Study of uric acid and lipid profile in recent onset essential hypertension

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Abstract
Introduction: Hypertension is a major public health problem. Uric acid is emerging as one of the strongest risk factors for hypertension. Alteration in lipid profile has been identified as independent risk factor for hypertension.

Aim: The aim of our present study was to determine the association of uric acid and lipid profile with hypertension of recent onset.

Materials and Methods: 45 subjects with age group between 20-50 yrs with recent onset essential hypertension were taken as test group. Control group comprised of 45 healthy, age and sex matched controls satisfying the exclusion criteria. Serum Uric acid, TC, HDL-C,LDL-C, TG’S were determined by enzymatic methods using commercially available kits on a fully automated analyzer. VLDL was a calculated parameter.

Results: In the test group the mean uric acid levels in males and females were 6.1 ± 0.78 mg/dl and 5.5 ± 0.93 mg/dl respectively. The mean uric acid levels among males and females in the control population was 4.2 ± 0.81 and 4.1± 0.56 mg/dl respectively. A significant difference in uric acid levels between the test group and control group both among males (p= 0.039) and females (p= 0.041) was observed. Among the lipid profile parameters. The mean Total cholesterol and Triglycerides were high in cases as compared to controls with p-values of 0.046 and 0.038 respectively. In test group higher mean values for HDL – C, LDL-C, VLDL were found as compared to controls but the increase was not statistically significant.

Conclusion: A significant association of UA with Hypertension both among males and females was observed in our study. Among the lipid profile parameters a significant association was found between Total cholesterol, Triglycerides and hypertension.

Keywords: Hypertension, Uric acid, Lipid profile.

Introduction

Hypertension is emerging as a major public health problem affecting 1 in every 4 individuals.1 Few studies suggest that one third of people are unaware of their hypertensive status, among the identified 40% are not on any medication, even among the patients identified and treated two thirds do not have their hypertension controlled to the level less than 140/90 mmHg.2 Hypertension is one of the most important risk factors for development of cerebral, cardiovascular and renal diseases.3 Worldwide increased blood pressure is estimated to cause 7.5 million deaths which accounts to 12.8% of total annual deaths.4 In India prevalence of hypertension varies from 17%- 21%.5 In various studies on hypertension, hyperuricemia as a risk factor, marker was extensively studied.6-8 According to Canon et al serum uric acid levels greater than 6.5 mg/dl has been found in 25-40% of their hypertensive patients and a serum uric acid concentration of 5.5 mg/dl was found in the remaining 60% of hypertensive patients included in their study. A linear relationship between serum uric acid and systolic blood pressure was found by them.10 Lack of proper understanding exists as regards role of uric acid in causation of hypertension. Reduction of nitric oxide, Renin angiotensin aldosterone system activation might be the possible mechanisms according to some studies.11 Possible role of increased uric acid in causation of hypertension at an younger age group was suggested by some studies.5,7

Alteration in serum lipid profile has been identified as an independent risk factor for essential hypertension.12,13 An abnormal change in lipid profile in hypertensives as compared to normal population was shown in many studies but it lacks specificity. Some studies suggest that hypercholesterolemia potentiates the effect of vaso constrictors such as endothelin1 and endothelin 2 on endothelium reduces nitric oxide production causing vasoconstriction leading to hypertension.14 Some studies suggest that hypertension might increase lipid oxidation enzymes causing formation of oxidised LDL leading to atherogenesis. Whether dyslipidemia is cause of hypertension or is an effect of hypertension is not clearly known. The aim of our present study was to determine the association of uric acid and lipid profile with recent onset hypertension.

Materials and Methods

The present study was undertaken in Department of biochemistry Kamineni academy of medical sciences and research centre, Hyderabad. This was a case control study done in collaboration with department of General medicine of the same institute from May – Oct 2016. Prior to the commencement of the study institutional ethical clearance was taken. A total of 90 subjects were enrolled into this study. They were divided in to two groups. 45 subjects between age group 20-50yrs with recent onset of essential hypertension less than one year of duration were included in test group. 45 age and sex
matched healthy subjects were included in control group. The participation of the subjects was on voluntary basis and informed consent was obtained.

The following were the Inclusion and exclusion criteria:

**Inclusion criteria:**
1. Patients with Hypertension of less than one year duration
2. No target end organ damage.
3. Males and Females between age group of 20-50 yrs.

**Exclusion criteria:**
1. Patients with hypertension more than one year duration.
2. Target end organ damage.
3. Patients suffering from type 1 and type 2 diabetes mellitus
4. Metabolic syndrome.
5. Body mass index greater than 30.
6. Coronary artery diseases
7. Chronic kidney disease
8. Cerebro – vascular diseases
9. Metabolic diseases
10. Chronic liver disease.
11. Myocardial infarction.
12. Endocrine disorder – hypothyroid patients.
13. Psoriasis patients.
14. Chronic alcoholics.

