**International Journal of Medical and Health Research**
**ISSN: 2454-9142**
**Received: 28-08-2018; Accepted: 30-09-2018**
**www.medicalsciencejournal.com**
**Volume 4; Issue 10; October 2018; Page No. 215-217**

# Assessment of serum uric acid in patients suffered from essential hypertension

**Dr. Musarrat Parveen[1], Dr. Ram Binay Sinha[2*]**
[1] Tutor, Department of Biochemistry, Patna Medical College, Patna, Bihar, India
[2*] Professor & H.O.D, Department of Biochemistry, Patna Medical College, Patna, Bihar, India
[*] Corresponding Author: Dr. Ram Binay Sinha

**Abstract**
Elevated serum uric acid level has been associated with increased risk for developing hypertension. The Normative Aging Study (NAS), a longitudinal study of aging begun in 1963 and with on-going follow-up, presented a unique opportunity to examine the relationship between serum uric acid level and the development of hypertension. The duration of follow-up, ≤40 years, allowed us to assess the durability of the prospective association of uric acid level with hypertension. Hence based on the above literature and findings the present study was planned to determine the prevalence and association of serum uric acid in patients diagnosed with essential hypertension.
The current retrospective study was planned in Patna Medical College from Oct 2016 to Sept 2017 on total 80 patients were enrolled in the present study. The 40 patients were divided in the patients suffered from the essential hypertension and 40 patients were considered in the normal group as control cases. After overnight fasting, samples were collected in the morning. The samples were left standing for one hour and then serum was separated by centrifugation at 3000 rpm for 10 minutes. The samples were analysed on the same day on EM 360 fully auto analyser. Uric acid was measured using Uricase method.
The data collected from the present study concluded that the Serum uric acid can be used as a biochemical marker to determine the severity and duration of hypertension. The relation in Serum uric acid levels between hypertensive patients and normotensive patients and Serum uric acid levels have direct relation to the duration and severity of hypertension.

**Keywords:** serum uric acid, essential hypertension, hypertension stage 1, hypertension stage 2

## Introduction
Essential hypertension (also called primary hypertension or idiopathic hypertension) is the form of hypertension that by definition has no identifiable cause. It is the most common type of hypertension, affecting 95% of hypertensive patients, it tends to be familial and is likely to be the consequence of an interaction between environmental and genetic factors. Prevalence of essential hypertension increases with age, and individuals with relatively high blood pressure at younger ages are at increased risk for the subsequent development of hypertension. Hypertension can increase the risk of cerebral, cardiac, and renal events [1].
A recent classification recommends blood pressure criteria for defining normal blood pressure, prehypertension, hypertension (stages I and II), and isolated systolic hypertension, which is a common occurrence among the elderly. These readings are based on the average of seated blood pressure readings that were properly measured during 2 or more office visits. In individuals older than 50 years, hypertension is considered to be present when a person's blood pressure is consistently at least 140 mmHg systolic or 90 mmHg diastolic. Patients with blood pressures over 130/80 mmHg along with Type 1 or Type 2 diabetes, or kidney disease require further treatment [2].
Renin elevation is another risk factor. Renin is an enzyme secreted by the juxtaglomerular apparatus of the kidney and linked with aldosterone in a negative feedback loop. In consequence, some hypertensive patients have been defined as having low-renin and others as having essential hypertension. Low-renin hypertension is more common in African Americans than [[white American] s, and may explain why African Americans tend to respond better to diuretic therapy than drugs that interfere with the renin–angiotensin system.
High renin levels predispose to hypertension by causing sodium retention through the following mechanism: Increased renin→Increased angiotensin II → Increased vasoconstriction, thirst/ADH and aldosterone → Increased sodium reabsorption in the kidneys (DCT and CD) → Increased blood pressure.
Hypertension can also be caused by Insulin resistance and/or hyperinsulinemia, which are components of syndrome X, or the metabolic syndrome. Insulin is a polypeptide hormone secreted by cells in the islets of Langerhans, which are contained throughout the pancreas. Its main purpose is to regulate the levels of glucose in the body antagonistically with glucagon through negative feedback loops. Insulin also exhibits vasodilatory properties. In normotensive individuals, insulin may stimulate sympathetic activity without elevating mean arterial pressure. However, in more extreme conditions such as that of the metabolic syndrome, the increased sympathetic neural activity may over-ride the vasodilatory effects of insulin. Recent studies claim that obesity is a risk factor for hypertension because of activation of the renin–angiotensin system (RAS) in adipose tissue, and also linked renin–angiotensin system with insulin resistance, and claims that anyone can cause the other [3].

For most patients, health care providers diagnose high blood pressure when blood pressure readings are consistently 130/90 mmHg or above. A blood pressure test can be done in a health care provider's office or clinic. To track blood pressure readings over a period of time, the health care provider may ask the patient to come into the office on different days and at different times. The health care provider also may ask the patient to check readings at home or at other locations that have blood pressure equipment and to keep a written log of results. The health care provider usually takes 2–3 readings at several medical appointments to diagnose high blood pressure. Using the results of the blood pressure test, the health care provider will diagnose prehypertension or high blood pressure if:

- For an adult, systolic or diastolic readings are consistently higher than 120/80 mmHg.
- A child's blood pressure numbers are outside average numbers for children of the same age, gender, and height [4].

Once the health care provider determines the severity, he or she can order additional tests to determine if the blood pressure is due to other conditions or medicines or if there is primary high blood pressure. Health care providers can use this information to develop a treatment plan [4].

