A STUDY ON CORRELATION OF SERUM URIC ACID LEVELS WITH SPIROMETRIC PARAMETERS OF COPD PATIENTS- A HOSPITAL BASED CROSS SECTIONAL OBSERVATIONAL STUDY

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ABSTRACT

BACKGROUND

Chronic Obstructive Pulmonary Disease (COPD) is an umbrella term used to describe a variety of clinical conditions with progressive lung diseases. So far there are few evidences that there is a positive relationship between oxidative stresses related biomarkers and pulmonary function.¹ Uric acid has antioxidant property and anti-inflammatory role when present in high levels. In this study, we examined the association between spirometric measures and serum uric acid levels in clinically stable patients attending OPD.

METHODS

This was a single centre nonrandomised prospective cross-sectional observational study. The diagnosis and classification of COPD was based on assessment of airflow limitation by post bronchodilator spirometry in stable condition. Patients were classified based on GOLD criteria. Principle used in serum uric acid estimation was uricase method by auto analyser.

RESULTS

70 subjects were enrolled in our study. There is a positive association of serum uric acid level with smoking with odds ratio of 1.0704. The mean serum uric acid level rises with worsening GOLD stages which is shown in our study is statistically significant (p<0.05).

CONCLUSIONS

There is a relation of serum uric acid and the progress of disease in the patients suffering from COPD. Results of the study have improved our understanding regarding role of serum uric acid in COPD in Indian Population.

KEYWORDS

COPD, Serum Uric Acid, GOLD Criteria

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The rate of decline of FEV1 can be used to assess susceptibility in cigarette smokers, progression of the disease and reversibility of the airways obstruction. It is important that a volume plateau is reached when performing the FVC; this can take 15 s or more in patients with severe airways obstruction. If this manoeuvre is not carried out, the FVC can be underestimated.

The measurement of FEV1 is largely effort dependent, so it is necessary to ensure maximum effort has been achieved by the patient in addition that full expiration has been performed. It has been suggested that the standard ATS criteria should be modified to encourage a maximum expiratory effort during the first part of the manoeuvre and then a ‘relaxed’ expiration when expiratory airflow falls to less than 200 mL/s.

We wanted to determine the association of serum uric acid levels with increasing severity of COPD in 70 outpatients presenting to our hospital in TMCH, Thanjavur, evaluate the variation in uric acid levels among smoking and non-smoking population and study the association of uric acid levels with age, sex and BMI of the patients.

**METHODS**

**Study Design**
This was a single centre nonrandomised prospective cross-sectional observational study in determining the correlation between serum uric acid level and severity of COPD as assessed by spirometry.

**Study Period**
Patients in and around Thanjavur district attended OPD at Thanjavur Medical College hospital during the period between Nov 2017 to Jun 2018 were taken up for this study.

**Inclusion Criteria**
This study includes both male and female patients of age more than 40 years. All are outpatients already diagnosed as a case of COPD. Patients having minimal complaints. Patients who gave informed consent.

**Exclusion Criteria**
Patients with acute exacerbation, patients with history of active respiratory disease other than COPD at the time of study, patients with past history of tuberculosis and recent history of hospital admission for respiratory complaints, patients on uricosuric drugs, pregnant patients, patients with history of hypertension, diabetes mellitus, chronic kidney disease, cardiac failure, liver diseases, malignancy, gout.

Patients were subjected to the following-
1. Thorough assessment of medical history to rule out co-morbid illness.
2. Full clinical assessment so that patients in acute exacerbation requiring admissions were not included.
3. ECG
4. Chest X ray
5. Blood samples for blood sugar, renal function test and serum uric acid level measurement.

**PFT Protocol**
The diagnosis and classification of COPD were based on assessment of airflow limitation by post bronchodilator spirometry in stable condition.

It was done using electronic spirometer. The results were reported in absolute volumes and in percent predicted based on regression equations. The measurements included forced vital capacity (FVC), forced expiratory volume at 1 second (FEV1), ratio of FEV1/FVC, peak expiratory flow rate. Patients were classified based on Gold Criteria as follows-

<table>
<thead>
<tr>
<th>Gold Stages</th>
<th>FEV1/FVC Ratio</th>
<th>FEV1%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage I</td>
<td>&lt;70%</td>
<td>≥ 80% of Predicted</td>
</tr>
<tr>
<td>Stage II</td>
<td>&lt;70%</td>
<td>50%-80% of Predicted</td>
</tr>
<tr>
<td>Stage III</td>
<td>&lt;70%</td>
<td>30%-50% of Predicted</td>
</tr>
<tr>
<td>Stage IV</td>
<td>&lt;70%</td>
<td>&lt; 30% of Predicted or &lt;50% with Signs of Respiratory Failure</td>
</tr>
</tbody>
</table>

Uricase Method by Auto Analyser was used to determine uric acid levels. Reference Range for male: 3.5 - 7.2 mg/dl, for female: 2.6 - 6.0 mg/dl.

**RESULTS**

Among 70 patients included in this study, 61 were males (87.14%) and 9 patients were females (12.86%).

Among 70 patients, majority of patients comes underage group of 50-60 years- 29 patients (41.43%). Followed by 40-50 age group- 24 patients (34.29%), and 60-70 age group- 16 patients (22.86%). Only one patient is in the age more than 70 years (1.43%).
52 of total 70 patients were smokers (74.29%), and 18 were non-smokers (25.71%) in their lifetime. Also, that all 9 females in this study were non-smokers.

