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# Study of renal profile in chronic obstructive pulmonary disease in a tertiary care hospital

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**Abstract**
**Background:** Patients with chronic obstructive pulmonary disease (COPD) and chronic kidney disease (CKD) share common risk factors. However, limited evidence is available about the association between COPD and CKD.
**Aims and Objectives:** To study the clinical profile, frequency of abnormal renal parameters and outcome in patients with COPD.
**Materials and Methods:** Hundred COPD patients attending OPD and in wards of JA Group of Hospitals, G.R. Medical College, Gwalior between September 2016 and August 2018 were studied. Based on FEV1 value, COPD was characterized in Mild, Moderate, Severe and Very Severe. Urine R/M, blood urea, serum creatinine, serum albumin, serum sodium, serum potassium, creatinine clearance and USG abdomen were performed.
**Results:** COPD was more prevalent in males (75%) with age groups of 60 to 70 years (45%) and who were chronic smokers. Majority of the patients had very severe COPD (43%). Anaemia was more prevalent among female population (20 out of 25), 59% of anemic patients had creatinine clearance of <60. Renal failure was more prevalent in male population (36%). Hyponatremia was more common in female (44%). Majority of the hyponatremia patients had very severe COPD (25 out of 41). Hypoalbuminemia was more common among male patients (37%), in the age group of 60-70 years. Pedal Edema was present in 21% patients and was more common in very severe COPD group (15 out of 21).
**Conclusion:** Hyponatremia, deranged renal functions and their magnitude can be an important prognostic tool in patients with COPD as well.

**Keywords:** hypoalbuminemia, creatinine clearance, pedal edema, anemia

## Introduction

Chronic obstructive pulmonary disease (COPD) is defined as a preventable and treatable disease with some significant extra pulmonary effects that may contribute to the severity in individual patients. Its pulmonary component is characterized by airflow limitation that is not fully reversible [1].

Prevalence surveys suggest that up to almost aquarter of adults aged 40 years and older have mild airflow obstruction. COPD is presently the fourth leading cause of death, but WHO predicts that it will become the third leading cause by 2030; mortality owing to cardiac diseases and stroke decreased over the period 1970–2002, but that of COPD doubled over the same period [2, 3].

Renal abnormalities, usually manifesting as oedema or hyponatraemia, are encountered frequently in patients with COPD [4] Edema in patients with COPD has been attributed to corpulmonale with backward heart failure. Chronic hypoxia leads to pulmonary hypertension which leads to structural changes in pulmonary arteries, increased systemic venous pressure, and reduced cardiac output [5, 6].

There are experimental evidences which show that imbalances in the renin-angiotensin aldosterone axis and the arginine vasopressin system are responsible for edema and hyponatraemia [7]. The most consistent alteration in renal function in hypoxemic hypercapnic patients with COPD is the reduction in Effective Renal Plasma Flow ERPF [8].

In present study we tried to study the clinical profile, frequency of abnormal renal parameters and outcome in patients with COPD.

## Materials and Methods

A prospective study was performed on 100 patients attending OPD and wards in JA Group of Hospitals, G.R. Medical College, Gwalior between September 2016 and August 2018.

Institutional Ethics Committee approval was obtained before starting the study. A written informed consent was obtained from each subject after reading the informed consent in the local language.

All COPD cases were selected on the basis of clinical examination and Spirometry findings. Patients with co-morbid illness including hypertension, diabetes mellitus, polycystic kidney disease, renal stone, CAD, cardiac failure, nephropathy and drug ingestion, tuberculosis and malignancy were excluded from the study.

All selected cases were subjected to history taking, clinical examination and investigation as per the proforma. Spirometry was performed in every case. All routine investigation with special emphasis to urine R/M, blood urea, serum creatinine,

serum albumin, serum sodium, serum potassium, creatinine clearance and USG abdomen were performed.
COPD patients were classified as Mild, Moderate, Severe and very severe based on FEV1 value.
The following cut offs were used in present study; serum sodium <135 mEq/L was defined as hyponetrimia, serum albumin <3.5 g/dLas hypoalbuminemia, hemoglobin <13g/dl anemia in males and hemoglobin <12g/dl as anemia in females.
All the data analysis was done using IBM SPSS ver. 20 Software. Cross tabulation and frequency distribution was used to prepare tables. Microsoft office 2010 was used to prepare the graphs. Paired sample t test and one way ANOVA was used to compare the mean whereas categorical data was compare using Chi square test. Level of significance was assessed at 5%.

