

## Association between Serum Uric Acid Levels and Hypertension: A Retrospective Study

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### Abstract

**Introduction:** Elevated uric acid levels are frequently associated with lifestyle related diseases. Serum uric acid levels also have shown to play a very important role in the development of cardiovascular morbidity and renal disease progression in the patients with hypertension. We had undertaken this study to assess the relation between elevated uric acid levels with hypertension.

**Materials and Methods:** 422 patient above the age of 18, with essential hypertension were included into this retrospective study. The medical records of these patients were reviewed for details such as medical history, age, sex, blood pressure at the time of diagnosis, the laboratory results for blood glucose levels, cholesterol and triglycerides, and the uric acid level. 50 healthy males and females with no hypertension and normal blood pressure and of similar age group were used as controls.

**Results:** The number of males were 54.7% and females were 45.3%. Many of the patients who had hypertension had a family history of elevated blood pressure. There was no significant difference in the age groups and the BMI of the patients with the controls while, there was significant difference in the urea creatinine, triglycerides and cholesterol levels among the patients with elevated uric acid and hypertension, in both males and females than the respective controls. Higher uric acid levels were observed in 64% of the males and 59% females.

**Conclusion:** We have observed a high prevalence of elevated serum uric acid levels among the patients with hypertension, irrespective of their age and gender with a positive correlation between the SUA and systolic and diastolic blood pressure.

**Keywords:** Serum Uric Acid, Hypertension, association

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### Introduction

Hypertension is one of the common health problems in the world. It is said to be the third leading killer diseases in the world and is responsible for 1 in every 8 deaths. Around 1 billion people are affected by this disease<sup>1</sup>.

Elevated uric acid levels are frequently associated with lifestyle related diseases<sup>2,3</sup>. Around 25-40% of untreated hypertensive patients have hyperuricemia<sup>4,5</sup>. There have been many studies which have described the association between obesity, dyslipidemia, and hypertension with elevated levels of uric acid in adults<sup>6-10</sup> all of which are also associated with increased risk for cardiovascular disease. Serum uric acid levels also have shown to play a very important role in the development of cardiovascular morbidity and renal disease progression in the patients with hypertension<sup>11-13</sup>. Nevertheless, it remains unknown whether uric acid is an independent risk factor, a mediator or merely a marker for the development of HT<sup>14,15</sup>.

A reasonable mechanism for the development of hypertension in hyperuricemia includes i. uric acid induced activation of renin-angiotensin system and action on glomerular apparatus<sup>16,17</sup>, increased insulin resistance and hyperinsulinaemia, which results in decreased uric acid, sodium, potassium excretion from the renal tubules<sup>18,19</sup>, Uric action in the proliferation and development of vascular smooth muscle.<sup>20</sup> However, there are associated factors such as metabolic syndrome, diabetes mellitus, chronic kidney disease, obesity, alcohol consumption, salt intake, fluid volume status which also influence the association of hypertension and hyperuricemia.

Thus, we had undertaken this study to assess the relation between elevated uric acid levels with hypertension.

### Materials and Methods

This 4 years retrospective study was conducted in the Department of Biochemistry at ACSR Government Medical College over a period of three years. 422 patients above the age of 18, with essential hypertension were included into the study. The medical records of these patients were reviewed and details such as medical history, age, sex, blood pressure at the time of diagnosis, the laboratory results for blood glucose levels, cholesterol and triglycerides, and the uric acid levels were noted. Patients already on hypertensive drugs or any other medication which can affect the

serum uric acid levels and patients with Diabetes mellitus were excluded from the study.

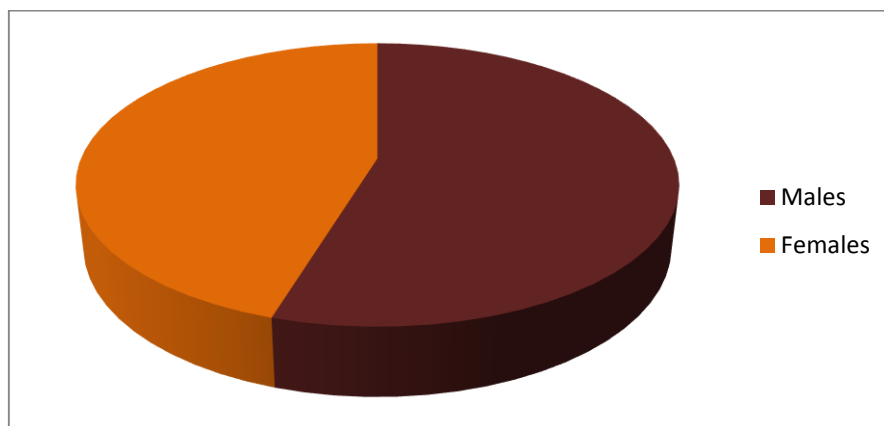
50 healthy males and females with no hypertension and normal blood pressure and of similar age group were used as controls. Blood for all the patients were collected as per the regular protocols, with 5ml of blood being collected from anticubital vein by sterile methods in a plain tube without any anticoagulants. The blood was allowed to clot for 30 minutes at room temperature

