Original Article

Demography of Hyperuricemia and its Association with Metabolic Syndrome

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Abstract

Introduction: Hyperuricemia and gout are associated with significant mortality. The mortality may be caused by hyperuricemia itself or its association with metabolic syndrome.

Objectives: To find out the association of hyperuricemia and metabolic syndrome.

Materials and Methods*:* This cross-sectional observational study was conducted in CMH Dhaka and KGH, Dhaka from February to July 2019. Both indoor and outdoor patients were enrolled to see the level of uric acid and associated diseases and conditions, especially the metabolic syndromes. Total 800 patients were tested out of which 100 were hyperuricemic (Group A). Group A were compared with 100 age and sex matched control with normal uric acid level (Group B). Chi square test was done to see the level of significance.

Results: Total 800 respondents were tested for serum uric acid. Male were 500 (62.50%) and female were 300 (37.50%). Normal serum uric acid was found in 700 (87.5%) and hyperuricemia were found in 100 (12.5%) cases. Majority of respondents were included in age group 41-60 and 61-80 years. Number of hyperuricemias in these two groups were 50 (12.5%) and 30 (20%) and number of gouts were 14 (3.5%) and 12 (8%) respectively. In group A 30 (30%) had gout and 70 (70%) were asymptomatic. Both hyperuricemia and gout were far more in male compared to female, hyperuricemia in 16% vs 6.66% and gout in 4.40% vs 2.66% respectively. Majority of hyperuricemic patients were serving, 30 (30%) and retired group 25 (25%). Number of HTN, DM, abdominal obesity, dyslipidemia and CKD were more in Group A as compared to Group B. In group A there were 35 metabolic syndromes and in group B there were only 15 metabolic syndromes. The difference is statistically significant (p value <0.01). It proves that there is a strong association of hyperuricemia and metabolic syndrome.

Conclusion: Strong association was found between hyperuricemia and metabolic syndrome. But a large scale community based study is needed to find the actual demography of hyperuricemia and its association with metabolic syndrome.

Key-words: Hyperuricemia, Gout, Metabolic syndrome (MetS).

Introduction

Hyperuricemia is an abnormally high level of uric acid in the blood[1,2]. In humans the upper end of the normal range is 360 µmol/L (6 mg/dL) for women and 400 µmol/L (6.8 mg/dL) for men[3]. Gout is a form of inflammatory arthritis characterized by recurrent attacks of a red, tender, hot and swollen joint[4,5]. Gout is due to persistently elevated level of uric acid in the blood. This occurs from combination of diet, other health problems and genetic factors[5,6]. Hyperuricemia and gout are associated with an increased likelihood of mortality, whether this is directly attributable to hyperuricemia or gout or to gout associated diseases (eg. Insulin resistance, type 2 diabetes mellitus, abdominal obesity, hypercholesterolemia or hypertension) has been much debated[7,8,9]. Among middle aged men, hyperuricemia is a significant risk factor for death from cardiovascular disease[10]. Hyperuricemia has two-way relationship with chronic kidney disease (CKD). It is responsible for urate nephropathy and renal stone. Hyperuricemia in tumour lysis syndrome may cause AKI due to acute tubular necrosis. In patients with CKD, there is tendency to increased serum uric acid level. Metabolic syndrome (MetS) is a constellation of an interconnected physiological, biochemical, clinical and metabolic factors that directly increases the risk of atherosclerotic cardiovascular disease and type 2 diabetes mellitus[11,12]. Since the initial description of MetS, several iterations of this definition have been proposed. The most commonly used criteria for definition at present are from the World Health Organization (WHO)[13], the European Group for the study of Insulin Resistance (EGIR)[14], the National Cholesterol Education Programme Adult Treatment Panel III (NCEP ATP III)[15], American Association of Clinical Endocrinologists (AACE)[16], and the International Diabetes Federation (IDF)[17]. We have adopted the Asian modified version of NCEP ATP III for defining the metabolic syndrome, which includes 3 or more of the following:

1. FBS ≥100mg/dl
2. High BP ≥130/85mmHg or a history of HTN
3. HDL-C ≤40mg/dl in men or ≤50mg/dl in women
4. TG ≥150mg/dl
5. Waist circumference ≥ 90 cm for men & ≥ 80 cm for women (for Asian population, except Japan).

