EDITORIAL

SERUM URIC ACID CONCENTRATION AND URINARY EXCRETION OF URIC ACID IN SUDANESE PATIENTS WITH GOUT

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ABSTRACT

Objectives: To assess the relationship between serum uric acid concentration and urinary excretion of uric acid in patients with gout.

Materials and Methods: Fifty three Sudanese patients with gout were included in this study; thirty three of them were gouty subjects not under treatment, twenty subjects were under treatment. Twenty normal subjects were used as control. The biochemical parameters included in this study were: serum uric acid, urine uric acid. Urine volume, pH, specific gravity, and urine crystals were also determined. Results: Serum uric acid concentration in gouty subjects not under treatment was significantly higher ($p<0.01$) as compared to control group. While serum uric acid concentration in gouty subjects under treatment was not significantly higher than the control group, the difference between means was statistically significant between gouty subjects not under treatment and control group. No significant differences were found for urine uric acid excretion. There was a weak positive correlation between serum uric acid concentration and urinary excretion of uric acid in gouty groups; however control group gave a weak negative sign. The risk factors, which were considered, were obesity (over weight), ethnic origin, and age. The difference between means for body weight and height was significantly higher ($P<0.05$) in gouty subjects compared with control group, and the difference between means for urine volume, urine specific gravity, and urine crystalls showed no significant effect on the three groups, while urine pH showed significant mean difference between these groups.

Conclusion: The determination of serum uric is of good diagnostic value, whereas estimation of urine uric acid is of little diagnostic value.

EDITORIAL

Urine crystals can be used only for screening for the investigation of urine uric acid crystals.

Key words: Serum uric acid, urine uric acid, gout, hyperuricemia, Sudan

INTRODUCTION

Gout is a condition characterized by the deposition of monosodium urate crystals in the joints or soft tissues.The four phases of gout include asymptomatic hyperuricemia, acute gouty arthritis, intercritical gout and chronic tophaceous gout. The peak incidence occurs in patients 30 to 50 years old, and is much more common in men than in women. Patients with asymptomatic hyperuricemia do not require treatment, but efforts should be made to lower their urate levels by encouraging them to make changes in diet or lifestyle. Acute gout most commonly affects the first metatarsal joint of the foot, but other joints are also as well involved. Definitive diagnosis requires joint aspiration with demonstration of birefringent crystals in the synovial fluid under a polarized light microscope [(1)].

Gout is associated with hyperuricemia, defined as elevated serum urate concentration greater than 7 mg/dl in adult males or 6 mg/dl in adult females [(2)] . While hyperuricemia may indicate an increased risk of gout, the relationship between hyperuricemia and gout is unclear, many patients with hyperuricemia do not develop gout, while some patients with repeated gout attacks have normal or low blood uric acid levels.The normal urinary excretion of urate is within the range 250-750 mg/24 h. [(3)] Gibson et al [(4)] found that urate clearance was lower in gouty and hyperuricemic subjects.

Development of gout from asymptomatic hyperuricemia is often correlated with the degree of hyperuricemia as observed in population or family studies, the data presented indicate that unequivocal hyperuricemia is more often accompanied by excessive excretion of uric acid. [(5)] Despite wide variation of plasma urate concentration among different individuals, daily urate excretion varied little and did not correlate with plasma urate [(6)]. The objective of this study is to assess the relationship between the level of serum uric acid concentration and urinary excretion of uric acid and related factors in gouty patients.

MATERIALS AND METHODS

This study was carried out in the Gezira State, Central Sudan. 73 subjects were included in this study, classified as (known) gouty patients under treatment (n=20), gouty patients not under treatment (n=33), and control group (n=20), with an age range of

EDITORIAL

(34-85 yr.) and male to female ratio was 4.3:3. Blood and urine (24 hr.) samples were collected from patients at their homes. Blood samples were taken before breakfast, venous blood was collected with no anticoagulant, centrifuged and the serum analysed immediately after collection.

24-hour urine volume was collected in a clean plastic container, with no preservative, then urine samples were stored in a cold place and analysed within two hours after collection. A questionnaire was designed to get information about sex, age, race, history of gout, occupation, diet, weight, height, body mass index (BMI), habits, drugs used and symptoms. The analysis was done in Gezira Medical Laboratory. Uric acid was estimated using an enzymatic colorimetric method (URICASE PAPE, Spin React-Spain). Urine pH and specific gravity were measured using pH meter (mod.203), indicator paper and refractometer respectively. Microscopic examination for detection of urate and Ca+-oxalate was done in this study. A sensitive balance was used to measure the body weight of the subjects in kilograms.

