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RESEARCH ARTICLE

STUDY OF RELATIONSHIP OF ELEVATED SERUM URIC ACID LEVEL AND METABOLIC SYNDROME.

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Abstract

Introduction : Elevated serum uric acid (SUA) concentrations have been suggested to associate with metabolic syndrome (MetS) and its components. However, limited information is available regarding the relationship between SUA and MetS .

Material and Methods: A cross sectional prevalence study was done in department of Medicine, KGMU, Lucknow on 100 patients of the age between 25-65 years who fulfilled the IDF criteria for Metabolic Syndrome to study relationship between elevated serum uric acid metabolic syndrome.

Result:Maximum number of patients were in 31-40 years of age group (45%) followed by those aged 41-50 years (26%), <30 years (15%), >50 years (14%). Mean age of patients was 39.59±8.67 year. On comparing the serum uric acid value of two groups, statistically significant difference among patients of group I (Mets pt) and group II (non Mets patients) was observed. Serum uric acid level of subjects of group I (5.547±2.02 mg/dl) was found to be significantly higher than that of group II (4.8 ± 1.0).

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Introduction:-

Metabolic syndrome (MetS) consists of risk factors such as obesity, hyperglycaemia, high blood pressure, high triglycerides, and low high-density lipoprotein cholesterol.¹ It is associated with increased risk of type 2 diabetes mellitus (DM), cardiovascular disease, cardiovascular mortality and all-cause mortality.²

Uric acid (UA) is the end product of purine metabolism in humans.³ It is synthesized mainly in the liver, intestines, and other tissues such as muscles, kidneys, and the vascular endothelium as the end product of an exogenous pool of purines (derived largely from animal proteins), and the endogenous pool derived from live and dying cells degrading their nucleic acids, adenine, and guanine into uric acid.³ Recent studies had shown that increased UA may be a predictor for MetS.⁴ However, research on the relationship between UA and MetS is insufficient. Recent studies had shown that hyperuricemia is not only a result of insulin resistance states but also a significant predictor of the development of metabolic syndrome.⁵ In a study by Chen et al, hyperuricemic subjects had an odd ratio of 1.6-fold higher for developing metabolic syndrome.⁶ Also, Sui et al demonstrated this predictive role of uric acid even in human subjects who were free of all features of metabolic syndrome at baseline.⁷ In addition, it was shown that the

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correlation between elevated uric acid and metabolic syndrome was independent of estimated glomerular filtration rate (eGFR). Therefore we did a cross sectional study to evaluate the relationship between elevated uric acid level and metabolic syndrome.

Subject

A cross sectional prevalence study was done in department of Internal Medicine, KGMU, lucknow on 100 patients of the age between 25-65 years who fulfilled the IDF criteria for Metabolic Syndrome to evaluate the relationship between elevated uric acid level and metabolic syndrome. It was done over a period of 1 year from Sep 2016 to Aug 2017 and patients were enrolled from OPD and those admitted in indoor wards. Patients with cardiac, endocrine, pulmonary, orthopedic, or neurogenic condition and any systemic or surgical illness were excluded from the study.

Study protocol

The subjects were informed about the study through information sheets, and written consent was obtained from all subjects. The study was approved by Research and Ethical Committee of the institute. Testing was performed in the hospital where a rapid, appropriate response to an emergency was possible, and physician was also available on call whenever any emergency arises. A detailed clinical history and physical examination carried out for every subject. History of presence of risk factors, like smoking, hypertension, dyslipidaemia, diabetes mellitus and presence of any other chronic disease was inquired. The anthropometric characteristics, blood pressure, plasma glucose, and lipid levels, were measured. Metabolic syndrome was defined clinically, based on IDF criteria which include waist circumference >90 cm in males, >80cm in females and two or more of the following, a high triglyceride level (>150mg/dl) or on specific medication, a low high-density lipoprotein-cholesterol (HDL-C) level (<40mg/dl for men and <50 mg/dl for women) or on specific medication, high blood pressure (\geq 130/85 mm Hg) or on specific medication, and a high fasting plasma glucose concentration(>100 mg/dl) or on specific medication or previously diagnosed type 2 DM / Impaired fasting glucose/ impaired glucose tolerance. Serum uric acid concentrations were measured using the uricase EMST method.

Serum sampling and biochemical analysis

Blood samples were obtained following 12 hours of fasting were immediately centrifuged (3000 rpm) for 10 minute; the sera were separated and frozen at - 8 °C until analysis. Fasting blood glucose (FBG), total cholesterol, triglycerides (TG), and high density lipoprotein cholesterol (HDL-C) levels were determined by enzymatic method using commercial available diagnostic kit on fully automated biochemical analyzer. Low density lipoproteins cholesterol (LDL-C) was determined by using Friedewald formula (Friendewald et al., 1972). Serum uric acid concentrations were measured using the uricase EMST method.

