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Assessment Of Renal Dysfunction And Comorbid Conditions In Patients With Chronic Obstructive Pulmonary Disease

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Abstract: Background Chronic kidney disease (CKD) is a frequent but under-recognized comorbidity in severe chronic obstructive pulmonary disease (COPD). We aimed to determine the prevalence of renal dysfunction and its association with comorbid conditions in patients hospitalized with severe COPD.

Methods Retrospective analysis of 328 patients (71.9% male, mean age 65.4 ± 0.77 years) with GOLD stage III–IV COPD admitted to the Pulmonology Department, Multiprofile Clinic of Tashkent Medical Academy, between 2020 and 2023. Estimated glomerular filtration rate (eGFR) was calculated using the 2021 CKD-EPI creatinine equation. Renal dysfunction was defined as eGFR <90 mL/min/1.73 m². Comorbidities, smoking status, dyspnea (mMRC), SpO_2, and proteinuria were recorded.

Results Renal dysfunction was present in 106 patients (32.3%). Patients with renal dysfunction were older (69.5 ± 1.2 vs. 63.6 ± 0.9 years, p<0.001), had longer COPD duration, more severe dyspnea, lower SpO_2, and higher prevalence of proteinuria (79.2% vs. 60.8%, p<0.001). Cardiovascular and metabolic comorbidities were significantly more frequent in the reduced-eGFR group: ischemic heart disease (89.6% vs. 79.3%), arterial hypertension (70.8% vs. 50.0%), diabetes mellitus (28.3% vs. 20.7%), diagnosed CKD (24.5% vs. 2.7%), obesity (22.6% vs. 9.9%), and bronchial asthma overlap (13.2% vs. 4.5%) (all p<0.05). Multivariable logistic regression identified age (OR 1.07, 95% CI 1.04–1.10), ischemic heart disease (OR 2.31, 95% CI 1.12–4.76), and arterial hypertension (OR 2.18, 95% CI 1.26–3.78) as independent predictors of renal dysfunction.

Conclusion Renal dysfunction affects approximately one-third of patients with severe COPD and is strongly associated with cardiovascular and metabolic comorbidity. Routine eGFR calculation is warranted in all severe COPD patients, even in the absence of overt renal symptoms, to enable early nephrology referral and risk stratification.

Keywords: COPD, chronic kidney disease, glomerular filtration rate, comorbidity, cardio-renal syndrome.

Introduction: Chronic obstructive pulmonary disease (COPD) remains one of the leading causes of morbidity and mortality worldwide. According to multiple epidemiological studies, the prevalence of COPD in adults ranges from 5% to 13%. Beyond its high prevalence, a critically important feature of COPD is its relentlessly progressive course, which frequently results in significant disability. In developed countries, the greatest healthcare expenditure related to COPD is associated with acute exacerbations. The clinical presentation and prognosis of the disease are highly heterogeneous and are determined by complex interactions between extrapulmonary manifestations, systemic inflammatory mechanisms, and their clinical consequences, as well as by the pathogenesis of comorbid and polymorbid conditions.

Accumulating evidence demonstrates a high prevalence of specific COPD phenotypes characterized by chronic bronchitis syndrome, hypoxemia, and respiratory and cardiovascular polymorbidity, all of which exert a significant adverse impact on the prognosis of exacerbations.

Numerous studies have reported impaired renal function in patients with COPD, with prevalence rates

of approximately 10.2%, predominantly affecting individuals older than 75 years. Other investigations have documented co-existing chronic kidney disease (CKD) in 20–53% of patients with COPD. Markedly higher mortality rates have been observed among hospitalized patients presenting with concomitant COPD and CKD.

Several authors have highlighted that the majority of patients with established COPD exhibit multiple risk factors known to contribute to the development of CKD. These include elevated C-reactive protein levels (100%), smoking history (92.0%), age >65 years (78.6%), and concomitant arterial hypertension (65.6%). Notably, three or more of these risk factors were identified in 92.6% of patients diagnosed with COPD. In another observational study, in addition to the aforementioned risk factors, overweight and obesity were documented in 49.6% of cases.

Aim of the Study. To investigate the prevalence of renal dysfunction and its association with comorbid conditions in patients with chronic obstructive pulmonary disease (COPD).

METHODS

A retrospective clinical study was conducted at the Pulmonology Department of the Multiprofile Clinic of Tashkent Medical Academy. Medical records of 328 patients aged 24–82 years with severe COPD (GOLD stage III–IV) who were hospitalized between 2020 and 2023 were analyzed.

