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Original article

Prevalence and Pattern of Comorbidities Among Chronic Obstructive Pulmonary Disease Patients at Zliten Medical Center, Libya

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ABSTRACT

Chronic Obstructive Pulmonary Disease (COPD) is a preventable and treatable disease. COPD remains the fourth leading cause of death worldwide. In the Middle East and North Africa (MENA) region, the prevalence of COPD has increased despite a decline in mortality rates since 1990. Comorbidities significantly affect the prognosis and clinical outcomes of COPD patients, particularly extrapulmonary conditions such as cardiovascular disease and diabetes mellitus. Tobacco smoking is a major shared risk factor for COPD and several chronic diseases, including lung cancer and coronary artery disease. Although comorbidities play an important role in COPD management, limited local evidence is available in Libya regarding their prevalence and clinical impact. Therefore, this study aimed to determine the frequency and pattern of comorbidities among COPD patients and assess their relationship with disease severity and clinical outcomes. A hospital-based cross-sectional study was conducted among COPD patients admitted to the Internal Medicine Department at Zliten Medical Center over a five-month period. Patients aged 40 years and above with a confirmed diagnosis of COPD, including newly diagnosed and previously known cases, were included. A total of 25 COPD patients met the inclusion criteria. Data were collected through direct patient interviews and review of medical records. Information obtained included sociodemographic characteristics, smoking status, vaccination history, comorbidities, clinical presentation, complications, and outcomes. Data were analyzed using the Statistical Package for Social Sciences (SPSS). Most participants were male, and more than half were active smokers. The majority had no history of vaccination. Comorbidities were highly prevalent among the studied patients, with diabetes mellitus being the most common comorbidity (56%), followed by hypertension (40%). The main causes of hospitalization were dyspnea, acute exacerbation of COPD, pulmonary edema, and pneumonia. Nearly half of the patients (44%) required intensive care unit (ICU) admission and oxygen therapy. Significant associations were observed between ICU admission and both lower limb edema and renal failure. Complications were relatively uncommon; however, renal failure was the most frequent complication, followed by respiratory failure and sepsis. Hospital readmission occurred in 20% of patients. Comorbidities are highly prevalent among COPD patients in Libya and are associated with poorer clinical outcomes, particularly ICU admission and complications. Early identification and comprehensive management of comorbid conditions may improve prognosis and reduce disease burden among COPD patients.

Introduction

Chronic obstructive pulmonary disease (COPD) is defined by the American Thoracic Society (ATS) and the European Respiratory Society (ERS) as a preventable and treatable condition characterized by persistent airflow limitation, resulting from abnormal lung inflammation in response to noxious particles, most commonly cigarette smoke [1]. Globally, COPD is the fourth leading cause of death, accounting for 3.5 million deaths in 2021, approximately 5% of all deaths. Nearly 90% of COPD-related deaths among individuals under 70 years occur in low- and middle-income countries (LMICs). COPD is also the eighth leading cause of poor health worldwide, measured in disability-adjusted life years (DALYs). In high-income countries, tobacco smoking contributes to over 70% of COPD cases, whereas in LMICs, it accounts for 30–40% of cases, with household air pollution representing a major risk factor [2].

In the Middle East and North Africa (MENA) region, the burden of COPD and its risk factors between 1990 and 2019 showed that the regional age-standardized point prevalence and mortality rates were 2333.9

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(2230.1–2443.6) and 26.1 (22.2–29.5) per 100,000, representing a 30.6% (28.2–33.0%) increase in prevalence and an 18.0% (2.8–30.9%) decrease in mortality since 1990. The regional age-standardized DALY rate in 2019 was 649.1 (574.6–717.7) per 100,000, a decline of 11.8% (0.9–21.1%) since 1990. A non-linear U-shaped association was observed between the sociodemographic index (SDI) and COPD DALY rates in the region. Countries such as Afghanistan, Egypt, and Turkey exhibited higher-than-expected rates, while Kuwait, Iraq, Libya, Palestine, Jordan, Tunisia, Iran, Algeria, Lebanon, and Morocco had lower-than-expected rates based on SDI levels [3]. Despite this, there remains a lack of comprehensive research assessing the burden of COPD across all MENA countries [3]. In Benghazi, Libya, COPD is highly prevalent and contributes substantially to morbidity and mortality. Spirometry is internationally recognized as the gold standard for COPD diagnosis and monitoring. However, in routine clinical practice, diagnosis is often made based on clinical assessment alone, without spirometric confirmation. A review of 1129 outpatient records identified 143 patients labeled with COPD, aged 36–85 years, predominantly male. Of these, only 88 patients (61.5%) underwent spirometry, while 55 (38.5%) were diagnosed without this essential test. Smoking status was unrecorded in 41 patients (28.7%), chest radiographs were absent in 67.8% of cases, and only 28.7% had documented chest CT scans. Overall, spirometry usage met only 62% of the audit standard, indicating underutilization in Libya [4].

