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Relationship of serum uric acid level and angiographic severity of coronary artery disease in patients with ST segment and non ST segment elevated myocardial infarction

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Abstract
Background: *Serum uric acid has not yet been proven to be a cardiovascular risk factor, and the relationship between it and ischemic heart disease is still debatable.*
Aim of the study: *The aim of our study was to investigate the relationship of serum uric acid level and angiographic severity of coronary artery disease in patients with ST segment and non ST segment elevated myocardial infarction.*
Methods: *This cross-sectional analytical study was conducted in the department of Cardiology, National Institute of Cardiovascular Diseases and Hospital, Dhaka, Bangladesh, from December 2011 to November 2012. The study included 103 patients who were newly diagnosed as acute coronary syndrome. All acquired data was entered into a Microsoft Excel Work Sheet and analyzed using descriptive statistics in SPSS 11.5.*
Results: *The study populations are mainly between 40 to 75 years (90.6% & 92% remaining in group- I & group- II respectively). Findings of the study shows that there is no statistically significant difference observed in respect smoking habit (p-0.86), hypertension (p-0.32), DM (p-0.53), dyslipidemia p-6.93) and family history of IHD (p-0.68) between two groups. NSTEMI patients are higher in percentage in group-II than group-I and patients of UA are higher in percentage in group- I than group-II and STEMI patients are identical in both groups. The range of serum uric acid distribution in case of male is 4-6.9 in group-I & 7.2-12.2 in group-II. The mean value of serum uric acid level in women is 4.5 for group-I and 7.3 for group II. The Pearson's correlation coefficient (r) for group II is 0.7181 which is more significant (p<0.001) than group-I.*
Conclusion: *In conclusion, there was a significant relationship between serum uric acid and angiographic severity of coronary artery disease in group II patients. Serum uric acid estimation provides a straightforward, low-cost, fast, and non-invasive approach for identifying such high-risk patients.*
Keywords: *Coronary artery disease, Cardiovascular, Angiographic Severity, Serum uric acid.*

I. INTRODUCTION

Ischemic heart disease is the top cause of death in industrialized countries and the second greatest cause of death in developing countries by 2020, it will be the major cause of disability according to the World Health Organization [1]. Coronary heart disease (CHD) is a leading cause of death worldwide, with pandemic proportions in both industrialized and developing countries [2]. In 2004, an estimated 17.1 million people died from cardiovascular disease (CVD), accounting for 29% of all global deaths, with coronary heart disease accounting for 7.2 million of these deaths [3]. South Asian countries such as India, Pakistan, Bangladesh, Sri Lanka, and Nepal bear the greatest part of the worldwide burden of Cardiovascular Diseases (CVDs) [4].

According to estimates from the global burden disease research, by 2020, this region of the world will have more people with atherosclerotic cardiovascular disease than any other [5]. Bangladesh is a small but populous country. Cardiovascular disorders have placed a serious strain on Bangladesh's health-care system. Three small-scale population-based investigations in Bangladesh found an average prevalence of ischemic heart disease of 6.5 per thousand rural residents [6]. Uric acid, produced from xanthine by the enzyme xanthine oxidase, is the final breakdown product of purine metabolism in humans. The higher serum uric acid level is due to enhanced xanthine oxidase activity, which generates more oxygen free radicals. This increased oxidative stress may cause endothelial dysfunction in tiny myocardial arteries, followed by mvocardial dysfunction. The breakdown of nitric oxide caused by oxidative stress can impair the Frank-Starling response in the heart and may be a mechanism of diminished cardiac function caused by hyperuricaemia. Serum uric acid influences platelet adhesiveness, free radical production, and oxidative stress [7]. Serum uric acid levels have been linked to atherosclerotic indicators such as inflammation, oxidative stress, endothelial dysfunction, and insulin resistance [8]. Relationship analysis between serum creactive protein, serum uric acid, plasma fibrinogen, and severity of coronary artery disease in patients undergoing coronary angiography reveals that these levels are positively correlated with the severity of coronary artery disease [9]. High serum uric acid levels are linked to an increase in the number of diseased arteries in individuals with coronary artery disease and predict the severity of CAD in patients with acute coronary syndrome [10]. The goal of this study is to assess the relationship of serum uric acid level and angiographic severity of coronary artery disease in patients with ST segment and non ST segment elevated myocardial infarction.