## Results

COPD was more prevalent in the age groups of 60 to 70 years (45%). Majority of the COPD patients were male (75%). COPD was more prevalent in patients who were chronic smokers, however majority of the male patients were chronic smokers.

**Table 1:** Distribution of severity of COPD Patients

| COPD Severity ( using Fev1) | Percentage |
|---|---|
| Mild (>80%) | 5 |
| Moderate (80 to 50%) | 21 |
| Severe (50 to 30%) | 31 |
| Very Severe (<30%) | 43 |
| Total | 100 |

Data is expressed as percentage, COPD; chronic obstructive pulmonary disease

It was found that the mean BMI reduces significantly with progression of COPD severity. COPD patient having less BMI(less than 18.5) are underweight and have poor prognosis.
While analyzing the COPD severity in different age groups, it was found that moderate, severe and very severe COPD was more common in 60-70 years of age group (P=0.020).
Anaemia was more prevalent among female population (20 out of 25) as compared to male (31 out of 75). Out of 51 anemic patients, 30 (59%) had creatinine clearance of <60 and 21 (41%) had creatinine clearance of >60 (p<0.001). Creatinine clearance <60ml/min/1.73m2 was defined as the cut off value for renal failure. Renal failure was more common among male (36%) as compared to female (24%) (p=0.026). Renal failure was more prevalent in > 60 years of age of COPD patients.

**Table 2:** Comparing renal failure with severity of COPD

| Severity of COPD | CrCl ≤60 | CrCl > 60 | Total | P value |
|---|---|---|---|---|
| Fev1 Mild (>80%) | 00 | 05 | 5 | 0.001 |
| Fev1 moderate (80 to 50%) | 00 | 21 | 21 | |
| Fev1 severe (50 to 30%) | 10 | 21 | 31 | |
| Fev1 Very Severe (<30%) | 23 | 20 | 43 | |
| Total | 33 | 67 | 100 | |

**COPD:** chronic obstructive pulmonary disease, CrCl; creatinine clearance

**Table 3:** Comparing hyponatremia with severity of COPD

| COPD Severity | Na <135 | Na >=135 | Total | P value |
|---|---|---|---|---|
| Mild | 0 | 5 | 5 | 0.042 |
| Moderate | 3 | 18 | 21 | |
| Severe | 13 | 18 | 31 | |
| Very Sever | 25 | 18 | 43 | |
| Total | 41 | 59 | 100 | |

Hyponatremia was more common in female (44%) and patients with age group of 60-70 years. Hypoalbuminemia was more common among male patients (37%), in the age group of 60-70 years.

**Table 4:** USG finding in COPD patients

| | Nephropathy | Normal USG | Other than nephropathy | Total | P value |
|---|---|---|---|---|---|
| No of cases | 9 | 51 | 40 | 100 | 0.432 |
| % | 9% | 51% | 40% | 100% | |

In 22% patients' urine albuminuria was reported. Urine albuminuria was more common among male patients (90%). Pedal Edema was present in 21% patients.

**Table 5:** Pedal edema vs. severity of COPD patients

| Severity of COPD | Present | Absent | P value |
|---|---|---|---|
| Fev1 Mild (>80%) | 1 | 4 | 0.023 |
| Fev1 Moderate (80 to 50%) | 2 | 8 | |
| Fev1 Severe (50 to 30%) | 3 | 12 | |
| Fev1 Very Severe (<30%) | 15 | 55 | |
| Total | 21 | 78 | |

## Discussion

COPD is one of the leading causes of morbidity and mortality worldwide; the prevalence and mortality rates have shown a rising trend. Finding the associated comorbidities in COPD patients may help further risk-stratification and treatment.
In present study COPD was more common in male patients (75%). While comparing the COPD severity among different age groups; moderate, severe and very severe COPD was most common in 60-70 years of age group. Similar reports were revealed in the previous study done by Elborn *et al.* and Gjerde *et al*. [9, 10]
Smoking is an important risk factor for COPD, and it also increases the risk of CKD [9]. Agreement to that in present study, COPD was more prevalent in patients who were chronic smokers; however majority of the males patients were chronic smokers in present study than females. In patients who continue to smoke cigarettes there are no proven treatments that prevent the progression of COPD.
Advancing age, diabetes, hypertension, body mass index (BMI), and cigarette smoking have previously been identified as risk factors for new-onset kidney disease [11]. But contrary to above statement in present study BMI was less in COPD patients and an inverse relationship was observed between BMI and COPD severity.
In present study majority of the patients had very severe (43%) COPD followed by severe (31%), moderate (21%) and mild (5%).