Acute exacerbations of COPD (AECOPD) occur when respiratory symptoms worsen during the stable phase, substantially affecting quality of life. Triggers include infections, tobacco smoke, air pollution, comorbidities, airflow limitation, biomarkers, prior exacerbations, immune dysfunction, genetic predisposition, nutritional and muscle abnormalities, psychological factors, and seasonal temperature changes [5]. COPD encompasses chronic bronchitis and emphysema, leading to airflow limitation and lung hyperinflation [6].

Comorbidity in COPD, defined traditionally as any disease coexisting with the primary condition, lacks a universally accepted definition [7]. Extrapulmonary comorbidities significantly affect prognosis. Tobacco smoking is a shared risk factor for conditions such as coronary heart disease, heart failure, and lung cancer. Some comorbidities, including pulmonary artery disease and malnutrition, are directly caused by COPD, while others—such as systemic venous thromboembolism, anxiety, depression, osteoporosis, obesity, metabolic syndrome, diabetes, sleep disturbances, and anemia—have no clear pathophysiological link but share chronic systemic inflammation as a common mechanism. These comorbidities exacerbate morbidity, increase hospitalizations and healthcare costs, and may cause mortality independently of respiratory failure. Effective management of COPD requires comprehensive assessment and treatment of comorbidities [8,9]. However, research on optimal strategies for comorbidity assessment and management in COPD is limited, and the underlying mechanisms remain incompletely understood, leaving clinicians with minimal guidance in caring for multi-morbid COPD patients [9].

Despite the recognized importance of comorbidities in COPD, there is limited local evidence in Libya regarding their prevalence and clinical impact. Most available data are derived from international studies, which may not accurately reflect local population characteristics and healthcare settings.

Therefore, this study aims to assess the prevalence and pattern of comorbidities among COPD patients admitted to Zliten Medical Center, Libya, and to evaluate their association with disease severity and clinical outcomes.

Methods

A hospital-based cross-sectional study was conducted in the Internal Medicine Department at Zliten Medical Center, Libya, from December 2025 to May 2026. The study included patients aged 40 years and above with a confirmed diagnosis of chronic obstructive pulmonary disease (COPD) based on clinical assessment and/or spirometry, when available. Both newly diagnosed and previously known COPD cases were considered eligible. Patients with incomplete medical records or other significant respiratory diseases that could confound the diagnosis, such as bronchial asthma or pulmonary fibrosis, were excluded.

A total of 25 COPD patients meeting the inclusion criteria were enrolled using a convenient sampling technique. Data were collected through a structured form by reviewing medical records and, when necessary, conducting direct patient interviews. Information collected included sociodemographic characteristics such as age and sex, smoking history classified as current, former, or non-smoker, and clinical characteristics including disease duration and severity, if available. Comorbidities, including hypertension, diabetes mellitus, cardiovascular disease, anemia, and depression, were recorded, along with clinical outcomes such as frequency of exacerbations, hospital admission history, ICU admission, length of hospital stay, and management details.

Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics were used to summarize the data, with means and standard deviations reported for continuous variables and frequencies and percentages for categorical variables. Inferential analyses included chi-square or Fisher's exact tests for categorical variables, independent t-tests or Mann–Whitney

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U tests for continuous variables depending on the distribution, and correlation analysis to examine the relationship between the number of comorbidities and clinical outcomes. A p-value of less than 0.05 was considered statistically significant, with a 95% confidence interval.
Ethical approval was obtained from the institutional review board of Zliten Medical Center, and written informed consent was obtained from all participants prior to data collection. The confidentiality and anonymity of patient data were strictly maintained throughout the study.