II. METHODOLOGY

This cross-sectional analytical study was conducted in the department of Cardiology, National Institute of Cardiovascular Diseases and Hospital, Dhaka, Bangladesh, from December 2011 to November 2012. A total of 103 patients with newly diagnosed acute coronary syndrome were studied. The individuals in this study were separated into two groups based on their serum uric acid levels. Group I included 53 patients with newly diagnosed acute coronary syndrome and normal blood uric acid levels (<7 mg/dl in males and <6 mg/dl in women). Patients with newly diagnosed acute coronary syndrome and increased blood uric acid levels (>7 mg/dl in men and > 6mg/dl in women) were included in group II. All acquired data was entered into a Microsoft Excel Work Sheet and analyzed using descriptive statistics in SPSS 11.5.

III. RESULT

The study populations are mainly between 40 to 75 years (90.6% & 92% remaining in group- I & group- II respectively). Only 9.4% study population in group- I and 8% in group II are below 40 years of age. The mean age of study subjects among group- I and group- II are 50.45±10.33 years and 32.96±10.56 years respectively and there is no statistically significant differences observed between two groups in respect of mean age (p-0.22) [Table-1]. Findings of the study shows that there is no statistically significant difference observed in respect smoking habit (p-0.86), hypertension (p-0.32), DM (p-0.53), dyslipidemia p-6.93) and family history of IHD (p-0.68) between two groups [Table-2]. [Figure-1] shows that patients of unstable angina (UA), ST segment elevated myocardial infarction (STEMI) and non ST segment elevated myocardial infarction (NSTEMI) are 41.5%, 47.2% and 11.3% in group- I and 24%, 48% and 28% in group-II respectively. Here NSTEMI patients are higher in percentage in group-II than group-I and patients of UA are higher in percentage in group- I than group-II and STEMI patients are identical in both groups. The mean value of serum uric acid level in men is 5.5 for group-I and 8.2 for group-II which is shown in [Figure-2]. Here range of serum uric acid distribution in case of male is 4-6.9 in group-I & 7.2-12.2 in group-II. The mean value of serum uric acid level in women is 4.5 for group-I and 7.3 for group II which is shown in [Figure-3]. Here range of serum uric acid distribution in case of female is 3-5.9 in group-I & 6.3-11.3 in group-II. [Figure-4] shows the correlation between Friesinger score and normal level of serum uric acid for group-I. The Pearson's correlation coefficient (r) is 0.288 which is significant (p< 0.037). [Figure-5] Shows the correlation between Friesinger score and elevated serum uric acid level for group-II. The Pearson's correlation coefficient (r) is 0.7181 which is more significant (p<0.001) than group-I. Therefore, it shows that there is a strongly positive linear correlation between Friesinger scores and elevated serum uric acid level.

Table -1: Comparison of age between two groups (N=103)

Age in years	**Group-I** (n=53)	**Group-II** (n=50)	**P-value**
25-39	05 (9.4)	04 (08)	0.22
40-49	17 (32.1)	15 (30)	
50-59	18 (34)	15 (30)	
60-75	13 (24.5)	16 (32)	
Mean ± SD	50.45 ± 10.33	52.98 ± 10.55	

Table-2: Percentage distribution of study subjects by risk factors (N=103)

Risk factors	**Group-I** (n=53)	**Group-II** (n=50)	**P-value**
Smoking	20 (37.7)	18 (36)	0.86
Hypertension	19 (35.8)	21 (42)	0.52
DM	17 (32.1)	19 (38)	0.53
Dyslipidaemia	28 (52.8)	26 (52)	0.93
F/H of IHD	06 (11.3)	07 (14)	0.68