and then was centrifuged at 1000rpm for 10 minutes to obtain the sera.

The sera was then used for evaluation of blood glucose, uric acid, creatinine, Total cholesterol, HDL cholesterol and triglycerides.

**Results**

The number of males were 231(54.7%) and females were 191(45.3%) (Fig: 1). Among the controls, 28 were males and 22 were females.



**Fig. 1: Gender wise distribution of patients**

The general demographic details of all the patients and controls is given in Table: 1. Many of the patients who had hypertension had a family history of elevated blood pressure. There was no significant difference in the age groups and the BMI of the patients with the controls.

**Table 1: General demographic details of the patients**

Variables	Males	Controls	Females	Controls
Age	51.1 ± 8.2	49.6 ± 4.5	49.9 ± 7.1	50.6 ± 5.2
Weight	78.6 ± 1.5	72.8 ± 3.9	59.2 ± 5.1	55.1 ± 6.1
BMI	25.3 ± 3.2	21.4 ± 4.1	26.4 ± 5.2	22.6 ± 6.8
Smokers	14.9 %	12.5	0%	0%
Family history of hypertension	54%	35%	51%	44%

The physical and laboratory examination showed that there was significant difference in the urea creatinine, triglycerides and cholesterol levels among the patients with elevated uric acid and hypertension, in both males and females than the respective controls (Table: 2).

**Table 2: Laboratory data analysis in patients and controls**

Variables	Males	Controls	Females	Controls
SBP (mmHg)	152 ± 7	120 ± 8	160 ± 10	110 ± 11
DBP (mmHg)	99 ± 8	80 ± 7	102 ± 13	75 ± 13
SUA (µmol/l)	476 ± 25.1	321 ± 12	442 ± 23.8	286 ± 13.2
Urea (mmol/l)	6.87 ± 0.43	4.98 ± 1.23	6.76 ± 0.39	4.41 ± 0.94
Creatinine (µmol/l)	96 ± 3.12	65 ± 2.87	88 ± 3.76	59 ± 4.91
TC (mmol/l)	5.23 ± 0.24	3.91 ± 0.18	5.41 ± 0.84	3.66 ± 0.42
TG (mmol/l)	1.44 ± 0.06	1.15 ± 0.03	1.21 ± 0.07	1.10 ± 0.05
HDLc	1.18 ± 0.04	1.35 ± 0.04	1.39 ± 0.06	1.22 ± 0.06
LDLC	3.36 ± 0.09	2.41 ± 0.16	3.45 ± 0.16	2.28 ± 0.41

Higher uric acid levels were observed in 64% of the males and 59% females (Fig: 2).

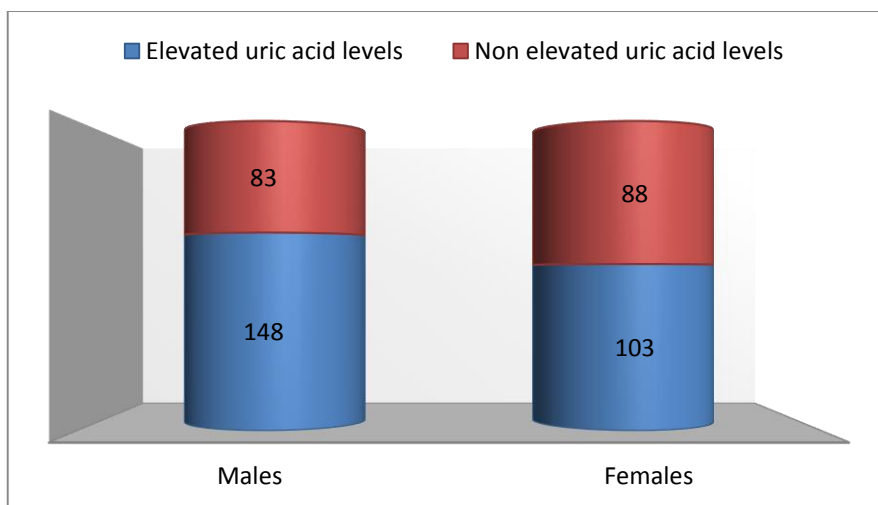


Fig. 2: Uric acid levels among patients

Statistically significant values were found in triglyceride levels and creatinine levels among the patients with abnormal uric acid levels as compared to those with normal uric acid levels. The triglycerides levels were also elevated in these patients.

