Correlation of Serum Uric Acid Level with Blood Pressure in Middle-aged Population: A Cross-Sectional Study from Public Sector Hospital of Islamabad

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ABSTRACT

In Pakistan hypertension is the leading cause of mortality and morbidity and is affecting approximately one-third of the population, meanwhile hyperuricemia is also highly prevalent and has important clinical implications, but association of hypertension and hyperuricemia is still a matter of debate in Pakistani population. To determine the correlation between serum uric acid and Hypertension. Cross-sectional analytical study of six month duration was carried out at at tertiary care public sector hospital of Islamabad from February to August 2019. After taking the informed written consent 100 middle-aged (40 to 65years) asymptomatic individuals visiting tertiary care hospital for the test of serum uric acid for the first time were enrolled. Beckman Coulter AU analyzers and uriucase method was used to measure uric acid as per manufacturer's instructions. Blood pressure of all enrolled participants was measured through a mercury sphygmomanometer. Demographic information of the study participant, clinical history, height, weight, family history, uric acid level and blood pressure were recorded on pre-structured questionnaire. BMI was calculated by using WHO formula. Among 100 enrolled study participants, 50 (50%) were males and 50 (50%) were females. The mean age was 50±8 years. The frequency of hyperuricemia was 16.0% and among these 93.8% were hypertensive with a significant Pearson correlation coefficientp value of 0.014. There is a significat correlation between hyperuricemia and hypertension. Our findings remain to be confirmed in future prospective studies.

Keywords: Hyperuricemia, Systolic blood pressure, Diastolic blood pressure

INTRODUCTION

Globally Hypertension is the most common chronic diseases, affecting more than one billion people (Faris et al., 2017). In the United States, it is a significant health problem, with an estimated 65 million adults suffering from hypertension (Fields et al., 2004). Increased serum uric acid levels have been associated with hypertension (Ogbera and Azenabor., 2010), diabetes (Cappuccio et al., 1993), obesity (Nakanishi et al., 1999), insulin resistance (Dehghan et al., 2008), dyslipidemia (Bonora et al., 1996) and cardiovascular diseases. Regardless of many hypertension-related successes over the years, higher-than-preferred hypertension prevalence and lower-than-optimal BP control rates reflect a continuing need for active health policy and practice (Fields et al., 2004).

Hyperuricemia is a metabolic disturbance of purine nucleotide and considered a precursor

of gout. Previous studies have examined the putative association between serum uric acid levels and blood pressure (Conen et al., 2004; Wingrove et al., 1998). Literature from Pakistan is lacking regarding association between serum uric acid levels and raised blood pressure that is not only a cardiovascular risk factor but also plays a role in renal and metabolic diseases (Lu et al., 2009). Uric acid is the end product of purine metabolism in humans (Rashid et al., 2009). High plasma uric acid causes gout and is a risk factor for cardiovascular diseases (Kuzuya et al., 2002; Lara-Castro et al., 2007). Hyperuricemia occurs in 16% of cases dying due to any cause and in 39% due to cardiovascular disease (Lin et al., 2007).

In Pakistan as both the prevelance of hypertension and hyper Ureciemia are raising to alarming level, it is the required to determine if there is any association between hyperuricemia and hypertension in adult Pakistani population.

MATERIAL AND METHODS

It was a cross-sectional analytical study. Total of 100 middle-aged individuals 40 to 65 years of age were enrolled in visiting polyclinic laboratory for the investigation of their uric acid level first time. Their blood pressure level was measured through a mercury sphygmomanometer. Systolic blood pressure ≥130 mm Hg or Diastolic blood pressure ≥85 mm Hg was defined as Hypertension and serum uric acid concentration of >7mg/dL in men and ≥5.7mg/dL in women was labelled as hyperuricemia. Demographic information of the study participant (age, gender) clinical history, height, weight, uric acid level, blood pressure, family history of hypertension, hyperuricemia was recorded on a pre-structured questionnaire. BMI was calculated by using WHO formula.