Data analysis: All information included in the questionnaire was coded. SPSS and Microstat Statistical program was used for the analysis.

Two parts of analysis were used in this study:

Part one: Descriptive analysis for the mean, standard deviation, minimum and maximum values, were obtained for serum uric acid and urinary excretion of uric acid in both control and gouty groups.

Part two: Analysis of results included, partial correlation, logistic regression, paired samples statistics and chi-square test, were the analysis applied to estimate the correlation coefficient between serum uric acid and urinary excretion of uric acid, and the factors that affect the two variables. P value <0.05 was considered statistically significant.

RESULTS

The results of serum uric acid concentration and 24-hr urinary excretion of uric acid are presented in (Table U). Serum uric acid in gouty subjects not under treatment (7.8 mg/dl) was significantly higher than that of control (6.15 mg/dl) subjects (P<0.001), however serum uric acid in gouty subjects under treatment (6.9 mg/dl) was not significantly higher than that of the control (6.15 mg/dl) group. The difference between means for serum uric acid in gouty subjects undergoing treatment and gouty subjects not under treatment was statistically not significant. The difference between means for urine uric acid in control group (462.3 mg/24hr), gouty subjects under treatment (450.7

EDITORIAL

mg/24 hr), and gouty subjects not under treatment (479.2 mg/24 hr), was statistically not significant. Table (U) shows that the correlation coefficient between serum uric acid concentration and urinary excretion of uric acid for control and gouty subjects is weak, but it has a positive sign for gouty subjects. In Table (2) the mean age was found to be higher in gouty subjects under treatment than that of gouty subjects not under treatment and control group. The mean for body weight and height was significantly higher ($P<0.05$) in gouty subjects compared with control group.Body mass index (BMI) was found higher in gouty groups compared to control group, and the difference between means was significant ($P<0.05$) between gouty subjects under treatment and control group. The mean urine pH showed significant difference ($P<0.05$) between gouty groups, while urine volume and specific gravity showed no significance among the three groups. Urine differences in crystals and other related diseases are shown in Table (3).

Table (E) Mean, standard deviation, minimum, maximum, and correlation coefficient values for serum uric acid and urinary excretion of uric acid.

	N	Serum uric acid mg/dl			Urine uric acid (mg/dl)			Co	Si
Control		Min Level	Max Level	Mean –STD	Min Level	Max Level	Mean–STD		
Gouty subjects under treatment	20	4.5	9.0	6.15–1.39	180	799	462.3–196.2	0.09	NS
Gouty subjects notunder treatment	20	3.0	10.0	6.96–2.20	124	814	450.7–169.2	0.06	NS
	33	4.5	12.0	7.8–1.83	160.0	972	469.2–180.8	0.02	NS

N= Number of samples
S= Significant ($P<0.05$)
NS= Not Significant
STD= Standard deviation

EDITORIAL

Table (2 ; A&B) : The difference of the means and standard deviation of the age, body weight, body height, body mass index, urine pH, urine volume, and urine specific gravity.

Table 2; A

Sample group	N (%)	Age Mean–STD	Body weight Mean–STD	Body height Mean–STD
Control Gouty under treatment	20 (27) 20 (27)	55.6–10.6 61.3–15.2	71.0–13.9 85.5–14.0	170.1–5.69 175.2–7.45
Significance		NS	S	S
Control Gouty under treatment	20 (27) 33 (46)	55.6–10.6 58.9–10.3	71.0–13.9 79.6–11.8	170.1–5.69 175.6–5.45
Significance		NS	S	S
Gouty under treat Gouty not under treat.	20 (27) 33 (46)	61.3–15.2 58.9–10.3	85.5–14.0 79.6–11.8	175.2–7.45 175.6–5.45
		NS	NS	NS

Table 2; B

Sample group	Body mass index Mean–STD	Urine PH Mean–STD	Urine volume Mean–STD	Urine SG Mean–STD
Control Gouty under treatment	24.4–4.5 27.2–4.0	55.6–10.6 61.3–15.2	5.1–0.54 5.2–0.45	968.0–430.7 1259.5–650.4
Significance	S	NS	NS	NS
Control Gouty under treatment	24.4–4.5 25.7–2.6	55.6–10.6 58.9–10.3	5.1–0.54 4.9–0.57	968.0–430.7 1324.3–772.7
Significance	NS	NS	NS	NS
Gouty under treatment Gouty not under treat.	27.2–4.0 25.7–2.6	61.3–15.2 58.9–10.3	5.2–0.45 4.9–0.57	1259.5–650.4 1324.3–772.7
	NS	NS	S	NS

N= number of samples

S= significant (P<0.05)

NS= Not significant

STD= Standard deviation

EDITORIAL

Table (3) Frequency and percentage of other related diseases and urine crystals.

