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Original Research Article

A Comparison of Serum Uric Acid in Acute Stroke Patients with Healthy Controls

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Abstract

Background: Stroke is a sudden onset of neurological deficit due to focal vascular cause. It results in reduced cerebral perfusion. Globally every year about 16 million people suffer from stroke 85% of all strokes are ischemic that occur due to blockage of cerebral arteries. The pathophysiology of stroke is complex which may involve inflammation, oxidative damage causing neuronal death. Uric acid has been found to act as both pro-oxidant and antioxidant. As a pro-oxidant, uric acid might increase vascular smooth cell proliferation, reduce nitric acid production, and increase platelet adhesiveness. Present study was thus conducted to find a correlation, if any, between uric acid, and stroke.

Material and Methods: A cross-sectional study was conducted at SMS hospital, Jaipur after taking necessary permissions. Uric acid of 50 patients of an acute stroke aged 35-70 years and 50 healthy controls were assessed by spectrophotometric assay. Patients with a known risk for cardioembolic disorders and hyperuricemia were excluded.

Results: 50 patients of acute stroke and controls were studied. The mean age in our study was 56.8 ±9.19 years in cases vs 57.4 ± 8.68 years in controls. Mean serum uric acid level in stroke patients was 6.4 ±1.21 mg/dL and in controls was 5.10±0.97 mg/dl ($P<0.05$).

Conclusion: Significant increase in serum uric acid level might be a risk factor for stroke, hence, it can be a useful diagnostic marker for stroke.

Keywords: Stroke, Hyperuricemia, uric acid.

Introduction

Stroke is the third common cause of death in the world after coronary heart disease and cancer especially in the elderly [1]. Stroke is a sudden onset of neurological deficit due to focal vascular cause. It results in reduced cerebral perfusion. It has been reported that globally every year 16 million people suffer a stroke, more than 5.7 million dies and 5 million are permanently disabled. [2] The estimated prevalence rate of stroke in India ranges from 84-262/lakh in a rural areas and 334-424/lakh in urban areas. [3]

Stroke is the main cause of disability and mortality among the aging population, and about 85% of all cases are ischemic stroke while 15% are hemorrhagic stroke [4]. Ischemic stroke occurs due to blockage of cerebral arteries caused by thrombus or embolus whereas haemorrhagic stroke occurs due to rupture of cerebral vessels often as the result of high blood pressure exerting excessive pressure on arterial walls already damaged by atherosclerosis, aneurysm, or arteriovenous malformation [5].

There is a multitude of etiologies that can lead to a stroke, some of the most common risk factors include hypertension, diabetes mellitus, physical inactivity, obesity, genetics, and smoking. The pathophysiology of stroke is complex:- decreased cerebral circulation causes oxidative damage which in turn causes microvascular injury, blood-brain barrier dysfunction, and initiates post-ischemic inflammation. These events all exacerbate the initial injury and can lead to permanent cerebral damage and cell death [6].

Uric acid is the final product of purine nucleotide metabolism, synthesized by xanthine oxidase in humans [7]. Uric acid might act as both pro-oxidant and antioxidant. Some studies suggest hyperuricemia promotes oxygenation of LDL causing lipid peroxidation and also might cause endothelial dysfunction, thus leading to atherosclerosis. Also, uric acid might play an important role in vascular smooth muscle proliferation, nitric oxide synthesis, and platelet adhesiveness.

The present study was thus conducted to find the correlation between uric acid and stroke.

Materials and Methods:

After taking necessary permissions from the institute ethics committee and Department of Neurology, the study was conducted at Central Lab, Department of Biochemistry, and Department of Neurology SMS Medical College and Hospital, Jaipur. This study was a hospital-based comparative cross-sectional study and the sampling for the study was done from period of January 2020 to October 2020. The informed written consent was obtained from patients and controls.

50 patients of an acute stroke aged 35-70 years identified based on clinical as well as laboratory and radiological evaluation (CT/ MRI) were taken as cases and 50 age and sex-matched healthy controls were included in the study. The informed written consent was obtained from patients and controls.

Patients with a known risk for cardioembolic disorders, previous history of vascular disease like IHD, cancer patients, patients on chemotherapy or drugs altering uric acid like diuretics, allopurinol, patients with gout or lymphoproliferative disorders were excluded.

5ml of venous blood was collected under aseptic conditions in the plain tubes and serum was used for the analysis of uric acid and lipid profile. The Uricase method was used to assess uric acid by spectrophotometry. Statistical analysis was done using SPSS's latest version and a Students-test was applied to compare the data between the two groups. P-value <0.05 was considered significant.

