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ORIGINAL ARTICLE

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Hyperuricemia in Acute Coronary Syndrome Patients at Tertiary Care Hospital Peshawar

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ABSTRACT

OBJECTIVE: To investigate the affiliation between elevated uric acid and acute Coronary syndrome.

METHODOLOGY: This descriptive cross-sectional study was conducted over twelve months from June 2022 to May 2023 in the Cardiac Care Unit (CCU) and Pathology Laboratory of Kuwait Teaching Hospital. A total of 201 patients were included, determined using the WHO sample size calculator. Inclusion criteria were patients with typical ischemic chest pain indicative of ACS, irrespective of gender and age, who were willing to participate. Data were collected using a structured preform questionnaire covering demographics, medical history, clinical presentation, and diagnostic findings. Key data included patient age, gender, history of hypertension, diabetes, hyperlipidemia, smoking status, family history of coronary artery disease, and symptoms at presentation. ACS was classified into STEMI, NSTEMI, or Unstable Angina based on ECG and troponin-I levels. Serum uric acid levels were measured after an eight-hour fasting period. Data were entered into Microsoft Excel and analyzed using SPSS version 25, employing descriptive statistics and Chi-square tests, with a p-value of <0.05 considered significant.

RESULTS: Total 201 study participants were enrolled (average age: 57.5 years), with 99 (49%) males. Diabetes mellitus was found in 88 (44% of patients) and hypertension in 83 (41%). In 73 (36%) of the patients, hyperuricemia was seen. Males were more likely to have hyperuricemia (75%) than females 60 (59%), and diabetics were more likely to have it (80%) than hypertensive people 59 (71%). The overall incidence of hyperuricemia in ACS patients was 52%.

CONCLUSIONS: Our findings demonstrate the high prevalence of hyperuricemia in persons diagnosed with acute coronary syndrome. Routine monitoring and surveillance of blood uric acid levels in the general population appears to be a viable technique for proactively identifying and addressing anomalies promptly.

KEY WORDS: Hyperuricemia, Acute Coronary Syndrome, Risk Factors

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INTRODUCTION

Ischemic Heart Disease (IHD) has overtaken heart disease as the principal cause of death worldwide, particularly in affluent nations.[1] Patients of IHD are divided into two main groups; One group consists of people with coronary artery disease (CAD) that have stable angina and the other group comprise of patients with acute coronary syndrome (ACS). The individuals in this group are of three types which include; ST-segment elevation acute myocardial infarction (AMI) on their electromyogram, Non-ST segment elevation myocardial infarction (NSTE-MI), and unstable/resting angina.[2]

Many studies have pointed that preeminent uric acid concentrations in blood are related with unfavorable cardiac events and death among people with an acute heart attack, and it also hastens the intensity and fatality in persons with acute coronary artery disease (CAD).[3,4]

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Increased uric acid levels are thought to be an indication of risk for coronary artery calcification, but this is debatable because some studies show a robust or noteworthy connection between raised uric acid concentrations and plaque buildup in the coronary arteries.[5,6] In contrast, researchers in other studies found no link between heart disease and elevated uric acid levels.[7]

The ultimate result of purine nucleotides metabolism is uric acid, which is produced during the breakdown of adenosine and guanine.[8] Uric acid with a pH of 5.8 exhibits the properties of a weak acid, whereas it exists in the form of salt with the blend of urate crystal and is eliminated in the urine.[9] When the dissolution rate of the uric acid inside a person exceeds 6.8mg/dl, uric acid crystals as monosodium urate develop.[10]High blood uric acid levels disrupt the xanthine oxidase pathway, resulting in the generation of reactive oxygen compounds, which deteriorates cell-membranes.1 Reactive oxygen compounds (ROC) produce oxidative stress in the vascular system as well as endothelial dysfunction. Both of these are allied with an increased risk of atherosclerosis, produce cardiomyocyte and/or vascular endothelial damage, resulting in contractility of the myocardium and vasoconstriction abnormalities.[11] A higher uric acid concentration in the heart diseases strata reflect an adaptive mechanism that mitigates oxidative stress, resulting in tissue hypoxia; thus, elevated uric acid amounts could indicate a retort to tissue impairment in correspondence to high risk, whereas a greater hazard at lesser concentrations of uric acid could indicate a consequence of decreased antioxidant capacity. [12,13]

Pakistani population has a high prevalence of hyper uricemia, several studies reported a frequency of 30-39%. [14,15]

The scope of our study was to look at the increasing level of uric acid in the blood in ACS patients. There are many un-identified risk factors for ischemic heart disease in the world and lot of studies are under process. Same situation is prevailed in our local patients. Our study will help in recognizing hyperuricemia as a risk factor for ischemic heart disease. And it will help in further randomized studies to confirm it.

