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Original Research Article

Study of Serum Uric acid and CRP Levels & its Association in Patints with Type 2 Diabetes Mellitus with Metabolic Syndrome

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Abstract

Background: Diabetes is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Metabolic syndrome is a term referring to the frequent clustering of the cardiovascular risk factors of hypertension, obesity, insulin resistance, dyslipidemia, and dysglycemia in a single patient. Uric acid and highly sensitive C reactive protein (hs-CRP) each now share a respected inclusion as two of the novel risk markers – risk factors associated with the metabolic syndrome in patients with type 2 diabetes mellitus.

Methods: The study was conduct in the Department of medicine Jhalawar Medical College & Hospitals, Jhalawar. After taking informed consent eligible patients were enrolled according to the inclusion and exclusion criteria.

Result: In our study, Uric acid levels in males were 7.12 ± 1.74 mg/dl, while those in females were 6.37 ± 1.81 mg/dl. There was a significant difference in uric acid levels between males and females (p = 0.038S) in the study. A significantly higher mean was observed in males as compared to females. The mean FB sugar in groups with low UA and high UA was 160.01 ± 40.11 and 176.94 ± 40.23, respectively. (P value, LS 0.048S). A significant positive correlation was observed between uric acid and fasting blood sugar. Significantly high SBP and DBP were associated with high uric acid. The uric acid level and the lipid profile were found to be significantly related with P = 0.49S, a significantly higher mean value of LDL was observed with uric acid >6. Waist circumference was increased in all patients with 47% having high uric acid and 33% having high CRP.

Conclusion: In our study, a significant positive relationship of uric acid and CRP with components of metabolic syndrome was observed, so it is concluded that chronic inflammation exists in patients with DM with metabolic syndrome.

Keywords: Type 2 DM, Metabolic Syndrome, S.Uric Acid, S.CRP, hSCRP.

Introduction

Diabetes Mellitus (DM) is a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both. The predominance of diabetes has increased worldwide in both genders equally.[1]

Type 2 Diabetes is the predominant form of diabetes worldwide, accounting for 90% to 95% of cases globally. An epidemic of T2DM is under way in both developed and developing countries. The International Diabetes Federation estimated in 2017 that 425 million people have diabetes worldwide and that by 2045 this number will rise to 629 million among with diabetics currently, 79% live in low-and middle-income countries.

ADA CRITERIA FOR DIAGNOSIS OF DIABETES [2]

FPG ≥126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 h.*

OR

2-h PG ≥200 mg/dL (11.1mmol/L) during an OGTT. The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water. *

OR

A1c ≥6.5% (48 mmol/mol). The test should be performed in a laboratory using a method that is NGSP certified and standardized to the DCCT assay. *

OR

In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥200 mg/dL (11.1 mmol/L).

(*In the absence of unequivocal hyperglycemia, results should be confirmed by repeat testing).

Metabolic syndrome is defined as a cluster of cardiovascular risk factors which include raised fasting plasma glucose, central obesity, hypertension, raised triglycerides, and reduced High-Density Lipoprotein (HDL) cholesterol and entails an increased risk for cardiovascular disease and mortality from both cardiovascular disease and all causes.[3]

According to the NCEP ATP III definition, metabolic syndrome is present if three or more of the following five criteria are met: waist circumference over 40 inches (men) or 35 inches (women), blood pressure over 130/85 mmHg, fasting triglyceride (TG) level over 150 mg/dl, fasting high-density lipoprotein (HDL) cholesterol level less than 40 mg/dl (men) or 50 mg/dl (women) and fasting blood sugar over 100 mg/dl.[4]

Hyperuricemia, hyperhomocysteinemia, reactive oxygen species, and highly sensitive C-reactive protein (hs-CRP) each play an important role in expanding the original Syndrome X. Hyperuricemia has been presumed to be a consequence of insulin resistance but recent studies suggest that uric acid is related to development of DM-2. Recent study in rats also showed that fructose induced hyperuricemia plays a role in the pathogenesis of metabolic syndrome.[3]

Recently, elevated CRP levels have been associated with the features of the insulin resistance syndrome, namely abdominal obesity as assessed by waist girth, fasting glucose, hyperinsulinaemia and insulin sensitivity, high triglyceride and low HDL cholesterol [5,6]

Material and Methods

Study Setting

The study was conducted in the patients admitted in Department of General Medicine, Jhalawar Medical College, Jhalawar, Rajasthan. The subjects were selected by Simple random sampling method.

