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HYPERURICEMIA – PREDISPOSING FACTOR FOR EARLY CATARACT FORMATION IN DIABETICS

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ABSTRACT **BACKGROUND:** Cataract is the most common cause of blindness which is treatable.[1] Diabetes mellitus (DM) is a chronic systemic disease that can affect all ocular structures, with cataract being the most common ocular complication.[2] Diabetes is the leading cause of adult blindness. Serum uric acid levels independently predict the development of micro vascular complications, that leads to Diabetes.[3] Excessive serum uric acid level lead to an increase in reactive oxygen species (ROS) production, which leads to inflammation and dysfunction in the vessel.[4] Uric acid-mediated oxidative stress induces lipid peroxidation, DNA damage, and activation of inflammatory factors finally lead to cellular damage .[5] So increase in serum uric acid level is a predisposing factor in diabetic patients for formation of ocular complications like cataract.[6] In this study, we find out the association of serum uric acid level with the micro vascular , ocular complications of diabetes in the formation of cataract. **MATERIALS & METHODS:** In this hospital based case control study, 50 diabetic cataract patients were included which were compared to nondiabetic normal healthy control. Blood investigations including blood sugar level and serum uric acid level were estimated in all patients. All the parameters were compared between the two groups that is Group I included 50 Diabetic cataract patients and Group II included 50 age & sex matched healthy nondiabetic control. This Study included all Cataract patients attending Ophthalmology and Biochemistry OPD, IGGMC, Nagpur for routine Blood sugar check up prior to surgery. Blood samples were drawn for estimation of Sugar to know Diabetes in cataract patients, and for serum Uric acid level in both diabetic cataract and nondiabetic healthy control, which were estimated & their level were compared and correlated (45-85 yrs) by students ' t' test. History was taken as per designed proforma and consent form was obtained. Blood Glucose level & Serum Uric acid level were estimated on Autoanalyser EM 460 in clinical Biochemistry Laboratory in both diabetic cataract and age & sex matched nondiabetic control . Results of blood sugar level & serum uric acid level were compared & correlated. The data was analysed & Student's 't'-test was used for the calculation. P <0.05 was considered significant. **RESULT:** The mean age of the patients presented with diabetic cataract and nondiabetic was 56.4 ± 9.3 and 59.9 ± 10.3 respectively. Mean serum uric acid levels was higher among patients with Diabetic cataract (5.96 ± 2.16) compared to patients with nondiabetic control (4.95 ± 2.04) which was statistically significant (P value =0.021). Blood sugar level in Diabetic cataract was found to be 210.1 ± 60.3 compared to 107.7± 52.7 nondiabetic healthy control. So High Serum Uric acid level can be an additional risk factor for progression of cataract in diabetic compared to nondiabetic healthy control. **CONCLUSION:** Patients with diabetic cataract had higher levels of serum uric acid [SUA] compared to those without cataract. Also there was positive correlation between blood sugar level and serum uric acid levels that progresses complications of Diabetes like cataract formation . Here, we studied, the effects of hyperuricemia on diabetes and its complications and concluded that high levels of serum uric acid is closely related to diabetes and its ocular complications like cataract formation. We conclude that hyperuricemia is an additional risk factor in diabetic patients for progression of disease like cataract formation while in nondiabetic patients there is no alteration in serum uric acid level which can be a protective factor in reducing progression of disease. So decreasing blood sugar level as well as serum uric acid level may further reduces ocular complications of Diabetes like cataract formation.

KEYWORDS : Blood sugar level, Diabetes, Hyperuricemia, SUA, Cataract

INTRODUCTION

UA is a powerful antioxidant that can remove superoxide and hydroxyl radicals in plasma, hyperuricemia causes a series of patho physiological changes through inflammation, oxidative stress, vascular endothelial injury, and so on and thus subsequently promotes the occurrence and development of diseases like Diabetes,cataract formation etc.(7,8).

Uric acid (UA) is primarily a purine metabolic waste product. About 70% of it gets excreted by the kidneys. Hyperuricemia has gained importance as many studies have reported that it not only has an important role in the development of metabolic syndrome but also micro vascular risk factor.[9] Hyperuricemia was defined as the circulating uric acid levels of more than 6.0 mg/dl for women and 7.0mg/dl for men.

Elevated serum uric acid is a feature of hyperinsulinemia or insulin resistance (9,10,11) Many studies have suggested that inflammation and oxidative stress results from the metabolism of uric acid, leading to vascular injury [12] . When the blood uric acid concentration exceeds the normal , the human body fluid becomes acidic, which affects the normal function of the human cells, leading to metabolic disease in the long term [13]. Excessive uric acid will lead to an increase in reactive oxygen species (ROS) production, which leads to inflammation and dysfunction in the vessel and UA has prooxidant effects in vascular tissue by increasing ROS production, such as H_2O_2 [14].

In India alone, cataract accounts for 80% of treatable blindness .[15] One of the most common types of cataract is the senile cataract which occurs as a consequence of the aging process Senile cataract usually occurs after the age of 45 years. Approximately 75 percent of population above the age of 65 years suffers from cataract [16]. Many risk factors such as age, sex, radiation, genetics, metabolic disorders, protein aggregates, oxidative stress are proposed for cataract formation, including hyperuricemia which leads to oxidative stress ,diabetes,metabolic disorders and progression of cataract. So increase serum uric acid level is an additional risk factor in diabetic cataract for progression of disease.