Beckman Coulter AU analyzers and uriucase method was used in hospitals lab to measure uric acid as per manufacturer's instructions. Blood pressure was measured using a sphygmomanometer after resting for more than 5 min. Those with systolic blood pressure ≥140 mmHg and diastolic blood pressure ≥90 mmHg were labelled as hypertensive (Bergler-Klein., 2019).

In order to keep patient information confidential, we used the codes only known to the researcher instead of their identifyable identities. We also used the aggregate information to present for public instead of individual information from tis limited group of patients.

The data was entered and analyzed by using SPSS version 20.0 The correlation between serum uric acid and blood pressure was determined by using the Pearson correlation coefficient. P-Value of ≤0.05 was considered statistically significant.

RESULTS

Total 100 study participants visiting tertiary care hospital were enrolled with a mean age of 50±8 years. Among them 50% were male and 50% were female. Overall 44% were literate and 56% were illiterate. The proportion of overweight was 48% while 23% were obese and only 26% of study participants were normal of normal weight. While 65% of the study participants have an elevated level of systolic blood pressure while 40% of the participants had an elevated level of diastolic blood pressure.

It is salient that males are more prone to hypertension. When we combine the systolic and diastolic blood pressure to estimate the overall hypertension status either systolic is elevated or both systolic and diastolic is raised, 71% of the patients were

hypertensive. Among females, the frequency of hypertension is 66% while for males it was 76%. About 16% of the study patients were raised serum uric acid levels (Table 1).

Table 1: General Characteristics of the Study Participants

Variables		Gender		Total
		Male	Female	
		(n=50)	(n=50)	(n=100)
Education Status	**Literate**	19(38%)	25(50%)	44
	Illiterate	31(62%)	25(50%)	56
BMI	**Under weight**	2(4%)	1(2%)	3
	Normal	16(32%)	10(20%)	26
	Overweight	26(52%)	22(44%)	48
	Obese	6(12%)	17(34%)	23
Systolic Blood Pressure	**Raise**	33(66%)	32(64%)	65
	Normal	17(34%)	18(36%)	35
Diastolic Blood Pressure	**Raise**	27(54%)	13(26%)	40
	Normal	23(46%)	37(74%)	60
Uric Acid(mg/dL)	**Raise**	4(8%)	12(24%)	16
	Normal	46(92%)	38(76%)	84

By applying the Pearson correlation coefficient, it was found that systolic and diastolic blood pressure is correlated with serum uric acid at $p \leq 0.05$ while the strength of correlation between systolic blood pressure and serum uric acid is too weak i-e SBP vs SUA= 0.199, the same is for the diastolic blood pressure DBP vs SUA= 0.217. (Table 2 & Figure 1). Table 3 suggested that hyperuricemia is significantly associated with gender and hypertension.the odds of hyperurecemia for females are1.658 times higher than males. The odds of hyperurecemia in hypertensive patients are 1.406 times higher than normotensive. Although age and Education is not significantly associated with hyperuricemia but the odds of hyperurecemia for young adult (age less than 50 years) are higher than old adult. The odds of hyperurecemia in illiterate patients are 1.41 times higher than literate.

Table 2: Correlation of serum uric acid level with Blood Pressure

	Correlation Coefficient (r)	P-Value
Systolic Blood Pressure	.199*	0.047
Diastolic Blood Pressure	.217*	0.03
*. Correlation is significant at the 0.05 level (2-tailed).		
**. Correlation is significant at the 0.01 level (2-tailed).		