### Table 1: Demographic distribution of groups

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Hypertensive patients cases (n=45)</th>
<th>Healthy controls (n=45)</th>
<th>p – value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>41.2 ± 5.3</td>
<td>39.6± 7.5</td>
<td>0.13</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>23 (51.1)</td>
<td>21 (46.6)</td>
<td>0.55</td>
</tr>
<tr>
<td>Females</td>
<td>22 (48.8)</td>
<td>24 (53.3)</td>
<td>0.62</td>
</tr>
<tr>
<td>Systolic BP</td>
<td>139 ± 6.2</td>
<td>117± 3.6</td>
<td>0.04*</td>
</tr>
<tr>
<td>Diastolic BP</td>
<td>90± 3.2</td>
<td>79± 2.6</td>
<td>0.038*</td>
</tr>
</tbody>
</table>

* P-value<0.05-significant

The mean age of control group and test group was 41.2 ± 5.3 and 39.6 ± 7.5 respectively. The test group included 23 males (51.1%) and 22 females (48.8%), the control group included 21 males (46.6%) and 24 females (53.3%) (Table 1). The mean Systolic blood pressure of test group and control group were and 139 ± 6.2 and 117 ±3.6 mm of Hg respectively (p=0.04). The mean Diastolic blood pressure of test group and control group were 90± 3.2 and 79±2.6 mm of Hg respectively (p=0.038) (Table 1).

### Table 2: Normal ranges for Uric acid & Lipid profile parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Normal range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uric acid (males)</td>
<td>3.4 – 7.0 mg/dl</td>
</tr>
<tr>
<td>Uric acid (Females)</td>
<td>2.4 – 5.7 mg/dl</td>
</tr>
<tr>
<td>Total Cholesterol</td>
<td>&lt; 200 mg/dl</td>
</tr>
<tr>
<td>HDL - Cholesterol (males)</td>
<td>40-60 mg/dl</td>
</tr>
<tr>
<td>HDL - Cholesterol (Females)</td>
<td>40-65 mg/dl</td>
</tr>
<tr>
<td>LDL - Cholesterol</td>
<td>&lt; 100 mg/dl</td>
</tr>
<tr>
<td>VLDL - Cholesterol</td>
<td>15 – 40 mg/dl</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>Less than 150 mg/dl</td>
</tr>
</tbody>
</table>
Table 3: Parameter wise distribution of results in groups

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test group (n = 45)</th>
<th>Control group (n = 45)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting Blood Sugar (mg/dl)</td>
<td>97.1 ± 5.4</td>
<td>95.6 ± 6.8</td>
<td>0.11</td>
</tr>
<tr>
<td>TSH (µIU/ml)</td>
<td>2.3 ± 0.77</td>
<td>2.2 ± 0.92</td>
<td>0.86</td>
</tr>
<tr>
<td>Total Cholesterol (mg/dl)</td>
<td>192.6 ± 28.6</td>
<td>176.2 ± 16.2</td>
<td>0.046*</td>
</tr>
<tr>
<td>HDL-Cholesterol (mg/dl)</td>
<td>45.6 ± 5.1</td>
<td>44.1 ± 4.8</td>
<td>0.162</td>
</tr>
<tr>
<td>LDL-Cholesterol (mg/dl)</td>
<td>94.6 ± 11.3</td>
<td>87.4 ± 9.6</td>
<td>0.134</td>
</tr>
<tr>
<td>VLDL-Cholesterol(mg/dl)</td>
<td>29.5 ± 8.9</td>
<td>23.4 ± 6.1</td>
<td>0.054</td>
</tr>
<tr>
<td>Triglycerides (mg/dl)</td>
<td>150.6 ± 40.9</td>
<td>114.7 ± 30.5</td>
<td>0.038*</td>
</tr>
</tbody>
</table>

* P-value<0.05-significant

Fig 1: Gender wise distribution of uric acid levels in test and control group

Table 4: Showing comparision of uric acid levels (overall) among test and control groups

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test group</th>
<th>Control group</th>
<th>P –value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uric acid</td>
<td>5.8 ± 0.85</td>
<td>4.1± 0.68</td>
<td>0.040*</td>
</tr>
</tbody>
</table>

Table 5: Showing comparision of uric acid levels among gender in test and control groups

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test group</th>
<th>Control group</th>
<th>P –value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uric acid (males)</td>
<td>6.1 ± 0.78</td>
<td>4.2 ± 0.81</td>
<td>0.039*</td>
</tr>
<tr>
<td>Uric acid (females)</td>
<td>5.5 ± 0.93</td>
<td>4.1± 0.56</td>
<td>0.041*</td>
</tr>
</tbody>
</table>

* P-value<0.05-significant

In the test group the mean uric acid levels in males and females were 6.1 ± 0.78 mg/dl and 5.5 ± 0.93 mg/dl respectively. The mean uric acid levels among males and females in the control population was 4.2 ± 0.81 and 4.1± 0.56 mg/dl respectively. A significant difference in uric acid levels between the test group and control group both among males (p= 0.039) and females (p= 0.041) was observed (Table 5).

There was positive correlation between systolic BP and uric acid.

Fig. 3: Correlation between Diastolic BP and uric acid

There was a positive correlation between diastolic BP and uric acid.