OBJECTIVES OF THE STUDY

The aim of this study is to

1) Estimate serum uric acid level in diabetic cataract patients.
2) Compare serum uric acid level with blood sugar in diabetic cataract patients and its association with nondiabetic normal healthy control.
3) Association of hyperuricemia with ocular complications of Diabetes like cataract formation.

Method of collection of data & selection of subjects

50 cataract patients attending the outpatient department of Ophthalmology & clinical Biochemistry, IGGMC, Nagpur were selected for study . 5 ml of blood sample was drawn from cataract patients who were attending biochemistry OPD for blood sugar level prior to cataract surgery. History was taken as per designed proforma and consent form was obtained. Their Blood samples were analysed for blood sugar level as well as serum uric acid level and compared with 50 normal healthy nondiabetic control attending biochemistry OPD for routine check up . Both groups cataract and non cataract were age & sex matched cases & controls.

Based on this, two groups were made

Group I: 50 Senile cataract patients, who were scheduled to undergo

cataract surgery attending ophthalmology OPD and found to be diabetic in biochemistry OPD

Group II: Age and gender matched normal healthy individuals without cataract and Diabetes, who were attending Biochemistry OPD from December 2018 to February 2020 ,IGGMC, Nagpur

Independent 't' test was used to compare the blood parameters between diabetes with cataract and nondiabetics. P value less than 0.05 was considered statistically significant.

Inclusion Criteria

1. Age group in between 45 - 85 yrs.
2. Both male and female cataract patients attending ophthalmology & biochemistry OPD ,IGGMC,Nagpur advised for cataract surgery found to be diabetic.

Exclusion Criteria

1. Gout , renal failure, cushing's syndrome, hyperaldosteronism
2. Cataract due to any other aetiology like drug induced, trauma, radiation, hypertension etc.
3. Patients with asthma, acute or chronic renal failure, any history of drug intake like antipsychotics, chemotherapy etc.

The data was analysed & Student's 't'-test was used for the calculation. P<0.05 was considered significant.

METHODS

For Serum Uric acid Estimation

Kit based on Uricase method (Autoanalyser)
(Normal range – 3 to 7 mg%)

For Blood Sugar Estimation

Kit based on GOD – POD method (Autoanalyser)
(Normal range – 70 to 120 mg%)

Analysis was carried on Autoanalyser EM – 460 in clinical Biochemistry lab,IGGMC for Blood Sugar & Uric acid estimations . All estimation were carried out in cataract patients as well as normal healthy controls & their values were compared & correlated

RESULT

Serum uric acid level & Blood sugar level in Diabetic cataract & Nondiabetic

Table 1. Showing Mean±SD of Uric acid & Blood Sugar level in both the Groups

Analytes	Group-1 (Diabetic Cataract) n=50 Mean±SD	Group-2 (Nondiabetic) n= 50 Mean±SD	'P' value
Male Female	24 (39) 26 (68)	38 (61) 12 (32)	0.004*
Age	56.4 ± 9.3	59.9 ± 10.3	0.084
Blood Sugar	210.1 ± 60.3	107.7± 52.7	0.008*
Uric acid	5.96 ± 2.16	4.95 ± 2.04	0.021*

'P' value < 0.05= statistically significant, 'p' value < 0.001= statistically highly significant.

DISCUSSION

As shown in Table , mean serum uric acid level was higher among patients with diabetic cataract(5.96 ± 2.16 mg/dl) compared to nondiabetic (4.95 ± 2.04 mg/dl) which was statistically significant (P value = 0.021).

These findings correlate with the Sarah S, Premraj et al [15] In their study they proved that there was a significant association between diabetic cataract and the levels of uric acid in the patient's serum while Tuomilehto J, Zimmet [16] stated that there is a relation between the uric acid level elevation and development of diabetic cataract.

UA-mediated oxidative stress-induced lipid peroxidation, DNA damage, and activation of inflammatory factors finally lead to cellular damage. Oxidative stress also can affect the expression of insulin gene, causing a decrease in insulin secretion.[15,16] Some mechanisms have been proposed for cataract formation in diabetes mellitus such as excessive tissue sorbitol concentrations, abnormal glycosylation of lens proteins and increased free radical production in the intraocular region, Andrade JA, Kang demonstrated that high UA contributes to the development of ocular complications in diabetic patients [17].

Nasri et al [18,19] showed serum uric acid was significantly associated with diabetes .In their study SUA correlated positively with insulin secretion and the insulin resistance index in male patients. While Krizova et al. [20,21]. reported that vitreous concentrations of uric acid were significantly higher in patients with diabetes than in nondiabetic controls

In this study we measured serum uric acid level in diabetic cataract and non-diabetic groups .We found that the patients with diabetes and cataract had significantly increased serum uric acid level compared to nondiabetic individuals which was statistically significant ($p < 0.05$). The results of this study suggest that increased blood sugar level in diabetic might be associated with increased serum uric acid in patients with diabetic cataract. This increase in uric acid levels might lead to the acceleration of cataract formation.

CONCLUSION

This study confirmed the positive correlation between uric acid and diabetes mellitus and its association with ocular complications like cataract formation .

SUA mainly affects diabetes and its complications through inflammation, oxidative stress, endothelial function damage, and other effects.

Comparatively higher serum uric acid level observed and higher risk of cataract formation in diabetics suggest an etiological role of hyperuricemia in diabetic cataract formation. This study may be useful in patient care in the following way: The derangement of serum uric acid level can be corrected which may delay the progression. Alterations in SUA level pose an added risk of cataract formation in diabetics in addition to hyperglycemia.So, along with carbohydrate restricted diet, high purine restriction like nonvegetarian diet tea, coffee etc may be help in prolonging cataract formation as well as progression.

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