Type of disease	Total No.	Gouty patients under treatment		Gouty patients not under treatment		Control	
		Freq.	%	frequ	percent	freq	%
Rheumatoi	16	7	35	8	24.2	1	5
Hypertension	15	5	25	9	27.3	1	5
Diabetes mellitus	1	0	0	1	3	0	0
DM&HTN	2	0	0	2	6.1	0	0
Uric acid crystals	10	3	15	5	15.2	2	10
Calcium oxalate crystals	5	2	10	1	3	2	10
Calcium oxalate& Uric acid Crystals	13	2	10	4	12.1	7	35

DISCUSSION

Biochemical investigation of gout usually depends on serum uric acid determination. In this study we analysed uric acid excretion in addition to serum uric acid, because accurate determination of serum uric acid and urinary excretion of uric acid is essential for the diagnosis and classification of gout according to uric acid metabolism [7], while Cantarow and Trumper [8] reported that determination of uric acid excretion in gout was of little practical importance.

In this study there was a negative correlation between serum uric acid concentration and urinary excretion of uric acid in control group, this result agrees with the result reported by lang et al [6], who found that there was clear cut negative correlation between plasma urate concentration and fractional urate clearance in normal subjects, also this result seems to agree with Puig et al and Sota et al [9,10], who found a significant inverse correlation between uric acid clearance and serum uric acid concentration in normal control. But we found a weak positive correlation in the two groups of gouty subjects, this result is in agreement with the result reported by Yau and Kaung [5], who showed that unequivocal hyperuricemia, is more often accompanied by excessive excretion of uric acid. In more than 75% of patients with gout there appear to be a genetically determined defect in fractional urate excretion which results in an inability to increase excretion in response to a purine load [11]. Those under treatment are affected with the drugs used, which reduces circulating urate and also reduces urate excretion [3]. From the quessionnaire, age was found to be higher in gouty subjects copared with control group, while it shows a negative association with serum uric acid. Body weight was significantly higher in gouty subjects compared to control group, also it was positively correlated with serum uric acid and urinary excretion of uric acid, this result

agrees with the result reported by Loenen et al [12], Nishioka and Mikanagi [13], who found a positive correlation between serum uric acid and body weight, but Reuter et al [14], showed no correlation between them. So reducing body weight is one of the effective measures to prevent and treat gout or hyperuricemia in elderly [15]. Height was significantly greater in gouty subjects compared with control group; this finding indicates that height was strongly associated with serum uric acid concentration. Body mass index (BMI) was higher in gouty subjects compared to control group, this result was in line with Saggiani et al [16], who reported that BMI was one of the major predictors of the urate levels.This finding is also similar to that obtained by Al arfaj [17] who found that uric acid levels correlated significantly with BMI in males and females. Mean serum uric acid levels were correspondigly higher in hypertensive than non hypertensive peoples, while some of the univariate relation of serum uric acid to blood pressure is apparently due to the strong relation of body mass to both serum uric acid and blood pressure, they concluded that hypertension is one of the significant risk factors in both men and women with gout [18, 19, 20, 21]. These results reflect the high number of gouty patients with increased BMI and hypertension as shown in Tables (1) and (2). Consequently, measures to effect predisposing and associated conditions should be taken including, weight reduction, physical exercise and diet guidance, treatment of hypertension and possibly changes in medication [22]. Patients with gout or hyperuricemia have some times acidic urine, and increased urine uric acid excretion [21]. In this study urine PH was lower in gouty subjects not under treatment than that of control and gouty subjects under treatment; this finding indicates that low purine high vegetable diets were required to increase urine pH, inspite of the confounding variation of the purine rich diet in the three groups. Table (3) showed high number of patients with rheumatoid due to high erythrocyte sedimentation rate (ESR) level which was found significantly higher and correlated with serum uric acid in females [17].

28 gouty patients out of 53 were suffering from renal crystals with low urine PH. Since most of the urinary calculi were composed of uric acid, stone formation can be reduced by alkalization of the urine [23].

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EDITORIAL

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EDITORIAL

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