Shihong *et al*. reported that incidence of renal impairment increased with the increase in COPD severity. Secondly, COPD patients with renal impairment had a significantly deteriorated quality of life and a higher incidence of exacerbation as compared to that in patients who had normal kidney function [12]. Ibrahim *et al.* reported an overall prevalence of CRF (GFR < 60 mL/min/1.73 $m^2$) as 46% in the COPD group and 22% in the control group (P < 0.001). While serum creatinine greater than 1.26 mg/dL for men and 1.04 mg/mL for women is a reliable marker of CKD, the GFR was frequently depressed in patients with COPD despite normal serum creatinine in previous study [13]. Gestel *et al*. [14] studied the association between COPD and CKD in 3358 patients who underwent elective vascular surgery. They found that COPD was associated with a higher risk of prevalent CKD. After adjustment for other factors, patients with COPD had increased odds of CKD (adjusted OR: 1.22 & 95% CI: 1.03–1.44 & P = 0.03). Similar results were obtained in the present study.

In another study by Incalzi and co-workers incidence of renal failure among the COPD patients was 43% as compared to 23.4% among controls [15].

Van Gestel and others studied the association between COPD and CKD in a cohort of 3358 vascular surgery patients and reported that prevalence of COPD was inversely related to kidney function. COPD was present in 47, 38 and 32% of patients with an estimated GFR <60, 60–89 and ≥90 mL/min/1.73 m2, respectively. COPD was independently associated with CKD. Besides moderate and severe COPD were associated with increased long-term mortality in patients with CKD compared to patients without COPD [16].

The mechanism by which COPD potentiates the development of CKD remains unclear. Several hypotheses have been put forward. It might be related to the fact that COPD is mainly a disease of the elderly population who have comorbidities such as diabetes mellitus, hypertension and coronary artery disease; known risk factors associated with CKD. COPD has been associated with systemic inflammation [10, 17].

In present study anaemia was more common in renal failure patients and they were directly proportional to each other. Out of 47 anaemic patients 61.7% had creatinine clearance <60.

As per the previous reports patients with an FEV1 less than 35 percent predicted have about 10 percent mortality per year. If a patient reports that they are unable to walk 100 meters without stopping because of breathlessness, the 5-year survival is only 30 percent [18]. Present study findings goes hand in hand where renal failure was more common in the age group of 60-70 years (44%) and among males (36%) as calculated using creatinine clearance (p=0.026). Out of 43 patients with very severe COPD, 67% had renal failure whereas out of 31 severe COPD patients, renal failure was reported in 21% (p=0.002).

Hyponatremia was more common in male (31%) (p=0.021), especially those who had very severe COPD (25%) as compared to severe (13%) and Moderate (3%) COPD (p=0.042). Also hyponatremia was more common in age group of 60-70 years (16%) (p=0.032). Similar report were observed by the study done by Decramer and co-workers where they reported that hyponatraemia is encountered frequently in patients with COPD [19].

In present study hypoalbuminemia was more common among male patients (28%) as compared to female (5%) (p=0.002). Logistic regression analysis done by previous study showed that COPD was significantly associated with both concealed and overt CKD. In present study hypoalbuminemia was more common in age group of 60-70 years (12%) (p=0.001). Out of 100 patients, Hypoalbuminemia was present in 33% of patients with a mean albumin level of 2.66±0.35 (p=0.001).

In present study nephropathy was reported in 9% patients, and 40% patients had abnormal findings other than nephropathy (p=0.432). In 22% patients' urine albuminuria was reported and it was more common among male patients (20%).

Pedal edema was more common in very severe COPD (15%) as compared to severe (3%), and moderate (2%) (p=0.023). Out of 41 patients with hyponatremia, 22 had creatinine clearance <60 (54%) and 46% had creatinine clearance of ≥60 (p=0.0002).

Present study has few limitations. First cross sectional nature of the present study was the main limitation which restricts the use of present study findings to large population. Second is the small sample size; a large randomize clinical trial is required to strengthen the present study findings.

## Conclusion

COPD was more prevalent among male patients who are in the sixth to seventh decade of their life. COPD was more prevalent in patients who were chronic smokers. Anemia was more prevalent among female.

Renal failure was more common among male with age group of 80-90 years. Hyponatremia and Hypoalbuminemia were more common in very severe COPD patients. To conclude hyponatremia, renal failure and its magnitude can be an important prognostic tool in patients with COPD as well.

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