Different studies show that there is close association between hyperuricemia and MetS. But in Bangladesh such study is scarce. Therefore, present study aimed to find the association of hyperuricemia and MetS

Material and Methods

This cross-sectional observational study was conducted in Combined Military Hospital (CMH) Dhaka and Kurmitola General Hospital (KGH) Dhaka from February to July 2019. Patients reported to male and female medical OPD, Rheumatology and Nephrology OPD and admitted cases in male and female medical wards with age range of 20-80 years were enrolled for the study purpose. Verbal consents were obtained from the respondents and ethical clearance was taken. Total 800 respondents were randomly tested for serum uric acid levels. Associated symptoms and disease conditions were noted. Data collection were done in preplanned and predesigned form by face to face interview, from medical history, clinical examination and relevant investigation reports. Total 100 patients with hyperuricemia (Group A) were studied meticulously to see the various disease associations. Total 100 age and sex

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matched individuals with normal serum uric acid level (Group B) were also selected as control group. The associated disease condition in Group A and B were compared. Chi square test was done to see the level of significance.

Results

Total 800 respondents were tested for serum uric acid level. Number of males was 500(62.5%) and females were 300(37.5%). Out of 500 males, hyperuricemia and gout were found in 80(16.00%) and 22(4.40%) respectively. Amongst 300 female respondents the number of hyperuricemia and gout were 20 (6.66%) and 8 (2.66%) respectively. In age group 20-40 years number of respondents were 250. Amongst them, hyperuricemia was found in 20(8%) and gout was found in 4(1.6%) individuals. In age group 41-60 number of population were 400 and amongst them hyperuricemia and gout were found in 50(12.5%) ad 14(3.5%) respectively. In age group 61-80 the number of respondents were 150 and amongst them hyperuricemia and gout were found in 30(20%) and 12(8%) respectively (Table-I). Normal uric acid levels were found in 700(87.5%) and hyperuricemia were found in 100(12.5%) respondents (Figure-2). Amongst the 100 hyperuricemic cases (Group A) only 30(30%) had gout and rest of them 70 (70%) were asymptomatic (Figure-3).

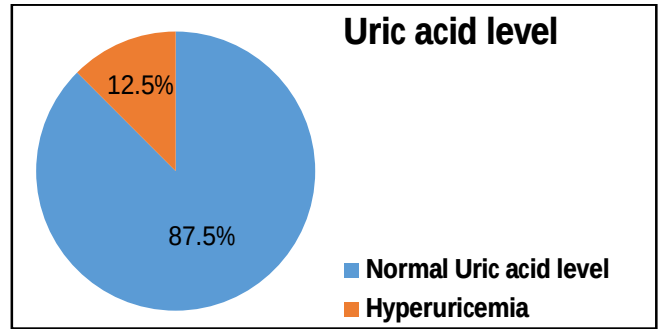

Figure-1: Distribution of uric acid level in the total sample.

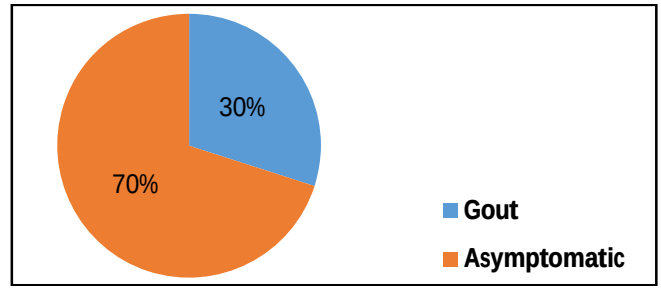

Figure-2: Distribution of gout among the hyperuricemic population

Table-I: Distribution of hyperuricemia and gout according to age and sex (n=800)

Characteristics		Total population	Hyperuricemia n (%)	Gout n (%)
Age group (years)	20-40	250	20 (8)	4 (1.6)
	41-60	400	50 (12.5)	14 (3.5)
	61-80	150	30 (20)	12 (8)
	Total	800	100 (12.5)	30 (3.75)
Sex	Male	500	80 (16.00)	22 (4.40)
	Female	300	20 (6.66)	8 (2.66)

Table-II: Distribution of hyperuricemia cases according to occupation (n=100)

Occupation	Frequency	Percentage
Service holders	30	30
Retired person	25	25
Housewives	15	15
Businessmen	12	12
Farmers	10	10
Students	3	3
Others	5	5
Total	100	100

