A study of serum uric acid levels in chronic obstructive pulmonary disease

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Abstract

Hyperuricemia as a predictor in COPD and Exacerbation. The study aims to measure serum uric acid levels in patients with chronic obstructive pulmonary disease as a predictor.

Materials and Methods: It is an observational study done on 50 COPD patients newly diagnosed or previously diagnosed. Serum uric acid level, chest x-ray and pulmonary function tests were performed with consent.

Results: The mean normal Serum uric acid (mg/dl) was 4.86 ± 1.6. The increased mean serum uric acid (Hyperuricemia) was 9.67 ± 1.8. The mean serum urea and creatinine levels were 26.74 ± 3.91 and 0.94 ± 0.20. The $FEV_1\%$ Predicted in Normal UAC – 51.8 ± 18.6 and in cases of Hyperuricemia 53.4 ± 16.7. FVC% Predicted in Normal UAC was 77.5 ± 17.8 in cases of Hyperuricemia it was 76.5 ± 18.5.

Conclusion: The outcome of our study shows serum uric acid is cost-effective, easy and non-invasive and possibly suitable in assessing the patient disease severity, progression to exacerbation.

Keywords: COPD, Serum uric acid, Hyperuricemia, Predictor.

Introduction

Chronic obstructive pulmonary disease (COPD) is a disease causing limitation of airflow due to inflammation of airways with parenchymal destruction and subsequent emphysema formation. Inflammatory mechanisms are mediated by IL-6, IL-8 and TNF-alpha leads to systemic inflammation and worsening of comorbid illness.[1]

Serum uric acid is the final product of purine degradation, which increases significantly during hypoxia.[2,3] Elevated uric acid levels have been associated with the presence of systemic inflammation and increased cardiovascular risk.[4,5] In this context, increased levels of uric acid have been shown in respiratory disorders, including obstructive sleep apnoea and pulmonary hypertension.[6,7]

Therefore the worse outcome of COPD patients with hyperuricemia seems to involve several factors including systemic inflammation, oxygen desaturation and lung function alterations. Hyperuricemia is also associated with an increased risk of coronary heart disease, comorbidity that is relevant for mortality in COPD patients.[8,9]

However some data exist on the significance of serum uric acid in patients with COPD, few more studies are warranting to add the evidence. Thus, the study aims to measure serum uric acid levels in patients with chronic obstructive pulmonary disease as a predictor in staging.

Materials and Methods

Study design and setting
This is a hospital-based observational study carried out in the department of General Medicine, Aarupadai Veedu Medical College & Hospital.

Sample size and sampling
Based on the Patients availability and feasibility during the study period, we considered 50 as sample size.

Study participants
Newly or previously diagnosed stable COPD patients were the study participants. All patients aged 30 to 70 years including males and females, smokers and non-smokers were included. Patients with chronic kidney disease, diabetes mellitus, myocardial infarction, gout, hypertension are excluded from the study.

Data and Statistical analysis
We collected patient's basic preliminary history and the required investigations were serum uric acid level, chest x-ray and pulmonary function tests. Data were entered in excel sheet and imported into Epi info for analysis. Descriptive analysis was done. The chi-square statistics were used for the test of significance.

Ethical issues
This study was approved by the Institutional Ethics Committee. After obtaining informed oral and written consent from patients we included them in the study.

Results

Table 1: Patient Demographic

Age (Mean)	58.78 ± 8.4
Sex	Male -39*
	Female - 11
Current smoker or H/o previous smoker	39*
Occupational exposure	17
Bio Mass fuel	3
Geographic place	Urban -36*
	Rural -14

*P value <0.005

Table 1, explains the patient demographic details, the mean years of age was 58.78+8.4. Out of 50 study participants, 39 were males, which is significantly higher than the females (<0.005). The current smokers or patients with previous history of smoking is 39. All the 39 males presented with this category. About 17 (34%) had occupational exposure. Only 3 (6%) had Biomass fuel exposure. Regarding the geographical place, 36 (72%) were from an urban area and 14 (28%) from the rural area, which is significant. (<0.005).

Table 2: Comparison between exacerbation and COPD

| Parameters		Exacerbation N=24	COPD N = 26
Sex	Male	20*	19
	Female	4	7
Serum uric acid (mg/dl)	Increased	18*	-
	Normal	6	26

*P value <0.005

Above table describes the comparison between exacerbation and COPD. Out of 50 participants, 24 were in exacerbation and 26 patients as COPD case. Out of 24 exacerbation cases, 20 were males and 4 were females. And in 26 COPD cases, 19 were males and 7 were females. Regarding the Serum uric acid (mg/dl) in exacerbated cases, it is increased for 18 cases and only 6 cases with a normal level. Whereas in COPD cases all 26 cases were reported to be normal with the Serum uric acid level.