Study Duration: From February 2022 to December 2022.

Study design: Prospective Observational study.

Study Population: Diabetics patients with metabolic syndrome admitted in Hospital.

Inclusion criteria

Those subjects of age >18 years, with diabetics and meeting the IDF (International diabetics federation) criteria for metabolic syndrome, who are able to give valid informed written consent.

Exclusion criteria

1. Type 2 diabetes with Chronic Kidney Disease.
2. Subjects who are on Nonsteroidal antiinflammatory drug's (NSAID's) or xanthine oxidase inhibitors or uricosuric agents for last 14 days.
3. Known case of gouty arthritis and other arthritis or connective tissue disorders.
4. Patients with active infections.

Sample Size

n = t2 x p x (1-p)/e2

where t = 95% confidence interval (t = 1.96)

p = Proportion of Type 2 Diabetes patients with metabolic Syndrome among total IPD of Medicine department, SRG Hospital, Jhalawar in month of January 2022.

(p = 64/1354 = 0.04726 ~ 0.05) e = allowed error 5% (e = 0.05) putting these values n = (1.96)2 x 0.05 x (1-0.05)/ (0.05)2 n= 72.96 ~ 73 effect of error N = n + 5% =73 + 5 % of 73 = 73 + 3.65 = 76.65 ~ 77. Now we increase the sample up to 100 cases. So, 100 cases with Type 2 Diabetes with Metabolic syndrome were included in the study.

Methods

All patients admitted in the Department of General Medicine at Jhalawar medical college, Jhalawar satisfying the inclusion and exclusion criteria were taken for the study.

Examination and Investigations:

1. A detailed clinical history was taken.
2. Complete physical examination including vitals- blood pressure, pulse, respiratory rate, oxygen saturation, height, weight, waist circumference, investigations.
3. All routine investigations like CBC, RFT, LFT, S. electrolytes, Lipid profile(S. cholesterol, TG, HDL, LDL, VLDL),S. uric acid, S.CRP, FBS, RBS Cardiac profile(CPK- CKMB, LDH), Urine routine and complete microscopy, ECG & USG Abdomen and pelvis done.

Results

Table 1: Association of Uric Acid with sex

Sex	N	Mean	SD	P Value LS
Female	45	6.37	1.81	0.038S
Male	55	7.12		

Table 2: Association of uric acid with FB Sugar

	<6			>6			P-values LS
	N	Mean	Std. Deviation	N	Mean	Std. Deviation	
FBS	53	160.01	40.11	47	176.94	40.23	0.048S

Table 3: Association of uric acid with Blood Pressure

	<6			>6			P-values LS
	N	Mean	Std. Deviation	N	Mean	Std. Deviation	
SBP	53	133.32	19.45	47	142.87	18.78	0.04S
DBP	53	82.45	8.61	47	87.40	8.75	0.005S

Table 4: Association of uric Acid with lipid Profile

	<6			>6			P-values LS
	N	Mean	Std. Deviation	N	Mean	Std. Deviation	
LDL	53	185.95	29.24	47	173.36	33.88	.049
HDL	53	40.68	5.11	47	38.46	5.11	0.03S
TG	53	183.49	21.53	47	187.47	20.43	.347

Table 5: comparison of cases according to SBP /DBP with CRP

CRP	Normal			Raised			P value LS
	N	Mean	Std. Deviation	N	Mean	Std. Deviation	
SBP	67	134.25	18.46	33	145.09	19.87	0.008S
DBP	67	84.67	8.99	33	88.97	9.10	0.027S

Table 6: Comparison of cases according to LDL, HDL, TG with CRP

CRP	Normal			Raised			P value LS
	N	Mean	Std. Deviation	N	Mean	Std. Deviation	
LDL	67	172.25	31.61	33	176.88	31.06	0.03S
HDL	67	41.33	5.54	33	38.45	4.07	0.008S
TG	67	182.45	21.112	33	191.27	19.81	0.04S

Discussion

Table number 1 showing a comparison of groups according to uric acid and sex. Uric acid levels in males were 7.12 ± 1.74 mg/dl, while those in females were 6.37 ± 1.81 mg/dl. There was a significant difference in uric acid levels between males and females (p = 0.038S) in the study. A significantly higher mean was observed in males as compared to females.