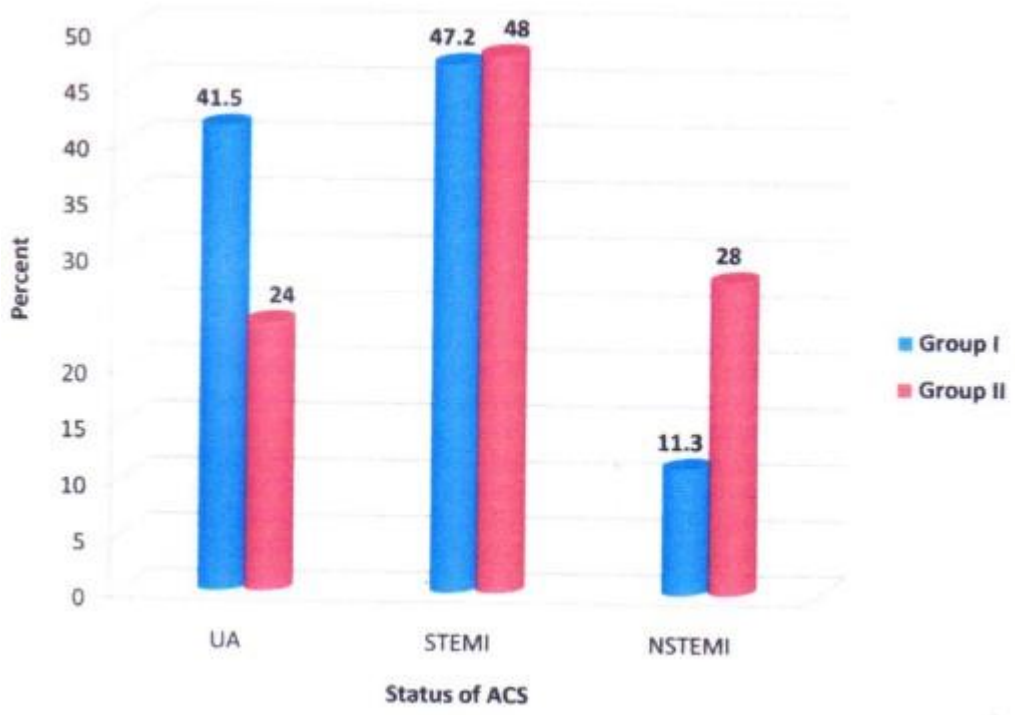

Figure-1: Percentage distribution of study subjects by status of ACS.

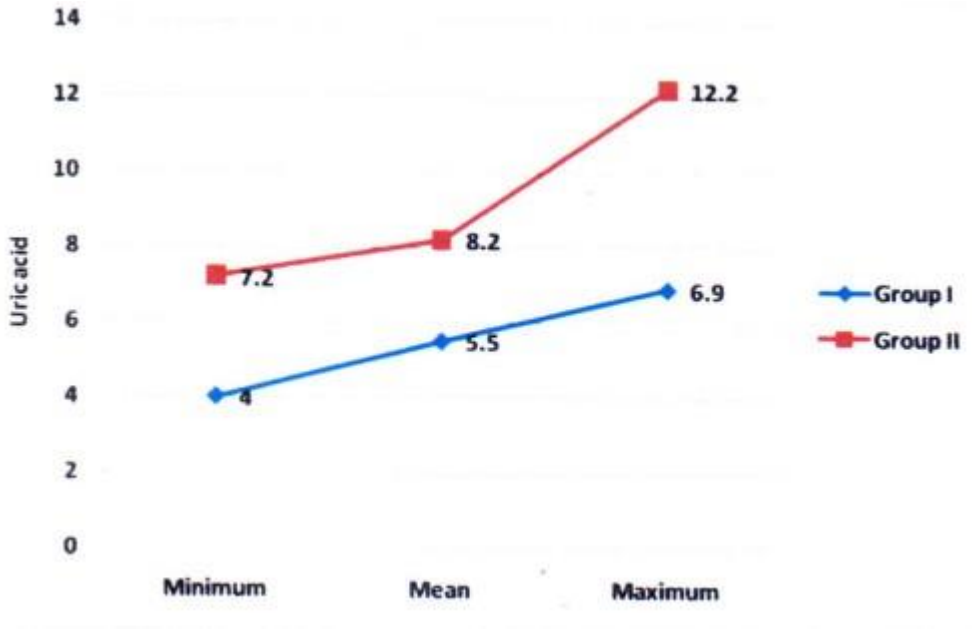

Figure-2: Distribution of serum uric acid in male by groups.