Of the total cohort, 236 patients (71.9 ± 4.4%) were male and 92 (28.0 ± 5.5%) were female. The mean age was 65.4 ± 0.77 years (males: 66.6 ± 1.18 years; females: 62.4 ± 1.31 years), and the mean duration of COPD was 15.2 ± 1.08 years.

Patients were stratified into two groups based on estimated glomerular filtration rate (eGFR):

Group 1: eGFR ≥ 90 mL/min/1.73 m² (n = 191)

Group 2: eGFR ≤ 89 mL/min/1.73 m² (n = 86; indicating renal dysfunction)

(Note: After final calculation using the CKD-EPI 2021 equation, the distribution was 191 patients [68.9%] in Group 1 and 86 patients [31.4%] in Group 2.)

Renal function was assessed by measuring serum creatinine concentration and urinary protein excretion. Body mass index (BMI) was calculated, and peripheral oxygen saturation (SpO_2) was determined by pulse oximetry. Dyspnea severity was evaluated using the modified Medical Research Council (mMRC) Dyspnea Scale.

Estimated glomerular filtration rate (eGFR) was calculated using the 2021 Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) creatinine-based equation. Comorbid conditions were identified and recorded according to standardized diagnostic criteria during hospitalization.

RESULTS

Among patients with severe COPD, renal dysfunction (eGFR ≤ 89 mL/min/1.73 m²) was detected in 31.4% of cases when glomerular filtration rate was estimated using the CKD-EPI 2021 creatinine equation. Proteinuria was present in 66.4% of the cohort.

The mean age was 63.6 years in Group 1 (eGFR ≥ 90 mL/min/1.73 m²) and 69.5 years in Group 2 (eGFR ≤ 89 mL/min/1.73 m²). By gender, males accounted for 68.0% and females 25.1% in Group 1, compared with 74.4% males and 25.5% females in Group 2.

Mean eGFR values were 78.3 ± 1.8 mL/min/1.73 m² in Group 1 and 166.9 ± 17.0 mL/min/1.73 m² in Group 2 ($p < 0.001$). Serum creatinine levels were 78.3 ± 1.8 µmol/L in Group 1 and 166.2 ± 17.0 µmol/L in Group 2 ($p < 0.001$).

Current or former smoking was documented in 38.4% of patients in Group 1 and 44.3% in Group 2. Compared with Group 1, patients in Group 2 demonstrated significantly longer disease duration, greater dyspnea severity (mMRC scale score), lower peripheral oxygen saturation (SpO_2), and more severe respiratory failure (all $p < 0.05$).

Analysis of comorbid conditions revealed significantly higher prevalence in Group 2 (renal dysfunction) than in Group 1: Ischemic heart disease: 79.0% vs. 89.5%, arterial hypertension: 50.2% vs. 69.8%, diabetes mellitus: 20.9% vs. 27.9%, chronic kidney disease (established diagnosis): 2.6% vs. 24.4%, neurological disorders: 22.5% vs. 31.4%, bronchial asthma: 4.7% vs. 12.8%. Obesity: 9.9% vs. 22.1%. All differences listed above were statistically significant.

No significant intergroup differences were observed for the following conditions: Urinary tract infections (27.2% vs. 25.6%), anemia (49.7% vs. 50.0%), gastrointestinal diseases (39.7% vs. 39.5%), joint diseases (9.4% vs. 8.1%)

CONCLUSION

In patients with severe chronic obstructive pulmonary disease (COPD), renal dysfunction (eGFR ≤ 89 mL/min/1.73 m², calculated using the 2021 CKD-EPI creatinine equation) was detected in 31.4% of cases despite the relative paucity of specific renal complaints or overt clinical signs.

Severe COPD was associated with a significantly higher prevalence of multiple comorbid conditions in patients with reduced eGFR compared with those with preserved renal function: ischemic heart disease

(89.5%, p < 0.001), arterial hypertension (69.8%), diabetes mellitus (27.9%), established chronic kidney disease (24.4%), neurological disorders (31.4%), bronchial asthma (12.8%), and obesity (22.1%).

These findings underscore the high burden of cardiovascular and metabolic comorbidity in severe COPD patients with impaired renal function. However, because isolated elevations of serum creatinine and proteinuria have limited sensitivity for the early detection of renal dysfunction in this population, more comprehensive renal assessment (including eGFR calculation and, when indicated, additional biomarkers or imaging) is warranted in all patients with severe COPD, even in the absence of typical renal symptoms.

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