Statistical analysis:-

The statistical analysis was done using SPSS (Statistical package for social science) Version 15.0 statistical analysis software. The values were represented in No (%), Mean \pm SD. Student's t-test was used while assessing spirometry data. P < 0.05 was considered statistically significant.

Result:-

A total of 100 patients of Met-S fulfilling the inclusion criteria of the study were enrolled as cases (male-70, female-30, mean age-39.59 \pm 8.67) and classified as group I while 100 age gender matched controls (normal healthy subjects, male- 66, female-34, mean age-42.81 \pm 9.45) were also included in the study and classified as group II. (table 1) (figure1)

Table 1:-Distribution of Study Population

Group	Description	No. of subjects
Group I	Cases	100
Group II	Controls	100

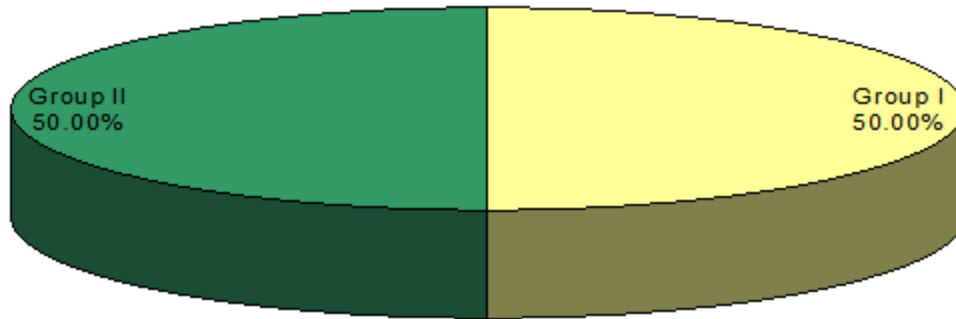


Figure 1:-Distribution of Study Population

Age of group I subjects ranged from 20-59 years (median 38.50 years) and mean was 39.59±8.67 years while that of group II ranged from 22-62 years (median 42 years) and mean was 42.81±9.45 years. Though proportion of subjects in group I were higher as compared to group II among aged ≤30 years (15 vs. 13) and 31-40 years (45 vs 30) while proportion in subjects of Group II were higher as compared to group I among aged 41-50 years (33 vs. 26) and >50 years (24 vs. 14), despite this difference, age of subjects in group I and group II were found to be comparable (p=0.086) (table-2)(figure 2).

Table 2:-Age wise distribution of Group I and Group II

AGE	Group I N=100	Group II N=100
≤30 yrs	15	13
31-40 yrs	45	30
41-50 yrs	26	33
>50 yrs	14	24
$\chi^2=6.605$ (df=3); p=0.086		
Min-Max (Median)	20-59 (38.50)	22-62 (42.00)
Mean±SD	39.59±8.67	42.81±9.45

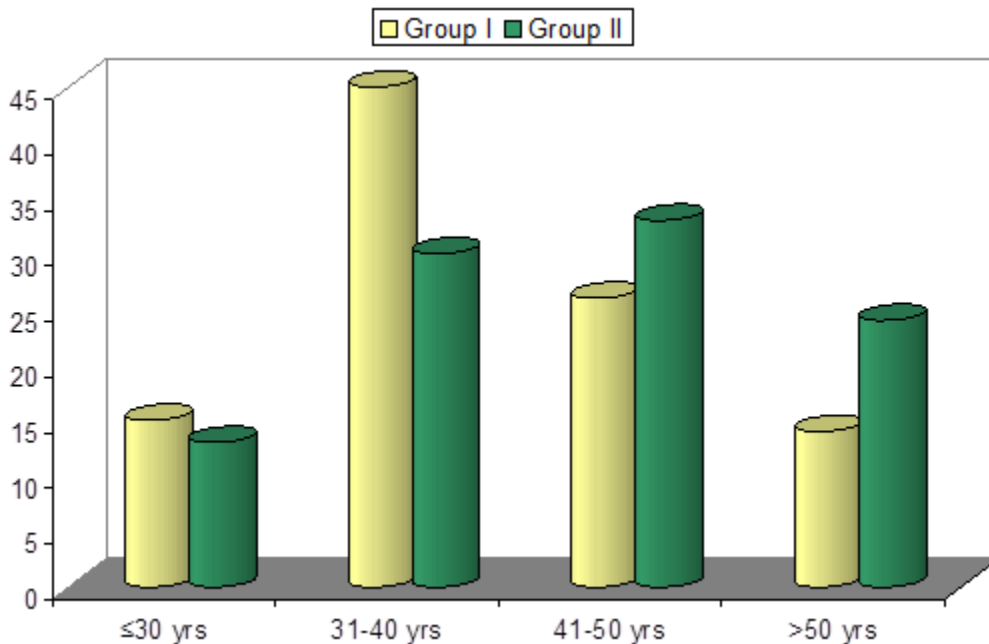


Figure 2:-Age wise distribution of Group I and Group II

Out of 200 subjects enrolled in the study, 136 (68.00%) were males and rest 64 (32.00%) were females. Though proportion of males was higher in group I (70.00%) as compared to group II (66.00%) but this difference was not found to be statistically significant (table-3).