Table 3: Biochemical profiles of the patients as mean values

Body Mass Index (kg/m^2)	24.8+1.65
Blood pressure	SBP-112.4 + 10.3 DBP – 68.7 + 10.8
Serum uric acid (mg/dl)	4.86+ 1.6
Increased Serum uric acid (mg/dl)	9.67+ 1.8
Serum Urea	26.74+3.91
Serum Creatinine	0.94+0.20
FEV$_1$% Predicted	Normal UAC – 51.8+18.6 Hyperuricemia- 53.4+16.7
FVC% Predicted	Normal UAC – 77.5+17.8 Hyperuricemia- 76.5+18.5

Table 3, shows the biochemical profiles as mean values of its parameter. The mean Body Mass Index (kg/m2) was 24.8+1.65. The mean Systolic and Diastolic blood pressure were 112.4 + 10.3 and 68.7 + 10.8. The mean normal Serum uric acid (mg/dl) was 4.86+ 1.6. The increased mean serum uric acid (Hyperuricemia) was 9.67+ 1.8. The mean serum urea and creatinine levels were 26.74+3.91 and 0.94+0.20. The FEV$_1$% Predicted in Normal UAC – 51.8+18.6 and in cases of Hyperuricemia 53.4+16.7. FVC% Predicted in Normal UAC was 77.5+17.8 and in cases of Hyperuricemia it was 76.5+18.5.
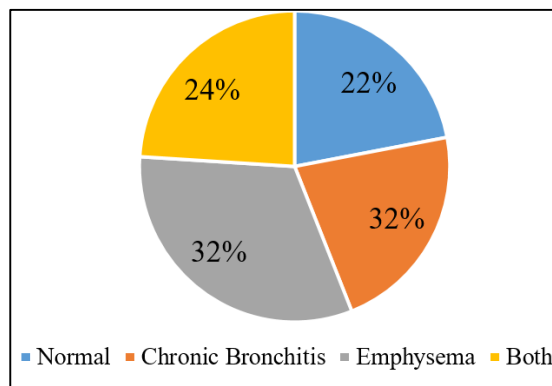
Fig. 1: Chest x-ray

From the above figure, in the chest X-ray interpretation, 32% had chronic bronchitis, 32% had Emphysema, 24% had both chronic bronchitis and emphysema and rest 22% were normal.

Discussion

In this study, we noted that smokers outnumbered the non - smokers. Almost all the male participants in this study were smokers. 17 were exposed to occupational exposure and 3 females were exposed to indoor air pollution and biomass fuel use for domestic purpose. In our study, about 72% were from an urban area which is again contributing to outdoor air pollution and other exposures. All together contributing to the recruitment of inflammatory cells and further progression of COPD from moderate to severe degree.[10]

Numerous earlier studies have conveyed a complex relation between Hyperuricaemia with Exacerbation and COPD cases.[11-14] There is a difference between oxidant/antioxidant status favours oxidative-stress induced injury of the airways. Proinflammatory effect of UA with increased serum concentration has also been proposed as a cofactor in the pathogenesis of COPD.[15] Pro-oxidant effects of uric acid with a raised level in a free-radical generation, inflammation predominates over its antioxidant effects. In the present study, there are an increased serum UA levels among exacerbated cases compared to COPD cases as mean Serum Uric Acid was 4.86+1.6 and the increased Serum Uric Acid was 9.67+1.8.[16,17]

The uric acid level increase in COPD and exacerbated cases are the basis for hypoxic damage of the cells of the lungs with additional factors such as Gender, BMI, Blood pressure, serum urea and Serum creatinine.[18] In the current study, the chest X-ray interpretation 32% had chronic bronchitis, 32% had Emphysema, 24% had both chronic bronchitis and emphysema and rest 22% were normal. Usha et al, Study reports different outcomes such as chronic bronchitis 8%, emphysema 18%, both 6% and normal 66%.[19]

Despite some positive outcomes, our study had certain limitations. Cross-sectional and observational nature of the study with a limited number of subjects was the major reason for not getting a statistically significant outcome to justify our findings.

Conclusion

The increased serum uric acid levels are harmful to patients with chronic obstructive pulmonary disease. The outcome of our study shows serum uric acid is cost-effective, easy and non-invasive and possibly suitable in assessing the patient disease severity, progression to exacerbation. It helps to predict the disease staging from the initial presentation and necessitates early intervention and prompt treatment

Source of Funding

None.

Conflict of Interest

None.

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