



A STUDY ON THE PREVALENCE OF RENAL DYSFUNCTION IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE PATIENTS

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ABSTRACT **Introduction:** COPD is currently the third leading cause of death globally. More than 3 million people died of COPD in 2012 accounting for 6% of all deaths worldwide. Chronic kidney disease is often asymptomatic, and unrecognized but can advance to established renal failure in concealed renal failure in no time in patients of COPD. **Materials and methods:** This study was done to look for the prevalence of renal dysfunction in COPD patients and to evaluate the prevalence of both concealed and overt renal failure in patients with COPD. Data was collected from 100 diagnosed patients of COPD in the age group of 40-80 diagnosed cases of COPD between December 2020- June 2022. Patients were categorized as per gold staging and renal functions were compared. **Results:** It was observed that the prevalence of renal dysfunction in my study sample was 19% in which 13% patients were found to have overt renal failure (eGFR<60, Creatinine>1.2), 6% had concealed renal failure (eGFR<60, Creatinine≤1.2) and 81% patients had normal renal function. Significant risk factors associated with the development of renal dysfunction in COPD patients are: age > 60, mMRC grade ≥ 2, FEV1% ≤ 50 % (gold 3 and gold 4), Smokers with pack years > 40, low BMI, frequent exacerbations and hospitalisations. **Conclusion:** In COPD patients the screening for renal function should not only be limited to estimation of serum creatinine but should also include estimation of glomerular filtration rate to avoid falsely low creatinine levels owing to lower muscle mass. Screening for renal dysfunction has to be done immediately for high-risk persons right from the primary health care level in order to decrease morbidity associated with an added disease as well as the renal toxicity associated with the drugs given for COPD.

KEYWORDS : COPD, acute renal failure, Filtration Rate, Glomerular, creatinine

According to recent GOLD guidelines, Chronic Obstructive Pulmonary Disease is a common, preventable and treatable disease characterized by a persistent respiratory symptoms and airflow limitation due to airway and / or alveolar abnormalities usually caused by a significant exposure to noxious particles or gases and influenced by host factor including abnormal lung development(1) It often co-exists with some other diseases among which some are causally related whereas others just share a common risk factor.

Renal dysfunction is one among the most overlooked comorbidity among COPD patients. Adding to the pile is the prevalence of concealed variety of renal failure among COPD patients making it more difficult to diagnose. It could be a part of systemic inflammation or it could be due to the common risk factors associated with both these conditions such as age and tobacco use.

It was observed that renal arteriolar resistances are increased in patients with COPD, because of the increase in the local adrenergic discharge due to carbon dioxide retention. Nicotine causes nephropathies with an increased incidence of microalbuminuria progressing to proteinuria. Pulmonary hypertension secondary to COPD, may be associated with the progression of kidney disease

MATERIALS AND METHODS: A cross sectional observational study was conducted among 100 diagnosed patients of COPD in the age group of 40-80 years attending respiratory medicine OPD and IPD were evaluated. Diagnosis of COPD was made according to GOLD 2022 guidelines with post bronchodilator FEV1/FVC less than 0.70. Patients with a known kidney disease and those with co-morbid illness that can lead to kidney disease were excluded. Data was collected on demographics, smoking and clinical history along with CAT score and renal parameters. Patients were categorized as per gold staging and renal functions were compared. Patients with renal dysfunction were classified into overt (eGFR<60, Creatinine>1.2) and concealed (eGFR<60, Creatinine<1.2) based on serum creatinine and GFR. Ethical clearance was obtained from institutional ethical committee.

STATISTICS: Pearson Chi square test was used for analysis of

categorical variables and Anova test was used for numerical variables. P value of < .05 was considered as statistically significant.

RESULTS: Among 100 patients enrolled in the study 18 were females and 82 were males and majority patients belonged to the age group of 60-69 years. The patient demographics have been summarised in the table 1.

Table 1: patient demographics

CATEGORY	FREQUENCY	PERCENTAGE
Age range		
40-49	6	6
50-59	27	27
60-69	42	42
≥70	25	25
Gender		
Male	82	82
Female	18	18
CAT score		
<10	42	42
≥10	58	58
Previous hospitalisation		
0	68	68
≥10	32	32
BMI		
<18.5	26	26
18.5-24.9	50	50
25-29.9	22	22
≥30	2	2
PACK YEARS		
0	20	20
1-20	16	16
21-40	18	18
≥40	46	46

Spirometry was done to assess the airflow limitation and to categorise the disease severity among the study participants. In our study, 3 patients had mild airflow limitation (>80% predicted), 34 had moderate airflow limitation (50% to 80% predicted) 54 had severe airflow limitation (30% to 50%) and 9 of them were in very severe airflow limitation (<30% predicted).

Patients were categorised on the basis of their GOLD category and it was found that 9 patients belonged to GOLD Category A, 69 patients were in GOLD Category B and 22 were in GOLD Category D. In this study population, 19 patients had creatinine values more than 1.2 and the remaining 81 had creatinine values less than or equal to 1.2. Overall, 19% of them had renal dysfunction among which 13% had overt renal failure (eGFR<60, Creatinine>1.2) and 6% had concealed renal failure (eGFR<60, Creatinine<1.2). 81 COPD patients had normal renal function.