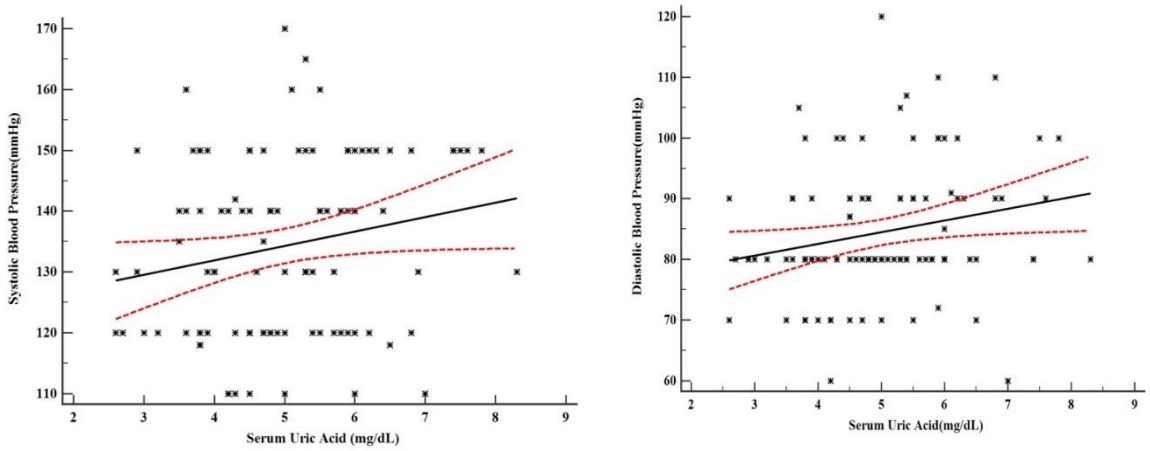

Figure 1: Corelation of serum uric acid level with systolic (left panel) and diastolic blood pressure (Right panel).

xshows scatter points of serum uric acid level and systolic and diastolic blood pressure level. The __ line was the linear regression line of the scatters in the plots. The red dash lines were the 95% Confidence interval of predicted mean. SBP, systolic blood pressure . SPSS, Statistical Package for the Social Sciences. SUA, Serum uric acid. WHO, World Health Organization. BMI, Body mass index

Table 3: Odd Ratios for hyperurecemia with multiple risk factors

Variables	Odd Ratio	95% confidence Interval	P-Value
Gender Female	1.658	1.148-2.395	0.026
Age<50	1.105	0.642-1.903	0.726
Education Illiterate	1.141	0.745-1.748	0.568
Obesity	2.365	0.754-7.420	0.133
Hypertension	1.406	1.155-1.713	0.029

DISCUSSION

The present study showed a 16% prevalence of hyperuricemia in adult population. This is almost in accordance with China 13.3%(36), Thailand 10.6% and Turkey 12.1%(37-38). Worldwide reported prevalence ranging from 2.6- 36 percent in different population (Uaratanawong et al., 2011).

The present study showed serum uric acid concentration were directly correlated with systolic and diastolic blood pressure. This positive relationship between Serum uric acid and hypertension has been described in numerous populations (Loeffler et al., 2012; Gois and Moraes Souza., 2017; Sundstrom et

al., 2005). It is evident from Several emipdimologiacal studies that hyperurecemia is accompanied with hypertension (Gois and Moraes Souza., 2017; Sundstrom et al., 2005; Yokokawa et al., 2016). It is salient to find that odds of hyperurecemia for hypertension 1.406 times higher. These findings were congruent with Lee (Lee et al., 2015) they found 1.25 higher odds of hyperurecemia for hypertension C-I (1.08-1.45).

Our study reported that the odds of hyperurecemia for females are1.658 times higher then males. This gender difference in uric acid levels in favor of women is most probably due to female gonadal hormones. Uric acid increased with age in men and women, irrespective of body mass index (Kanjilal et al., 2008). Although uric acid increases with age, this increase occurs more in women, especially after menopause. In a Chinese study, hyperuricemia was noted more in post-menopausal women (Lu et al., 2009).

This study described that hyperurecemia is associated with young adults the odds of hyperurecemia for young adults are 1.105 times higer then elders .this is consistent with findings of Chinese adults aged 41 to 50 years (Lee et al., 2015). There is a dire need to explore exact mechanism for the age-related correlation between derum uric acid and hypertension in presence of other confounders (Pogodina et al., 2014; Scheepers et al., 2017). Odds of hyperuricemia for obesity found to be 2.365 higher than normal weight/lean. This is confirmed from a study on Bangladesh adults (Ali et al., 2018).

The results of the study can not be generalized due to certatin limitation firstly because of its design and sample size, secondly more confounder like fasting glucose, lipid parameters, dietry behavior physical activity,smoking status needs to be addressed. Further studies are needed to investigate the exact mechanism between serum uric acid and blood pressure.

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