### Table 1. Mean Serum Uric Acid Level and Sex

<table>
<thead>
<tr>
<th>Gender</th>
<th>Number of Patients</th>
<th>Mean Serum Uric Acid Level</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>61</td>
<td>6.550</td>
<td>2.094</td>
</tr>
<tr>
<td>Females</td>
<td>9</td>
<td>6.700</td>
<td>1.816</td>
</tr>
</tbody>
</table>

In this study the mean serum uric acid level in males were 6.55(±2.094) and in females were 6.700(±1.816). The uric acid levels also vary according to the smoking history. The details are as follows.

### Table 2. Smoking and Mean Uric Acid Level

<table>
<thead>
<tr>
<th>Smoking History</th>
<th>Number of Patients</th>
<th>Mean Uric Acid Level</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoker</td>
<td>52</td>
<td>6.697</td>
<td>2.002</td>
</tr>
<tr>
<td>Non-Smoker</td>
<td>18</td>
<td>6.202</td>
<td>2.196</td>
</tr>
</tbody>
</table>

It is clearly shown that the average uric acid level is more among smokers than in non-smokers.

### Table 3. Association Between High Uric Acid Levels and Smoking

<table>
<thead>
<tr>
<th>Smoking</th>
<th>High Uric Acid Level</th>
<th>Normal Uric Acid Level</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>(28.27%) 8</td>
<td>(27.7%) 10</td>
<td>52</td>
</tr>
<tr>
<td>No</td>
<td>(22.22%) 4</td>
<td>(27.7%) 5</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>15</td>
<td>43</td>
</tr>
</tbody>
</table>

About 24 patients (46.15%) of the smokers had high uric acid level. 9 non-smokers (50%) also had high uric acid level in this study? This shows odds ratio of 1.0704 indicating a positive correlation between smoking and serum uric acid levels.

### Table 4. Mean Serum Uric Acid Levels in Each Gold Stage

<table>
<thead>
<tr>
<th>Gold Stage</th>
<th>No. of Patients</th>
<th>Mean Uric Acid Level</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>24</td>
<td>5.590</td>
<td>1.34</td>
</tr>
<tr>
<td>III</td>
<td>39</td>
<td>6.902</td>
<td>1.97</td>
</tr>
<tr>
<td>IV</td>
<td>5</td>
<td>8.072</td>
<td>1.86</td>
</tr>
</tbody>
</table>

Serum uric acid is found to be high in patients with gold stage IV COPD, followed by stage III and II. This result has a P value of 0.0045 (<0.05) which is statistically significant. The analysis was made using ANOVA, a parametric test for inequality of population means. This clearly tells us that serum uric acid raises in accordance to the severity of COPD.

### Table 5. Association of Mean Uric Acid Level of Smokers with their Gold Stage

<table>
<thead>
<tr>
<th>Gold Stage</th>
<th>No. of Patients Smoking</th>
<th>Mean Uric Acid Level</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>18</td>
<td>5.73</td>
<td>1.85</td>
</tr>
<tr>
<td>III</td>
<td>27</td>
<td>6.98</td>
<td>1.88</td>
</tr>
<tr>
<td>IV</td>
<td>7</td>
<td>8.07</td>
<td>1.86</td>
</tr>
</tbody>
</table>

Among 52 smokers, 18 smokers had GOLD stage II with mean uric acid of 5.73(±1.85). 27 in GOLD stage III had mean value of 6.98(±1.88) and 7 in GOLD IV with mean value of 8.07(±1.86).

Analysis of this data by ANOVA, parametric test showed a P value of 0.0149 which is statistically significant.

**DISCUSSION**

1. We found a strong association between serum uric acid levels with smoking.
2. We found a strong relation between serum uric acid with severity of COPD.
3. We may conclude that serum uric acid may be used as a screening test for assessing severity of COPD.
4. We may predict the treatment response by serial uric acid monitoring of the patients.

All the observations found in this study is comparable with the previous studies. We found that maximum number of patients belonged to 50-60 years. The mean age of patients enrolled in the study is 53.55±8.22 (standard deviation) years. Study done by Jain ET al6 and Sinha ET al7 had a mean age of 60.61±10.36 and 46±13 years respectively. A study by Xin ET al8 showed 33% of his subjects had high uric acid level, which is quite comparable with our study. These results were comparable with work done by Atsuro ET al9 which demonstrated serum uric acid levels in range of 5.7±1.4 among smokers and 4.8±1.3 among non-smokers. Also, in work done by Mouhamed ET al10 smoker and non-smoker uric acid levels were 5.67±1.66 and 3.41±1.66 respectively. The observations in our study is very comparable with the other works previously done.

Our study shows increasing levels of uric acid with increasing severity of COPD by GOLD staging. The results were compared with ANOVA parametric test which showed a P value of 0.0045 (<0.05) which is clinically significant. In a study by Kocak ET al11 mean uric acid in GOLD stages were 5.9(±1.3), 6.0(±1.7) and 6.1(±1.6) in stage II, III and IV respectively. The above study also shows that uric acid is high as the COPD worsens.

**CONCLUSIONS**

As serum uric acid is a widely available test which is routinely done, and also easy to interpret and economical, it can be used in identifying the COPD patients who are more prone for exacerbations and may need early intensive management.
Limitations
1. The number of subjects in this study is less.
2. The number of females enrolled in this study is less.
3. Only stable patients without exacerbations were included and correlation with acute exacerbations were not touched.
4. Though most of the comorbid conditions like hypertension, renal failure were eliminated, still there is chance of confounding factors.
5. The correlation of uric acid with the outcome of the patient is lacking.

REFERENCES