The mean Total Cholesterol value of test group (192.6 ± 28.6 ) was higher as compared to controls (176.2 ± 16.2) and this difference in mean was statistically significant (p=0.046). The mean HDL-
cholesterol values of test group was 45.6 ± 5.1 where as
those of controls was 44.1± 4.8 but the difference was
not statistically significant (p=0.162). The mean LDL-
cholesterol of test group was 94.6 ± 11.3 while in
controls was 87.4 ± 9.6 Though there was an increase in
LDL cholesterol in test group as compared to controls
this difference was not statistically significant (p=0.134).

The mean VLDL value of test group (29.5 ± 8.9)
was higher as compared to controls (23.4 ±6.1) but the
difference was not statistically significant (p= 0.054).
The mean Triglyceride values of test group was 150. 6 ±
40.9, those of controls was 114.7 ± 30.5. This difference
in mean was statistically significant (p=0.038) (Table 3).

Discussion

Hypertension is one of the causes of morbidity
worldwide.6 In cardiovascular,cerebral and renal
diseases hypertension is an important risk factor.3 In
pathogenesis of hypertension hyperuricemia is an
important risk factor.6 The proposed mechanism of increase in uric acid causing
hypertension might be:

a) Constriction of renal vasculature by inhibition of
Nitric oxide pathway and activation of renin angiotensin
aldoosterone pathway leading to blood pressure
elevation.16

b) Vascular smooth muscle cell proliferation leading to
irreversible damage to small renal vessel causing
persistent hypertension.16

The mean age of participants included in the present
study was 40.2 yrs. The test group showed an increase in
uric acid levels(5.8 ± 0.85 mg/dl) as compared to control
group (4.1 ± 0.68 mg/dl) and this difference in mean was
statistically significant (p=0.04). More so among males
a significant difference in Uric acid levels (p = 0.039)
was found in test group as compared to control group.
Even among females a significant difference in Uric acid
levels (p = 0.041) was found in test group as compared
to control group.

Fredrick akbar mohammed was first to document an
association of Uric acid with hypertension.17 Extensive
research was done to determine mechanism of the uric
acid induced hypertension but were inconclusive .
Plasma uric acid level as a predictor of increased risk of
hypertension was reported by Hunt et al in a prospective
study done in Utah.9 Similar association between Uric
acid and Hypertension was reported in japanese men by
Taniguchi et al.18 A 20% increased risk of hypertension
per 1 mg/dl increase of Uric acid were found by them.
Eshwar Krishnan et al19 in a follow up study found that
normotensive men with baseline hyperuricemia had an
80% excess risk for incident hypertension compared to
those who had normal serum uric acid concentration.
Another follow up study by sundstrom et al20 summarized uric acid as an independent risk factor of
hypertension incidence. They observed a 13% increase
in risk for each mg/dl increase in uric acid.

On contrary to other studies study by John P forman
et al16 (mean age = 61yr) showed no significant
association of plasma uric acid with incident
hypertension. In their study they specified that the role
of hyperuricemia in causation of hypertension was
prominent in the younger age group subjects. They stated
that earlier studies showing the association of uric acid
with hypertension were done in a population < 50yrs
(sundstrom et al mean age = 48.7yrs, Taniguchi et al
mean age = 41yrs). In a study done by N.N. Anand et al7
they discussed that the strength of association of uric
acid with hypertension decreases with increase in age of
the participants, suggesting Uric acid might have a role
in causation of early onset hypertension in young
subjects. This statement was supported by another study
done by Sujeet Raina et al.8

Alteration in serum lipid levels has been identified
as an independent risk factor for essential hypertension.
Halperin et al13 showed that dyslipidemia in apparently
healthy individuals leads to hypertension. Many studies
have reported an abnormal change in Total cholesterol,
Triglycerides and other lipid fractions more frequently in
hypertensives as compared to normal population but the
pattern of abnormality lacks specificity. Increase in Total
Cholesterol, LDL-C, TG’s was observed in
hypertensives as compared to controls in studies done by
Charles osuji et al21 Oladayo et al.22

Elevated Total cholesterol (p =0.046) and
Triglyceride levels (p= 0.038) were found in
hypertensive patients as compared to controls in our
present study and this increase was statistically
significant. This was in accordance with studies done by
Charles osujietal and Oladayo et al.21,22 The pathological
mechanism underlying this phenomenon is not clear.

No statistically significant increase was seen in
VLDL, LDL-C in the hypertensive group as compared to
controls in our study. This non significance might be due
to the low sample size studied. The mean HDL-C values
of hypertensive group and control group showed no
major difference and this was in accordance with the
earlier studies.21,22

Conclusion

A significant association between uric acid and
hypertension was found in our study. More over the
increase was also significant in males & females of test
group as compared to control group. There was also a
significant association between Total cholesterol,
triglyceride levels and hypertension in our study but
other lipid parameters lack significant association. The
low sample population included in this study might be
one of the probable causes for this lack of association.
Further studies on a large population groups might
increase our understanding of uric acid and lipid profile
with hypertension. The control of hyperuricemia in the
young subjects by change in diet and medication might
help in reduction of incidence of Hypertension.
References