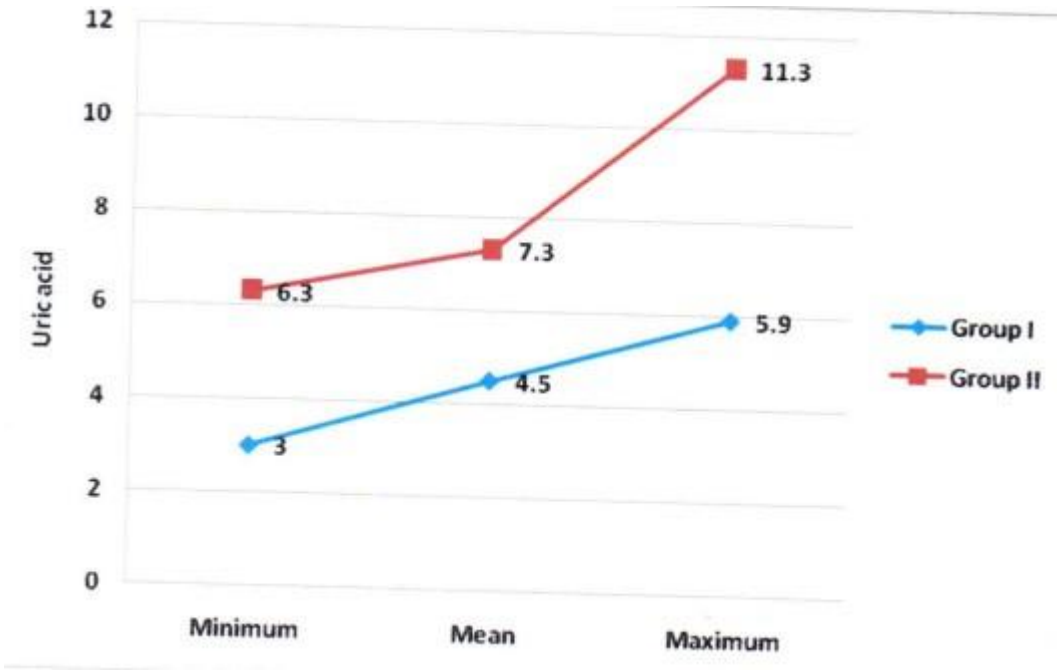

Figure-3: Distribution of serum uric acid in female by groups.