METHODOLOGY

This descriptive cross-sectional study was conducted over a period of twelve months from June 2022 to May 2023, in the Cardiac Care Unit (CCU) and the Pathology Laboratory of Kuwait Teaching Hospital. A total of 201 patients were included in the study. The sample size was determined using the World Health Organization (WHO) sample size calculator.[16] The inclusion criteria were patients admitted to the CCU with typical ischemic chest pain indicative of ACS, irrespective of gender and age, and who were willing to participate. Patients with stable angina, those unable to provide informed consent, or those unwilling to participate were excluded. A structured proforma was developed to systematically collect data on the demographic characteristics, risk factors, and clinical presentation of the patients. The proforma was divided into four sections: Demographic Information, Medical History, Clinical Presentation, and Diagnostic Findings, which centered around data collection on the patient's age, gender, past medical conditions and lifestyle factors like history of hypertension, diabetes, hyperlipidemia, smoking status, and family history of coronary artery disease. The proforma also recorded the presence typical symptomatology of ACS in the study population at the time of presentation (chest pain, dyspnea, sweating and palpitations). ACS was categorized into STEMI, NSTEMI, or Unstable Angina based on the presence of ST-segment elevation, depression, or other ischemic changes on ECG and troponin-I levels at presentation. Serum uric acid levels were also measured following an eight-hour fast, with reference ranges of 3.5-7.0 mg/dL in males and 3.5-5.7 mg/dL in females.

The data collection process involved filling of the proforma for patients or their attendants by trained medical staff during the initial assessment in the CCU. Information on demographic details and medical history was obtained through direct interviews and review of medical records. All patients underwent a detailed clinical examination performed by a cardiologist upon admission. Data collected from the proformas were entered into Microsoft Excel for initial organization. Statistical analysis was performed using SPSS version 25. Descriptive statistics, including mean & standard deviation, frequencies, and percentages, were used to summarize the demographic characteristics and clinical findings. The Chi-square test was employed to evaluate associations between categorical variables (e.g., gender and type of ACS). A p-value of <0.05 was considered statistically significant. Informed consent was obtained from all patients or their legal guardians before their inclusion in the study. The study protocol was reviewed and approved by the ethical review board of Kuwait Teaching Hospital. Patient confidentiality was maintained by anonymizing data, ensuring that personal identifiers were removed during data entry and analysis.

RESULTS

Total 201 study participants were enrolled (average age: 57.5 years), with 99 (49%) males and 102 (51%) females. Diabetes mellitus was found in 88 (44% of patients) and hypertension in 83 (41%). In 73 (36%) of the patients, hyperuricemia was seen. Males were more likely to have hyperuricemia (75%) than females 60 (59%), and diabetics were more likely to have it (80%) than hypertensive people 59 (71%). (Table 1)

Variables	Hyperuricemia		*p*-Value*
	Yes (n=135)	No (n=66)	
Gender			
Male (n=99) Female (n=102)	75 (76%) 60 (59%)	24 (24%) 42 (41%)	0.01
Age			
< 60 Years (n=94) > 60 Years (n=107)	63 (67%) 72 (67%)	31 (33%) 35 (33%)	
Diabetes Miletus			
Yes (n=88) No (n=113)	70 (80%) 65 (58%)	18 (20%) 48 (42%)	0.001
Hypertension			
Yes (n=83) No (n=118)	59 (71%) 76 (64%)	24 (29%) 42 (36%)	0.001

**p—value of <0.05 = significant.*

Table 1. Features of the study population at the onset

Moreover, the incidence of preeminent uric acid concentration in patients with STEMI was 45% as compared to NSTEMI patients (52%), while it was highest in patients with unstable angina (65%). Among STEMI patients, hyperuricemia was more common in females than males (30% vs 15%); however, opposite trend was seen in patients admitted with NSTEMI and unstable angina. 31% males with NSTEMI had hyperuricemia while only 21% of females exhibited raised uric acid levels. Similarly, 47% males with unstable angina had hyperuricemia vs 19% in female population. This is a significant finding which depicts a strong correlation between hyperuricemia and ACS particularly in male population (28% vs 24%). The overall incidence of hyperuricemia in ACS patients was 52%. (Table 2)

Male ACS patients having elevated uric acid levels had positive family history of IHD in contrast to female counterparts who themselves had a history of previous IHD.