Correlation between various categorical variables were assessed using chi square test and has been summarised in table 2. A statistically significant association was found between age, MMRC grading, previous hospitalisation, degree of airflow limitation, BMI and pack years.

Table 2: Association of various factors with the development of Renal dysfunction in COPD patients

	OVERT RF	CONCEALED RF	NORMAL RF	p VALUE
AGE				.04
41-49	0	0	6(100%)	
50-59	2(7.4%)	1(3.7%)	24(88.8%)	
60-69	7(16.6%)	3(7%)	32(76%)	
≥70	4(16%)	2(8%)	19(76%)	
GENDER				.07
MALE	12	1	69	
FEMALE	1	5	12	
MMRC GRADE				< .001
1	1(9%)	0	10(90.9%)	
2	2(4.6%)	1(2.3%)	40(93%)	
3	8(23.5%)	3(8.8%)	23(67.6%)	
4	2(16.6%)	2(16.6%)	8(66.6%)	
PREVIOUS HOSPITALISATION				.047
0	4(5.8%)	2(2.9%)	62(91.1%)	
≥1	9(28.1%)	4(12.5%)	19(59.4%)	
FEV1				< .001
MILD	1(20%)	0	4(85%)	
MODERATE	2(10%)	1(5%)	17(85%)	
SEVERE	7(13.7%)	3(7.3%)	41(80.3%)	
VERY SEVERE	3(12.5%)	2(8.3%)	19(79.1%)	
GOLD CATEGORY				0.32
A	1(11.1%)	0	8(88.8%)	
B	4(5.8%)	2(2.9%)	63(89.8%)	
D	8(36.3%)	4(18.1%)	10(45.4%)	
PACK YEARS				< .001
0	1(5%)	0	19(95%)	
1-20	2(14.7%)	1(6.25%)	13(81.25%)	
21-40	2(11.1%)	1(5.5%)	15(83.3%)	
>40	8(17.3%)	4(8.6%)	34(73.9%)	
BMI				<.001
<18.5	4(15.3%)	2(7.6%)	20(76.9%)	
18.5-24.9	6(12%)	3(6%)	41(82%)	
25-29.9	2(9.09%)	1(4.5%)	19(86.3%)	
≥30	1(50%)	0	1(50%)	

DISCUSSION:

This research was done in order to estimate the prevalence of renal dysfunction in Chronic Obstructive Pulmonary Disease patients and risk factors associated with it.

The mean age in my study population was 62.5 years which is in correlation with many large-scale studies conducted across the globe. Sharanya et al⁽²⁾ in their study observed the mean age to be 60 years which is in agreement with my study. It is slightly lesser than that observed by Incalzi et al⁽³⁾ which might be due the larger sample size of 356 in their study.

In the present study, 19% of patients had renal dysfunction among which 13% had overt renal failure and 6% had concealed renal failure. Various studies done in India has shown similar estimate of renal dysfunction among general. Nagomi et al⁽⁴⁾ in their case control study reported a 20% prevalence of renal failure in COPD patients. Ajay K Singh et al⁽⁵⁾ in their study named SEEK (Screening and Early Evaluation of Kidney Disease) found that prevalence of CKD was approximately 6%. In a study done by Tiwari et al⁽⁶⁾ the prevalence was 4%. Hence by comparing with other Indian studies the prevalence of renal dysfunction is 3 times higher among COPD when compared with the general population.

Some studies showed an increased prevalence of renal dysfunction compared to mine. Elmahallawy et al⁽⁷⁾ reported an increased incidence of renal dysfunction of 46% (20% overt renal failure, 26% had concealed renal failure). Incalzi et al⁽³⁾ reported an incidence of 43% of renal dysfunction among whom overt renal failure was seen in 22.2% and concealed renal failure was seen in 20.8%. this disparity might be due to the small sample size in my study.

In my study, 82% were males and the rest 18% were females. The male predominance in the study can be explained due to the higher incidence of smoking and hence COPD among males in the general population of India. In my study, 15.8% males had renal dysfunction (overt- 14.6%, concealed- 1.21%) and 33.2% females had renal dysfunction (overt- 5.5%, concealed- 27.7%). Gjerde et al⁽⁸⁾ had a prevalence of 9.6% in Female COPD patients and 5.1% in male COPD patients. Samiha et al⁽⁹⁾ showed in their study found a male predominance in contradictory to my study which can be explained by a lesser participation of females in their study (3.3%).

In our study, among the 15.8% males with renal dysfunction, 14.6 % had overt renal dysfunction and 1.2 % had concealed renal dysfunction. Out of the 33.3% females with renal dysfunction, 5.5 % had overt renal dysfunction and 27.7 % had concealed variety. Greater incidence of concealed variety among females in comparison to males can be due to the greater loss in muscle mass in females with age. Ibrahim I. Elmahallawy et al⁽⁷⁾ had found that the prevalence is more common among males and 70% of the overt renal dysfunction were males and 50% of the concealed renal dysfunction were females and it was statistically significant.