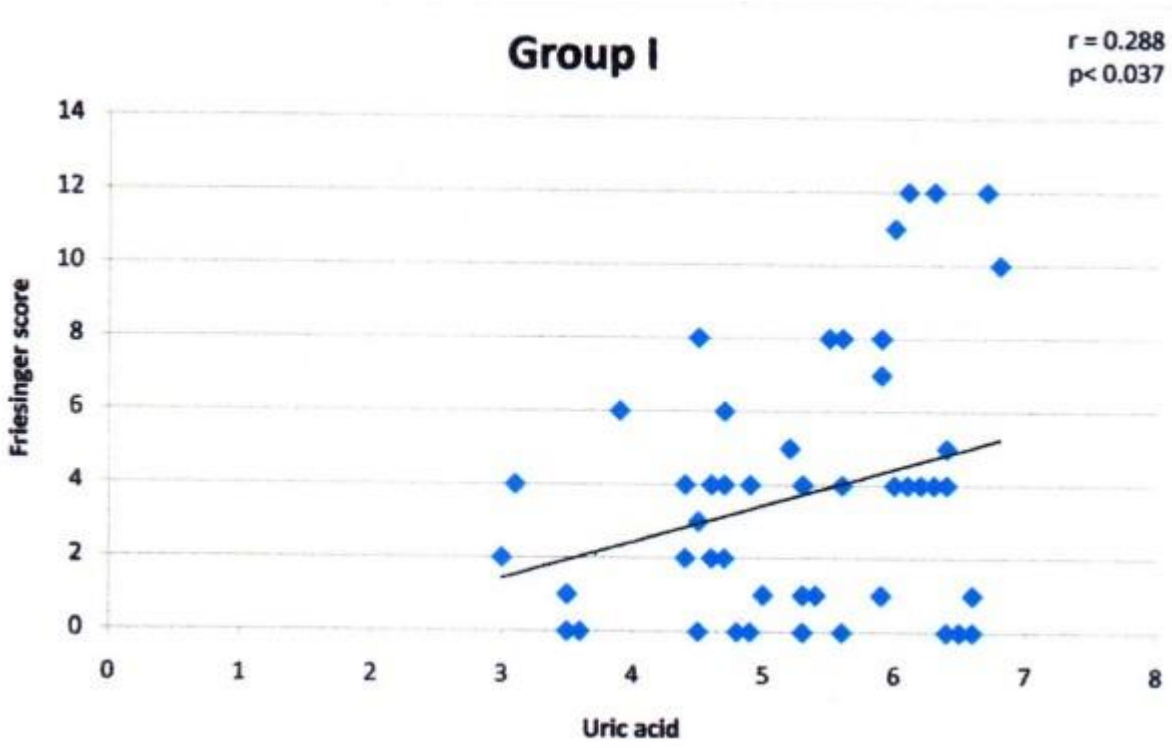

Figure-4: Correlation between Friesinger score and normal serum uric acid.

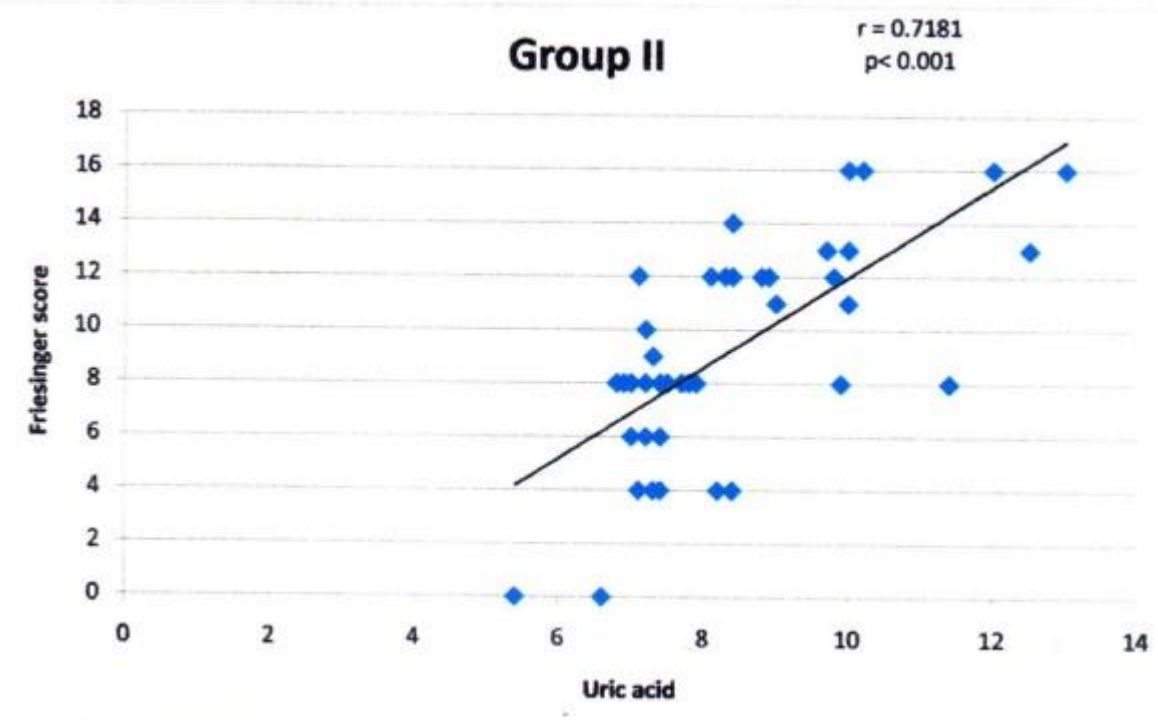

Figure-5: Correlation between Friesinger score and elevated serum uric acid.