DISCUSSION

Hyperuricemia remains a precursor for cardiovascular diseases, however the implication of hyperuricemia and gender disparities in individuals with ACS is equivocal. As a result, the primary objective of the present research was to investigate the link between high uric acid levels and ACS. The findings of this study indicate that those diagnosed with ACS have more preponderance of having hyperuricemia than those without hyperuricemia. Similarly, one such study showed that in patients with ACS, hyperuricemia remains a distinct risk predictor of MACE at one-year following discharge.[17]

Hyperuricemia has become increasingly widespread in recent years all across the world. Serum uric acid levels are raised in advanced nations, and figures are on the rise in developing and emerging nations. Hyperuricemia has turn out to be more common as a consequence of our lifestyles and environment. Raised-levels of circulating uric acid have been linked to calcium deposition in coronary arteries as well as condensed flow-mediated expansion, reflecting the presence of vascular endothelial dysfunction in these patients. These data suggest a relationship between hyperuricemia and arteriosclerosis.[18]

A recent study found that high-levels of uric acid is akin to an increased likelihood of long-term death and unadorned cardiovascular events in people who have experienced an acute coronary syndrome. In the cohort study, 1119 people were tracked on a regular basis for a median of 36 months. Greater-levels of uric acid have been linked to greater incidence of major cardiac incidents, cardiovascular-disease-mortality, and overall death.[19]

Whenever persistent and/or severe hyperuricemia causes urate crystal precipitation within joints, it causes an inflammation-related reaction that presents as gouty arthritis. Gout's inflammatory activity can be pro-atherogenic, promoting a pro-thrombotic milieu that end-up in episodes of acute coronary syndrome (Tiong and Brieger).[20] As a result, serum uric acid may play a role in platelet bonding, accumulation, or inflammation, as well as in the development of acute myocardial infarction. Krishnan et al. observed that gout is related with an elevated risk of Q-wave MI in a single retrospective cohort, and that both the severity of gouty arthritis and a high serum urate concentration are independent predictors of this interaction.[21]

According to the findings of Bhattacharya and colleagues, people who had elevated levels of uric acid in their blood had longer hospital stays and a substantially greater mortality risk. Over one quarter of the patients in the study (28%) had increased blood levels of uric acid (>7.0 mg/dl). Greater blood levels of uric acid were associated with a longer stay in the

Uric Acid Range (mg/dL)	STEMI (n)	*p*-Value*	NSTEMI (n)	*p*-Value*	USA (n)	*p*-Value*	TOTAL (N)	PERCENTAGE (%)
< 7.0	12	0.001	20	0.001	10	0.03	42	21%
> 7.0	11		26		20		57	28%
< 5.7	29		20		5		54	27%
> 5.7	23		17		8		48	24%
Total	**75**		**83**		**43**		**201**	**100%**

**p—value of <0.05 = significant.*

Table 2. Incidence of hyperuricemia in different subgroups

hospital (9 days for concentrations exceeding 7 mg/dL versus 6 days for values below 4 mg/dL). According to the study's findings, the overall number of deaths inside the hospital was 9.8%, with a large proportion of those who died (70%) having blood levels of uric acid above 7 mg/dl.[22]

Fromonot et al. discovered that those with documented ischemic heart disease exhibit elevated levels of uric acid in their blood than healthy people. They also discovered that serum uric acid levels were greater among those with acute coronary syndrome (ACS) than in people with stable CAD.[23] Duran et al. discovered a favorable correlation of hyper uricemia with angiographic severity of coronary artery disease in ACS patients, analogous to our findings.[24] Barbieri et al. recently demonstrated that blood concentration of uric acid was considerably greater in men vs women, although levels of uric acid that were elevated were solely related with severe CAD in women.[25]

Despite the significance of our findings, it is essential to acknowledge certain limitations. The small sample size and single-center aspect of our study may restrict the generalizability of our findings. Collaboration across several centers with diverse demographics could provide a more complete knowledge of the association between hyperuricemia and ACS.

CONCLUSION

In conclusion, Our findings demonstrate the high prevalence of hyperuricemia in persons diagnosed with acute coronary syndrome. Routine monitoring and surveillance of blood uric acid levels in the general population appears to be a viable technique for proactively identifying and addressing anomalies promptly. Such a strategy has the potential to improve the possible both immediate and long-term morbidity related to hyperuricemia in the setting of cardiovascular health. This statement is consistent with a broader public health perspective and emphasizes the need of preventative actions for improved cardiovascular outcomes.

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CONFLICT OF INTEREST

Author declared no conflict of interest

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AUTHORS CONTRIBUTIONS

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MA: Conception, Design of the work, Acquistion, Data Analysis, and Drafting, Reviewed, Final approval, Agreement to be accountable.

MAR: Conception, Design of the work, Interpretation of data for the work, and Drafting, Reviewed, Final approval, Agreement to be accountable.

STS: Conception, Design of the work, Data collection, and Drafting, Reviewed, Final approval, Agreement to be accountable .

MSA: Conception, Design of the work, Data analysis, and Drafting, Reviewed, Final approval, Agreement to be accountable.

MZ: Conception, Design of the work, Data collection, Interpretation of data for the work, and Drafting, Reviewed, Final approval, Agreement to be accountable.