3. Distribution of the Vitamin C and E in control group, Ischemic stroke group and Haemorrhagic stroke

Characteristics	Control group Mean±SD	Ischemic stroke Mean±SD	Haemorrhagic stroke Mean±SD
Vitamin C (mg/L)	1.43 ± 0.24	0.56 ± 0.63	0.98 ± 0.71
Vitamin E (mg/L)	11.64±0.53	7.41±0.65	8.85±0.72

In table 4 and graph 2, it was observed that the serum levels of Vitamin C and Vitamin E were significantly lowers in both ISPs and HSPs than those of control.

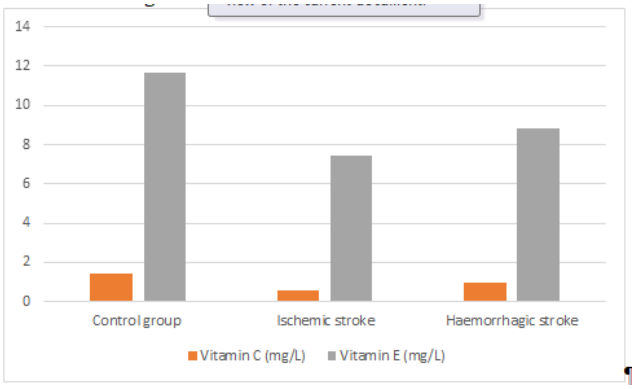

Figure 2. Distribution of the Vitamin C and E in control group, Ischemic stroke group and Haemorrhagic stroke

4 DISCUSSION

The current study depicts significant upsurge in lipid peroxides in Ischemic Stroke Patients (ISPs) and haemorrhagic stroke Patients (HSPs) as equated with control subjects. A study by Milanlioglu *et al.* determined that patients with acute ischemic stroke exposed increased oxidative stress reaction, and weakened antioxidant enzyme activity, signifying that imbalance of oxidant/antioxidant status could be a part of the pathogenesis of acute ischemic stroke. [10−17] To study the antioxidant potential of ischemic stroke patients we have included Glutathione peroxides (GPX), Uric acid and SOD, Catalase in our study.

Our results indicate that GPX levels are decreased significantly in ISPs and HSPs but extreme decrease is seen in ISPs. GPX reduction increases cerebral ischemic injury. Shivakumar et al. and Akila et al. have revealed that GPX levels have reduced in brain regions during reperfusion for 1 hours after moderate or severe ischemia for 0-5 hours. [18,19]The GPX was exhibited to decrease lethality, rise brain water levels and decline MDA levels in cerebral ischemic rats when given rapidly after ischemia signifying that its anti-ischemic results are due, in part to inhibition of lipid peroxidative reactions.[19−22] In our study, we have noticed reduced GPX levels in ISPs and HSPs which specifies that antioxidant capacity is declined in these patients. So, management with anti-oxidant could be helpful to decrease MDA in ischemic stroke patients.

We have also seen in our study that SOD levels are reduced in ISPs and HSPs when equated wtih control subjects, where as its levels are reduced in ISPs with HSPs. Similar to the current study, El Kossi et al. (2000) found significant difference between IS group and control group, concerning serum SOD activity.[23] Moreover, Cherubini et al. and Demikaya et al. found that SOD activity decreases significantly in IS patients. [24]SOD is an endogenous antioxidant that catalyses the dismutation of the superoxide anion radical. SOD plays an important role in the defense against fee radical damage in reperfusion injury a help in reducing the infarct size during ischemia and reperfusion. [24,25]

In our study that Catalase levels are reduced in ISPs and HSPs when equated with control subjects, where as its

levels are declined in ISPs with HSPs. Similar to the current study Cherobini et al. (2000) reported that the levels of CAT, activity in plasma and red blood cells in patients at the onset of stroke were lower than the control group.[26]

5 CONCLUSION

The prospective study on the evaluation of correlation of prognostic factors in stroke and haemorrhagic patients Glutathione peroxides, Uric acid, Superoxide dismutase (SOD), Catalase, Vitamin C (ascorbic acid) and Vitamin E (α- tocopherol) in patients with ischemic and haemorrhagic stroke cases. The antioxidative parameters like superoxide dismutase and Catalase was declined both ischemic and hemorrhagic stroke when equated with control. The sign for endothelial dysfunction nitric oxide level was declined significantly in ischemic stroke not in hemorrhagic stroke when compared to normal healthy volunteers. This may be beneficial for enhancing the dose regimen for improvement of patient health. Frequent exposure to CT scan could generate numerous problems to patient and some patients could not afford to take CT scan because of expensive. In this circumstance, our study consequences could be helpful for doctor and patient health. From these studies, we can conclude that antioxidant defence is impaired in ischemic stroke patients as a result of increased oxidative stress. [1–28]

Conflicts of Interest: Nil

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