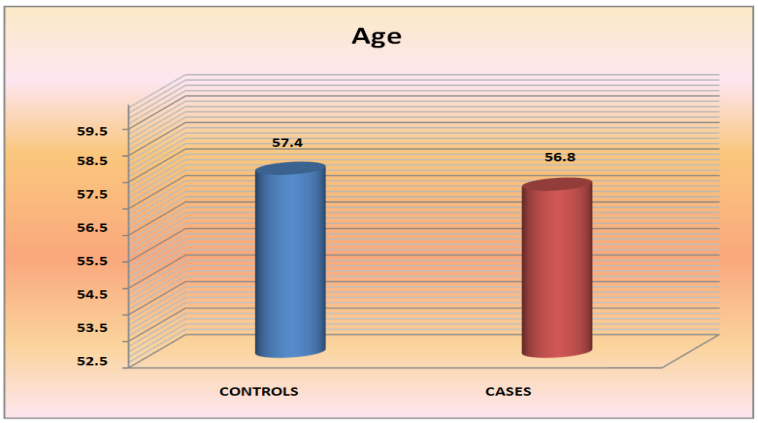
Results

Table 1: Comparison of Mean Age between Controls and Cases

Test/ Parameters	Controls (n=30)	CASES (n= 30)	P-value
Age (years)	57.4 ± 8.68	56.8 ± 9.19	0.398 (NS)

*P-value as obtained on applying students' t-test.

In the above table, it is shown that the mean age group of cases (56.8 ±9.19 years) is slightly less than the controls group (57.4 ± 8.68 years). However, the p-value is **nonsignificant (p=0.398)**as the cases and controls are matched for age.

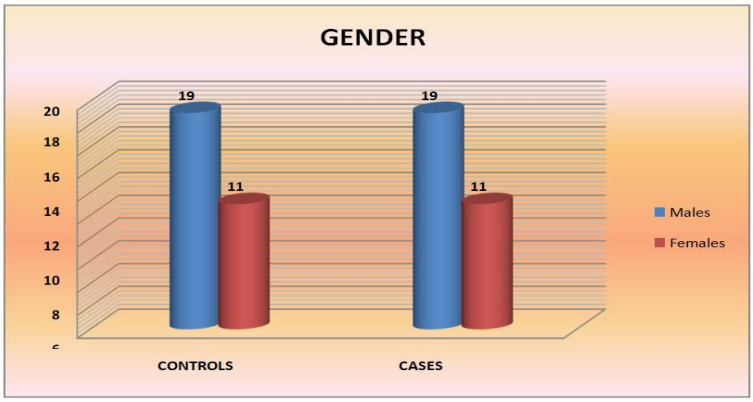


Graph 1: Comparison of Mean Age between Controls and Cases

Table 2: Comparison of Gender between Controls and Cases

Test/ Parameters	Controls(n=30)	CASES (n= 30)
Total No. of cases	30	30
Male: Female	19:11	19:11
%	63:37	63:37

The above table reveals that there is a Male dominance of the disease. Male cases are **63%** as compared to **37%** of females. Controls are matched in this regard.



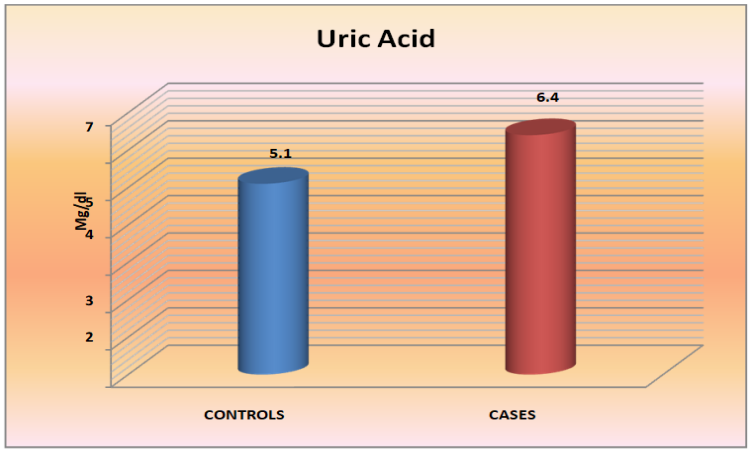
Graph 2: Comparison of Gender between Controls and Cases