The prevalence of renal failure was found to be high among the COPD patients with age > 60. Age was found to be statistically associated with the occurrence of renal dysfunction at the level of p = .04. Incalzi et al⁽³⁾ in their study observed a statistically significant association of age with both concealed and overt renal failure. Mean age was found to be 74.3 years and 76.8 years respectively in concealed and overt category. Similar association was found with age in the study done by Ibrahim et al⁽⁷⁾ (OR= 3.76, 95% C.I who opined that for every one - year increase in age the risk is tripled (3.76 times).

In my study, even though concealed renal dysfunction was more frequently observed in patients with age > 60, more patients in this age group had overt renal failure in comparison to concealed variety (16.4% vs 7.4%). This finding is in contradiction to majority of studies, but in my study morbidity of patients and type of COPD has not been considered which can be confounding the results. Incalzi et al⁽³⁾ found that the average of prevalence of renal dysfunction was 76.3% among concealed variety and 75.8 among overt renal failure and had found that most of the patients with concealed variety were in the age group of > 70.

The prevalence of renal dysfunction was found to be increasing with increasing airflow obstruction according to FEV1 (severe- 21%, very severe-20.8%). Similar findings were observed in the study done by Ibrahim I. Elmahallawy et al⁽⁷⁾ who had found that, most of the patients with both concealed and overt renal dysfunction had either Stage 3 or Stage 4 GOLD COPD severity but no statistically significant association was found in their study between severity of obstruction and development of renal dysfunction. In agreement to my study finding, Hesham et al⁽¹⁰⁾ in their case control study found a significant association between GOLD staging and development of renal dysfunction. It was found that only 10.2 % patients with renal dysfunction belonged to GOLD category B whereas 54.6% belonged to GOLD category D.

In our study pack years of smoking was significantly associated with

the development the renal dysfunction. Ibrahim I. Elmahallawy et al⁽³⁾ had found that smoking status was significantly associated with the development of renal dysfunction. The average pack years among the concealed renal dysfunction and overt renal dysfunction were 37.3 and 39.4. Hesham et al⁽¹⁰⁾ found a statistically significant association with pack years and GOLD stage III & IV at p value of .004. Mean pack year was found to be 36.59 in COPD group and 30.6 in GOLD stage III & IV.

In our study 15.3 % and 7.6 % of the underweight patients developed overt and concealed renal failure respectively. It was found that maximum patients (33.3%) with concealed variety were underweight which can be explained by the lower muscle mass and hence less release of creatinine in such patients. Raffaele Antonelli Incalzi et al⁽³⁾ observed that the average BMI in the concealed group was 26.5 and in the overt variety was 29.2 and it was statistically significant. Gjerde et al⁽⁸⁾ also found a statistically significant association between cachexia and development of renal dysfunction in COPD patients.

It was found that patients with prior history of hospitalisation with exacerbations had more worsening of renal function. 59.4% had normal renal function among the cohort with past history of hospitalisation in contrast to 91.1% who had normal renal functions in patients without any prior history of hospitalisation. This finding was in agreement with the study done by Hesham et al⁽¹⁰⁾ who found a statistically significant association between age and fall in GFR.

In our study the CAT Score and the prevalence of renal dysfunction had no statistical significance. Many studies found out a significant association between CAT scoring and development of renal dysfunction. More patients in my study fell under low socio-economic class with less literacy rates who were unable to give accurate history which might be the reason for this.

It was found that majority patients with renal dysfunction fell into mMRC grade III and IV. Overt renal failure was more prevalent than concealed variety in both grade III and IV (23.5% and 16.6%). This observation is in agreement with multiple studies done across the globe. Hesham et al⁽¹⁰⁾ observed the mean mMRC grading to be more among grade III and IV with a significant correlation between mMRC grading and renal dysfunction. In the study done by Shlipak et al⁽¹¹⁾ in 2003, association was proved between chronic renal failure and increased serum levels of inflammatory markers and prothrombotic molecules in COPD patients which might be the reason for more prevalence of renal dysfunction in more severe category of disease.

LIMITATIONS:

This is a hospital-based, single centre study with a small sample size, extrapolating the results of the study to the general population may not be accurate enough. Glomerular Filtration Rate (GFR) was not measured directly albeit CKD-EPI creatinine equation is a reliable surrogate for measured GFR in both the healthy elderly and the diseased population.

CONCLUSION:

In COPD patients, the screening for renal function should not only be estimated by serum creatinine alone but Glomerular Filtration Rate calculation should also be done since the muscle mass is decreased in COPD and hence creatinine value may be falsely low. Screening for renal dysfunction should be implemented immediately for high-risk persons at the primary health care level in order to decrease morbidity associated with an added disease as well as the renal toxicity associated with the drugs given for COPD. More prevalence of renal dysfunction among patients with previous hospitalisation has an indirect implication that efforts should be made to attain control of COPD and decrease frequency of exacerbations which can indirectly have a positive impact on renal functions.

CONFLICT OF INTEREST: None

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