Table 3:-Gender wise comparison between Group I and Group II.

	Group I (N=100)	Group II (N=100)
	No.	No.
Male	70	66
Female	30	34
$\chi^2=0.368(df=1); p=0.544$		

On comparing the hematological and biochemical variables, statistically significant difference among patients of group I and group II was observed in SGPT, S ALP and S. Albumin levels only. SGPT level of subjects of group I (90.18 ± 232.58 U/l) was found to be significantly higher than that of group II (42.32 ± 24.79 U/L). In the same way ALP level of subjects of group I (232.48 ± 84.50 IU/L) was found to be significantly higher than that of group II (191.89 ± 130.04 IU/L) and mean serum albumin levels of group I (3.07 ± 0.61) were found to be significantly higher than that of group II (3.31 ± 0.63) (Table 4).

Table 4:-Comparison of Biochemical/Hematological Variables between two groups

Variables	Group I N - 100	Group II N-100	Student 't' test	
	Mean \pm SD	Mean \pm SD	't'	'p'
Hb (g/100 ml)	11.92 ± 1.28	11.89 ± 1.27	0.199	0.842
TLC (cells/cumm)	8255.40 ± 2806.83	8125.9 ± 2800.21	0.327	0.744
DLC (Neutrophile %)	70.69 ± 7.88	70.74 ± 8.14	-0.044	0.965
DLC (Lymphocyte %)	33.09 ± 6.75	33.47 ± 6.52	-0.405	0.686
Platelet (Lacs)	1.95 ± 0.58	9.08 ± 45.34	-1.574	0.117
S. bilirubin (mg%)	0.85 ± 0.47	0.87 ± 1.05	-0.207	0.836
SGOT (U/L)	75.31 ± 175.44	42.55 ± 31.32	-1.836	0.068
SGPT (U/L)	90.18 ± 232.58	42.32 ± 24.79	2.046	0.042
ALP (IU/L)	232.48 ± 84.50	191.89 ± 130.04	2.597	0.010
S. Protein (g/dl)	6.17 ± 0.52	6.27 ± 1.07	0.859	0.392
S. Albumin (g/100 ml)	3.07 ± 0.61	3.31 ± 0.63	-2.699	0.008
S. Urea (mg/dl)	35.94 ± 8.08	35.48 ± 8.27	0.398	0.691
S. Creatinine	1.21 ± 0.35	1.20 ± 0.35	0.234	0.815

On comparing the serum uric acid value of two groups, statistically significant difference among patients of group I and group II was observed. Serum uric acid level of subjects of group I (5.547 ± 2.02 mg/dl) was found to be significantly higher than that of group II (4.8 ± 1.0).

Table 5:-Comparison of serum uric acid value between two groups

Variables	Group I N-100	Group II N-100	'p' value
	Mean \pm SD	Mean \pm SD	
Serum uric acid (mg/dl)	5.547 ± 2.02	4.8 ± 1.0	0.003

Discussion:-

Hyperuricemia is a common medical problem not only in the advanced countries, but also in the developing countries. It has been described that hyperuricemia is associated with metabolic syndrome components (Nakagawa et al., 2006; Conen et al., 2004; Schachter, 2005), such as obesity, dyslipidemia, hyperglycemia and hypertension. This study showed the significant relationships between increased serum UA and 5 components of the

metabolic syndrome. We found that serum UA level was significantly higher in patient of Mets. This result has also been demonstrated in other studies.⁷⁻¹² UA has been found to be associated with serum triglycerides in a number of studies on healthy participants.¹³ And in those studies, it has been observed that SUA also had association with hypertension, insulin resistance, and so on and there is a clustering of risk factors as SUA increases, suggesting probably the emergence of MetS. In a small number of studies, however, there has been an association additionally with LDL-cholesterol and a negative association with HDL-cholesterol.¹⁴

SUA has been found to be associated with altered liver function test, especially elevated ALT.¹⁵ In our study, SUA is correlated with both AST and ALT. In fact, in another study, hyperuricemia has been found to be independently associated with hepatic steatosis regardless of BMI category or the presence of the MetS.¹⁶

Limitation

our study was a cross sectional study which showed direct relationship between increased uric acid level and metabolic syndrome. However with this study we can't interfere that whether increased uric acid level leads to metabolic syndrome or vice versa.

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