IV. DISCUSSION

This cross sectional comparative study was conducted in National Institute of Cardiovascular Diseases (NICVD), Dhaka. One hundred and three consecutive patients with CAD admitted in NICVD and had undergone angiogram were included in this study and the patients were divided in two groups. Group I (53) included who had serum uric acid levels are normal (<7mg/dl in men & <6mg/dl in women) while 50 patients were enrolled as group II member who had serum uric acid levels are elevated (>7mg/dl in men & >6mg/dl in women). The study populations ranged in age from 40 to 75 years old (90.6% and 92% in groups I and II, respectively). Only 9.4% of the study population in Group I and 8% of the study population in Group II are over 40. Group I and II had mean ages of 50.45±10.33 and 52.98±10.56 years, respectively. There was no statistically significant difference detected between the two groups, but it was shown that the incidence of acute coronary syndrome increases after the age of 40. The majority of AMI occurs after the age of 40 in Bangladesh [11]. The results of biochemical studies show that HDL-C is lower in group II (38.72±2.19) than in group I (39.64±2.11), and this difference is statistically significant (p=0.032). Other indicators such as FBS, TC, TG, LDL, and creatinine level are nearly evenly distributed across the two groups. A significant relationship between low HDL and CAD in hyperuricaemic patients, but no relationship between TG, LDL-C, FBS, or creatinine level and CAD in these patients [12]. Several risk factors for developing coronary heart diseases are discussed in many studies [13,14]. This study revealed several risk factors such as smoking, hypertension, diabetes, dyslipidaemia family history of IHD are 37.7%, 35.8%, 32.1%, 52.8%, 11.3% in group-I and 36%, 42%, 38%, 52%, 14% in group-II respectively. But there is no significant difference observed between two groups in respect of smoking (p=0.86), hypertension (p=0.52), DM (p=0.53), Dyslipidaemia (p=0.93) and family history of IHD (p=0.68). Hong Buy Lim (2010) found no significant relationship between hypertension and smoking with patients of CAD having high serum uric acid [15]. Akanda (2012) revealed no association between family history of IHD with CAD in patients having high serim uric acid [16]. Tavil (2008) described that higher level of serum uric acid is associated with atherogenesis which is independent of hypertension [17]. Jelic-Ivanovic (2007) showed no significant relationship between hypertension, DM, dyslipidaemia with patients of high serum uric acid having CAD [18]. The mean distribution of serum uric acid level in male was 8.2 mg/dl and 5.5 mg/dl in group-II and in case of female that was 7.3 mg/dl and 4.5 mg/dl in group-II and group-I respectively. In case of correlation between Friesinger scores and uric acid for group-I, the Pearson's correlation coefficient was 0.288 (p<0.037). Although it is statistically significant, but it shows that there is a weak positive linear correlation between Friesinger scores and high normal limit of serum uric acid in group-I. Jelic-Ivanovic (2007) found that male with uric acid >5.40mg/dl (>324.7 (rniol/L) were 5 times more likely CAD than male with lower uric acid (OR=5, CI=2.928-8.612, PO.01) and female having uric acid >4.3 mg/dl (>258.0}imol/L) has obtained similar result than female with lower uric acid (OR=5, CI=2.61-9.64, P<0.01) [18]. Here the Pearson's correlation coefficient in group-II was 0.7181 (p<0.001) which is remarkably more significant than group-I. Therefore, it shows that a strongly positive linear correlation exists between Friesinger scores and hyperuricaemia in group-II population. Here, patients of unstable angina (UA), ST segment elevated myocardial infarction (STEMI) and non ST segment elevated myocardial infarction (NSTEMI) are 41.5%, 47.2% and 11.3% in group-I and 24%, 48% and 28% in group-II respectively. Here NSTEMI patients are higher in percentage in group-II than group-I and patients of UA are higher in percentage in group-I than group-II and STEMI patients are identical in both groups.

Limitation of the study:

A single-center study with a small sample size is insufficient to generalize the findings. Because the trial was conducted over a short period of time, patients were not observed for an extended amount of time to determine the outcome. The majority of the confounding factors were examined, although there may be some other confounding factors that influence CAD.

V. CONCLUSION & RECOMMENDATION

In conclusion, there was a significant relationship between serum uric acid and angiographic severity of coronary artery disease in group II patients. Serum uric acid estimation provides a straightforward, low-cost, fast, and non-invasive approach for identifying such high-risk patients.

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