Table-III: Distribution of Metabolic Syndrome in Group A and group B

Group	HTN	Abdominal Obesity	FBS≥100 mg/dl	Low HDL-C	Raised TG level	Number of MetS
Group A (n = 100)	+		+		+	8
	+	+		+	+	4
		+	+		+	3
		+	+	+		12
	+	+	+		+	3
	+			+	+	5
	20	23	26	21	23	35
Group B (n = 100)	+		+		+	3
	+	+		+	+	2
		+		+	+	3
		+	+	+		4
	+	+	+		+	2
	+			+	+	1
	9	12	9	10	11	15

Table-IV: Comparison of associated disease conditions in Group A and Group B

Disease conditions	Group A n (%)	Group B n (%)	Statistics
HTN	20 (20)	9 (9)	$\chi^2 = 0.708$ df = 5 p >0.05
Abdominal Obesity	23 (23)	12 (12)	
DM	26 (26)	9 (9)	
Low HDL-C	21 (21)	10 (10)	
High TG	23 (23)	11 (11)	
Metabolic Syndrome	35 (35)	15 (15)	

Discussion

Hyperuricemia is an increasingly common medical problem not only in the advanced countries, but also in the developing countries such as Bangladesh. It has been described that hyperuricemia is associated with metabolic syndrome components such as obesity, dyslipidemia, hyperglycemia and hypertension. The incidence of hyperuricemia has rarely been investigated in Bangladesh. The purpose of this study was to investigate the prevalence of hyperuricemia and its association with various metabolic syndrome components. We found that the incidence of hyperuricemia in males was 16.00%, which is much higher than that in females (6.66%). This result was in line with Conen et al research[18]. The pathogenic mechanism may be due to estrogen promoting uric acid excretion, so it may be more important for men to prevent hyperuricemia[19].

Obesity is one component of metabolic syndrome. Matsuura et al and Bonora et al reported that obesity and central body fat distribution were associated with hyperuricemia. In this study, we found elevated waist circumference to be at greater risk of having hyperuricemia, which is in line with Feig and Johnson's research[20]. Researchers conducted studies to evaluate the relationship between leptin (gene production of obesity) and the cluster of hyperuricemia in order to clarify the pathogenic mechanisms associating obesity with hyperuricemia. They found that the serum uric acid concentration is independently associated with the serum leptin concentration[21]. It was suggested that leptin could be a pathogenic factor responsible for hyperuricemia in obese patients.

In our research the data indicated that serum triglyceride was markedly associated with hyperuricemia. Conen et al and Schachter showed the same results[22]. Hyperuricemia and hypertriglyceridemia are suggested to be associated with insulin resistance syndrome and many investigators are studying the mechanisms of the emergence of this syndrome[23]. The association between insulin resistance syndrome, hyperuricemia, and hypertriglyceridemia are complicated. This might be expected from the fact that uric acid production is linked to glycolysis and that glycolysis is controlled by insulin. It was shown in this study that uric acid was negatively correlated with serum HDL-C. This finding was consistent with Rho et al research[24]. The mechanisms of this condition may be due to the relationship between decreased HDL-C levels and insulin resistance syndrome [25].

Serum uric acid concentration was found to independently correlate with hypertension (Yoo et al., 2005; Feig and Johnson, 2003). A study done by Krishnan et al found that men with hyperuricemia had more risk for incident hypertension[26]. Each unit increase in serum uric acid was associated with a 9% increase in the risk for incident hypertension. In this research, it was found that uric acid concentration was statistically significantly positively correlated with blood pressure. Yoo et al and Becker and Jolly reported that hyperglycemia was a remarkable risk factor for hyperuricemia[27]. In a study of 3,681 Japanese adult, it was found that an elevation of serum uric acid concentration in males increased the risk of type 2 diabetes[28]. It was concluded that hyperuricemia was positively associated with hyperglycemia. Insulin resistance may be the linking between them[27]. In this study we found the positive correlation between hyperglycemia and MetS.

This study shows serum uric acid is markedly associated with metabolic syndrome and its components, in particular serum triglycerides, waist circumference and fasting glucose. Considering the growing incidence of obesity and metabolic syndrome worldwide and the potential link to hyperuricemia, more emphasis should be put on the evolving morbidity prevalence of hyperuricemia in Bangladesh.

Conclusion

The mortality due to hyperuricemia is mostly due to association with metabolic syndrome which is a multifaceted problem. In this hospital-based study we found strong correlation of hyperuricemia and metabolic syndrome. Large scale community based study is required to find the actual demography of hyperuricemia and its association with metabolic syndrome.

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