Table 3: Comparison of Mean Uric Acid between Controls and Cases

Test/ Parameters	Controls(n=30)	CASES(n= 30)	P-value
Uric Acid (mg/dL)	5.1 ± 0.97	6.4 ± 1.21	<0.001 (S)

*P-value as obtained on applying students‘ t-test

As shown in the above table, the mean uric acid levels in cases (6.4 ±1.21 mg/dL) are more as compared to the controls (5.1 ± 0.97 mg/dL). The difference is **highly significant** (p <**0.001).**



Graph 3: Comparison of Mean Uric Acid between Controls and Cases

Discussion:

The mean age in this study in cases was 56.8 ± 9.19 years and in the controls, the mean age group was 57.4 ± 8.68 years. As control and cases were matched for age, the p-value was nonsignificant (p=0.398).In the present study, the number of females suffering from a stroke was less as compared to males. There were 11 females (37%) and 19 males (63%) out of a total of 30 cases of stroke. Similarly there were 11 females (37%) and 19males (63%) out of a total of 30 in the controls group. According to the American Heart Association, worldwide stroke prevalence was 3% in 2008 [8] being most prevalent in men (age-adjusted m/f ratio of 1.41). However, at 85 years of age and older, stroke was more common in women compared with men. [9] Part of this is explained by a lower global life expectancy for men versus women [10]Nevertheless, prevalent stroke increases exponentially in both sexes with age ([11].

In this study, the mean serum uric acid in patients was (6.4± 1.21 mg/dL) which was higher as compared to the control group (5.1±0.97 mg/dL). This difference was significantly high **(p<0.001).** Similar results were obtained in some other studies also:

In a study conducted by Masoud Mehrpour et al in the year 2012 in Iran, it was concluded that the prevalence of hyperuricemia in patients with acute stroke was significantly higher than the normal population [12]. A study conducted by Behera BK et al in the year 2017 in MKCG Medical College and hospital Berhampur Odisha, India it was concluded that serum uric acid levels were associated with increased risk for stroke as well as with poor prognosis after stroke [13].

A study conducted in Antalia Turkey in the year 2017 by Nermin Bayar et al showed that Serum uric acid levels equal to or higher than6.35 mg/dL were independently associated with the history of stroke/ transient ischaemic attack among patients with

paroxysmal Atrial Fibrillation. Atrial Fibrillation further is a major cause of ischaemic stroke [14]

As per the study conducted by Arunraj Ezhumalai et al in 2017, it was concluded that in patients with acute stroke, hyperuricemia prevalence was significantly higher than the normal population. Hyperuricaemia was also found to have increased Triglycerides and LDL cholesterol and is inversely related to HDL cholesterol levels. According to this, Hyperuricaemia can be considered as an individual and significant risk factor for acute stroke [15,16].

However, there is a contrasting study also:

Cazzato et al. in 1982 conducted a study that reported no difference in uric acid level between patients with stroke and the control group and their results demonstrated that hyperuricemia was not a high-risk factor in cerebrovascular diseases [17].

It has been found that uric acid can work as a pro-oxidant under certain circumstances, particularly if the levels of other antioxidants (like ascorbate) are low [18,19]. Some studies have also shown that uric acid can result in endothelial dysfunction which can lead to vascular diseases, and also, uric acid has been found to increase platelet adhesiveness [20,21] Uric acid can also promote LDL cholesterol in vitro [22] Another putative mechanism involves the role of xanthine oxidase; higher SUA levels might reflect the increased activity of xanthine oxidase, this increased xanthine oxidase activity leads to the generation of superoxide anions and the reactive oxygen species in human vascu-lature [23,24]. Uric acid is also known to activate critical proinflammatory pathways and stimulate cell proliferation in vascular smooth muscle cells and endothelial cells, uric acid decreases[25,26] NO bioavailability as well as inhi-bits cell migration and proliferation, which are mediated in part by the expression of C-reactive protein and oxidative stress [27],

Limitations:

There were a few limitations in this study: The sample size was limited. Studies with a larger sample would draw a better conclusion.

This study was a cross-sectional observational study which is not an ideal study. A cohort study or a metaanalysis can be a better study to find a correlation.

Conclusion:

In this study, it was found that serum uric acid levels were significantly high in patients of stroke as compared to healthy controls. This increase in serum uric acid level might be a risk factor for stroke. Thus, the uric acid level might be a useful marker for the diagnosis of stroke in the future.

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