Elevated serum uric acid level has been associated with increased risk for developing hypertension. The Normative Aging Study (NAS), a longitudinal study of aging begun in 1963 and with on-going follow-up, presented a unique opportunity to examine the relationship between serum uric acid level and the development of hypertension. The duration of follow-up, ≤40 years, allowed us to assess the durability of the prospective association of uric acid level with hypertension.

The mechanism (s) by which uric acid may engender organ damage is still incompletely understood, but there is increasing evidence that endothelial dysfunction is a fundamental mechanism whereby this substance may affect cardiovascular and renal function and structure.

Hence based on the above literature and findings the present study was planned to determine the prevalence and association of serum uric acid in patients diagnosed with essential hypertension.

## Methodology

The current retrospective study was planned in Patna Medical College from Oct 2016 to Sept 2017 on total 80 patients were enrolled in the present study. The 40 patients were divided in the patients suffered from the essential hypertension and 40 patients were considered in the normal group as control cases.

All the patients were informed consents. The aim and the objective of the present study were conveyed to them. Approval of the institutional ethical committee was taken prior to conduct of this study.

After overnight fasting, samples were collected in the morning. The samples were left standing for one hour and then serum was separated by centrifugation at 3000 rpm for 10 minutes. The samples were analysed on the same day on EM 360 fully auto analyser. Uric acid was measured using Uricase method.

Following was the inclusion and exclusion criteria for the present study:

**Inclusion criteria**

- Hypertensive patients, whom are of new-onset and recent onset
  (<1-year) without any target end organ damage
- Age group between 40 and 60 years
- Both sexes were included.

**Exclusion criteria**

- Hypertensive patients with target end organ damage
- Hypertensive heart disease as evidenced by left ventricular hypertrophy - electrocardiogram-voltage criteria
- Diabetes mellitus-Type 1 and type 2 or metabolic syndrome
- Patients with chronic kidney disease

## Results & Discussion

This hospital based cross sectional analytical study was carried out among 40 cases attending outpatient or indoor cases in department of Biochemistry in a tertiary healthcare institute, while 40 were the other cases without hypertension or any association with raised serum uric acid levels.

**Table 1:** Comparison of Clinical Findings

| Group | Group A | Group B |
|---|---|---|
| **Cases of** | **Essential Hypertensive** | **Control** |
| No, of Cases | 40 | 40 |
| Age | 44- 56 | 45 – 58 |
| Males | 25 | 29 |
| Females | 15 | 11 |
| Systolic Blood Pressure(mmHg) | 146 – 162 | 108- 126 |
| Diastolic Blood Pressure(mmHg) | 88- 101 | 72- 80 |
| Body Mass Index (kg/m$^2$) | 21.5- 26.3 | 20.9 – 24.5 |
| Haemoglobin (gm%) | 10.8 – 13.9 | 11.3 – 13.5 |

**Table 2:** Study of Serum Uric acid

| Group | Group A | Group B |
|---|---|---|
| Cases of | Essential Hypertensive | Control |
| Serum Uric Acid(mg/dl) | 4.7 – 7.9 | 3.5 – 5.1 |

In our study it was found that there is definite relation in serum uric acid levels between hypertensive patients and normotensive patients and there is a directly proportional relation in the levels of serum uric acid in relation to the severity of hypertension, though it is not of a linear correlation. Also it was found that there was no significant difference in the levels of serum uric acid in hypertensive on treatment as compared to those not on treatment. Hence the possibility of serum uric acid acting by the production of free radicals and causing oxidative stress leading to hypertension and whether the duration and severity of hypertension lead to renal dysfunction in the form of nephrosclerosis leading to higher levels of serum uric acid has to be considered as various other studies have also shown to have a positive relation in the serum uric acid levels and hypertension.

Many studies reported a positive relationship between uric acid and essential hypertension whereas some demonstrated that uric acid did not relate significantly to essential

hypertension. In various studies it was shown that serum uric acid is associated with myocardial infarction, cardiac failure, increased death in myocardial infarct patients and association with Cerebrovascular accident and its recurrence [5].

In male hypertensives there was a non- significant increase in serum uric acid levels when compared with female hypertensives & this finding was consistent with Abdalla Jarari *et al* study [6]. The present study revealed that the incidence and severity of hyperuricemia between cases and controls correlated significantly with the severity of hypertension. This was consistent with the Breckenridge studies [7]. Our study is consistent with the study of Tykarski *et al* in that there is a positive correlation between serum uric acid and severity of hypertension [8].

In the study of Breckenridge excretion of uric acid and uric acid clearance were lower in all hypertensive patients than in the normal group. When the uric acid clearance was expressed per 100ml of glomerular filtrate, there was no significant difference between normal subjects and hypertensive patients who had normal serum uric acid levels, but the difference between those 2 groups and the hyperuricemic hypertensive was significant and they suggested a renal tubular abnormality in the handling of uric acid, the nature of the abnormality which was not clear. Later Messerli *et al* showed that hyperuricemia in hypertensive is due to early renal vascular involvement, namely nephrosclerosis [9]. Serum uric acid rises because of impaired renal tubular function, which is the main site of regulation of serum uric acid due to nephrosclerosis.

Breckenridge in his study showed an increasing incidence of hyperuricemia as the diastolic BP increased in his study, but there was no tendency for hyperuricemia to occur, only with patients with more severe hypertension.

## Conclusion

The data collected from the present study concluded that the Serum uric acid can be used as a biochemical marker to determine the severity and duration of hypertension. The relation in Serum uric acid levels between hypertensive patients and normotensive patients and Serum uric acid levels have direct relation to the duration and severity of hypertension.

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