Table 3: Biochemical tests analysis on basis of Uric acid Levels

Variables	Males		Females	
	Normal	Abnormal	Normal	Abnormal
SBP (mmHg)	150 ± 4	158 ± 8	159 ± 4	161 ± 6
DBP (mmHg)	90 ± 9	100 ± 6	104 ± 4	105 ± 5
SUA (µmol/l)	421 ± 21	498 ± 31	376 ± 31	461 ± 27
Urea (mmol/l)	5.41 ± 0.34	7.21 ± 0.42	5.94 ± 0.37	6.98 ± 0.33
Creatinine (µmol/l)	89 ± 3.45	109 ± 3.45	82.52 ± 4.16	92 ± 3.87
TC (mmol/l)	4.96 ± 4.27	5.61 ± 3.91	5.15 ± 0.92	5.84 ± 0.76
TG (mmol/l)	1.11 ± 0.01	1.74 ± 0.06	1.09 ± 0.03	1.42 ± 0.06
HDLC	0.95 ± 0.01	1.48 ± 0.09	1.12 ± 0.09	1.62 ± 0.05
LDLC	3.01 ± 0.10	0.79 ± 0.04	3.19 ± 0.04	3.83 ± 0.08

### Discussion

Our study shows that uric acid levels were significantly elevated in the patients with hypertension. This is consistent with another study observed by Oppathan et al<sup>21</sup> where hyperuricaemia was observed in 50% to 70% of hypertensive patients and by Emokpae et al<sup>22</sup> where hyperuricemia was found in 59% of male hypertensive patients and 62% of female patients.

A comparative lesser association was observed by Poudel et al<sup>23</sup>, where they reported 28.8% of the hypertensive patients to have higher uric acid levels, and Garrick et al reported 31%<sup>24</sup>. The mean uric acid levels in the patients was comparatively higher than in the other studies<sup>23,25,26</sup>. There was a predominance of males with higher uric acid levels than females in our study, similar case was found in another study by Poudel et al and Feig et al<sup>27</sup>.

The systolic blood pressure in males was 152 as compared to 120 in controls. In females, the range was 160 versus 110 mmHg. The mean diastolic blood pressure was 99 in males and 102 in females as

compared to 80 and 75 in controls respectively. This was in concordance to the study by Poudvel et al<sup>23</sup> and comparatively lesser than Feig et al<sup>27</sup>.

There have been several reports that suggested that SUA has an independent relationship with hypertension<sup>4,10,17</sup>. However, the SUA elevation could be a consequence of hyperinsulinemia and reduced renal function<sup>28</sup>. Insulin resistance and resultant hyperinsulinemia are thought to play an important role in the pathophysiology of metabolic syndrome<sup>29</sup> as insulin reduced the renal excretion of uric acid<sup>30,31</sup>. However, we did not measure the serum insulin levels in hyperuricemia in our study. We found that patients with higher uric acid levels have a predisposition to get hypertension.

Choi et al reported that patients on hypertensive drugs are more likely to have elevated uric acid levels, while in our study, we observed that thought the patients were not on medication, elevated uric acid levels can occur. Therefore, it is necessary to monitor

the SUA levels especially during the administration of the hypertensive drugs.

In the controls, the cholesterol levels, triglycerides and other lipoprotein levels were within the normal limits but were significantly elevated in the patients with higher SUA. This was in concordance with other studies such as Emokpae et al<sup>22</sup> while Russo et al have shown uric acid levels to be associated with lipid levels even in normal subjects<sup>33</sup> and with other metabolic syndromes<sup>14</sup>.

Association of hypertension with uric acid levels have resulted in varied conclusions probably due to the difference in the age, gender of the patients as well as the risk factors and the geographical areas of the patients.

### Conclusion

We have observed a high prevalence of elevated serum uric acid levels among the patients with hypertension, irrespective of their age and gender. There was a positive correlation between the SUA and systolic and diastolic blood pressure. Therefore, measurement of uric acid levels can help to identify the risk of hypertension among the patients.

**Conflict of Interest: None**

**Source of Support: Nil**

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