A study done by Khichara *et al* 2013[7] showed the significant relationships between serum uric acid and all five components of the metabolic syndrome. As compared to the male and female groups, the serum uric acid level was higher in men. This result was not unexpected as it is known that estrogen promotes excretion of uric acid.

In the study done by ISLAM *et al* 2011[8] observed the level of uric acid was also significantly higher in male and female diabetic subjects ($p < 0.05$ and $p < 0.01$). This is in accordance with the previous observation suggesting that significantly higher mean uric acid levels in male and female diabetic subjects.

Table number 2 showing a comparison of fasting blood sugar according to uric acid levels. The mean FB sugar in groups with low UA and high UA was 160.01 ± 40.11 and 176.94 ± 40.23, respectively. (P value, LS 0.048S). In other words, a significant positive correlation was observed between uric acid and FB sugar.

Sahoo *et al* 2018[9] observed that diabetic patients with high uric acid levels had significantly fasting blood sugar.

Khichara *et al* 2013[7], Thweja *et al* 2021[10] also observed a positive correlation between uric acid and FBS.

Table number 3 provided a comparison of blood pressure in groups based on uric acid level. The mean systolic blood pressure in groups with low and high UA was 133.32 ± 19.45 and 142.87 ± 18.78, respectively P value = LS 0.04S. Maximum number of the cases 54.72% in Group< 6 were observed in high SBP as compared to in other group >6, A similar observation was made with diastolic blood pressure, with a P value of (0.005S). According to this study, significant high SBP and DBP were associated with high uric acid.

Sahoo *et al* 2018[9] stated that diabetic patients with high uric acid levels had significantly higher systolic blood pressure. Khichara *et al* 2013[7] also found similar results in their studies.

Table number 4 is showing that significant association was observed between the uric Acid with lipid Profile. Significant higher mean value of LDL was observed with uric acid >6 as compared to <6 level of uric acid (185.95 ± 29.24 vs 173.36 ± 33.88) respectively with P(P=0.49S) while In HDL its vice versa was observed (P0.03S). Significant association was observed in TG with uric acid.

In a study done by Wei Li *et al* 2021[11] it was concluded that there is strong association of serum uric acid level with hypertension, dyslipidemia, Metabolic syndrome and obesity. Khichara *et al* 2013[7] also stated a positive correlation between TG and uric acid.

Table number 5 is showing the Association of CRP with Blood Pressure. Significant association was observed with SBP and DBP with CRP. The mean SBP was significantly higher in Raised CRP cases as compared to normal CRP (145.09 ± 19.87 and 134.25 ± 18.46) respectively (P=0.008S) and the mean DBP was also significantly higher in Raised CRP cases as compared to normal CRP (88.97 ± 9.10 and 84.67 ± 8.99) respectively (P=0.027S).

In a study done by Mirhafez *et al* 2016[12], subjects those having Metabolic syndrome revealed higher levels of BMI, TG, SBP/DBP, low-density lipoprotein cholesterol, high-sensitivity CRP (hs-CRP) and FBG, whereas the levels of HDL-C were lower in the metabolic syndrome group, compared with the control group.

In a study done by Sah *et al*[13] they observed significantly higher BP (systolic and diastolic) and an increasing prevalence of hypertension with the rise in hs-CRP.

Table number 6 is showing the Association of CRP with Lipid profile. Significant association was observed with LDL, HDL and TG with CRP. The mean LDL was significantly higher in raised CRP cases as compared to normal CRP (176.88 ± 31.06 and 172.25 ± 31.61) respectively (P=0.038S) and the mean TG was also significantly higher in Raised CRP cases as compared to normal CRP (191.27 ± 19.81 and 182.45 ± 21.112) respectively (P=0.04S) while reverse in HDL.

In a study done by Mirhafez *et al* 2016[12] studied subjects those having metabolic syndrome revealed higher levels of BMI, TG, SBP/DBP, low-density lipoprotein cholesterol, high-sensitivity CRP (hs-CRP) and FBG, whereas the levels of HDL-C were lower in the metabolic syndrome group, compared with the control group.

Conclusion

In our study, A significant positive relationship of uric acid and CRP with components of metabolic syndrome was observed, so it is concluded that chronic inflammation exists in patients with DM with metabolic syndrome. Serum uric acid and CRP may be useful as biomarkers for identifying at risk of metabolic Syndrome in DM cases, and an acute decrease in uric acid

levels will be followed by a gradual decrease in inflammatory markers.

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