Results

A total of 25 patients were included in the study. The majority were male (88.0%), with females representing only 12.0%. More than half of the participants were active smokers (56.0%), while 40.0% were ex-smokers, and only (0.4%) was passive smokers. Regarding vaccination status, most participants (76.0%) had no history of vaccination, while only a minority received influenza or combined vaccines. Environmental exposure was uncommon, reported in only 8.0% of cases (Table 1).
Among the 25 participants, most across all smoking groups had no vaccination, no environmental exposure, no childhood respiratory infections, and no history of TB, with only small proportions showing influenza or combined vaccination, limited air pollution exposure (mainly in ex-smokers), and rare previous TB cases in ex-smokers (10.0%) and active smokers (7.1%) (Table 2).
Comorbid conditions were highly prevalent. The most common were diabetes mellitus (56.0%) and hypertension (40.0%), followed by chest pain (36.0%) and renal failure (28.0%). Cardiovascular manifestations such as atrial fibrillation and palpitations were present in 20.0% of patients each (Table 3).
Respiratory conditions showed that 28.0% had a history of pneumonia within the last 12 months, while sleep apnea was reported in 12.0% of cases. Other respiratory conditions were relatively rare (Table 4).
The leading causes of hospital admission were dyspnea (48.0%), acute exacerbation (36.0%), and pulmonary edema (32.0%). Pneumonia contributed to 28.0% of admissions (Table 5).
In terms of management, the majority of patients received antibiotics (80.0%) and bronchodilators (76.0%), while 60.0% were treated with systemic corticosteroids. Nearly half of the patients (44.0%) required ICU admission and oxygen therapy (Table 6). A statistically significant association was found between ICU hospitalization and lower limb edema ($p = 0.045$, Fisher's Exact Test), where higher ICU hospitalization categories were more frequently observed among patients with lower limb edema.
A significant association was also observed between ICU hospitalization and renal failure ($p = 0.045$, Fisher's Exact Test), indicating that patients with renal failure were more likely to require higher levels of ICU care.
In addition, a strong statistically significant association was identified between ICU hospitalization and respiratory failure as a cause of admission ($p = 0.032$, Fisher's exact Test), with respiratory failure being more common among patients with higher ICU hospitalization categories.
Complications were relatively infrequent, with renal failure (12.0%) being the most common, followed by respiratory failure and sepsis (8.0% each) (Table 7). The mean arterial blood gas analysis showed a slightly acidotic trend (mean pH = 7.34 ± 0.06) with elevated $PaCO_2$ levels (43.5 ± 9.5 mmHg), suggesting respiratory compromise in a subset of patients. Furthermore, 44% of cases were more than 5 years from COPD diagnosis (Table 8,9). Regarding outcomes, the majority of patients experienced partial recovery (68.0%), while 16.0% fully recovered. Readmission occurred in 20.0% of cases (Table 10,11).

Table 1. Sociodemographic and General Characteristics of participants (n = 25)

Variable	Category	N	%
Age		**69.6**	**±11.4**
Sex	Male	22	88.0
	Female	3	12.0
Smoking status	Active smoker	14	56.0
	Ex-smoker	10	40.0
	Passive smoker	1	4.0
Vaccination status	None	19	76.0
	Influenza vaccine	2	8.0
	Influenza + BCG	4	16.0
Environmental exposure	No exposure	23	92.0
	Air pollution	2	8.0
Childhood respiratory infection	No	24	96.0
	Yes	1	4.0
Previous tuberculosis	No	23	92.0
	Yes	2	8.0

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Table 2. Combination of smoking status and other risk factors in study participants (n = 25)

Risk Factor	Category	Ex-smoker f (%)	Passive smoker f (%)	Active smoker f (%)
Vaccination Status	No vaccination	8 (80.0%)	1 (100.0%)	10 (71.4%)
	Influenza vaccine	2 (20.0%)	0 (0.0%)	0 (0.0%)
	Influenza and BCG	0 (0.0%)	0 (0.0%)	4 (28.6%)
Environmental Exposure	No	8 (80.0%)	1 (100.0%)	14 (100.0%)
	Air pollution	2 (20.0%)	0 (0.0%)	0 (0.0%)
Childhood Respiratory Infection	No	9 (90.0%)	1 (100.0%)	14 (100.0%)
	Yes	1 (10.0%)	0 (0.0%)	0 (0.0%)
Previous TB	No	9 (90.0%)	1 (100.0%)	13 (92.9%)
	Yes	1 (10.0%)	0 (0.0%)	1 (7.1%)

Table 3. Prevalence of comorbid conditions among study participants (n = 25)

Condition	Yes n (%)	No n (%)
Hypertension	10 (40.0)	15 (60.0)
Diabetes mellitus	14 (56.0)	11 (44.0)
Atrial fibrillation	5 (20.0)	20 (80.0)
Chest pain	9 (36.0)	16 (64.0)
High cholesterol	4 (16.0)	21 (84.0)
Angina / MI	4 (16.0)	21 (84.0)
Lower limb edema	7 (28.0)	18 (72.0)
Palpitations	5 (20.0)	20 (80.0)
Stroke/TIA	2 (8.0)	23 (92.0)
Renal failure	7 (28.0)	18 (72.0)
Anemia	5 (20.0)	20 (80.0)
Obesity	3 (12.0)	22 (88.0)

Table 4. Distribution of respiratory and related clinical conditions among participants (n = 25)

Condition	Yes n (%)	No n (%)
Pneumonia (last 12 months)	7 (28.0)	18 (72.0)
Sleep apnea	3 (12.0)	22 (88.0)
Pulmonary hypertension	1 (4.0)	24 (96.0)
Snoring	1 (4.0)	24 (96.0)
Asthma	1 (4.0)	24 (96.0)

Table 5. Causes of hospital admission among study participants (n = 25)

Cause	Yes n (%)	No n (%)
Dyspnea	12 (48.0)	13 (52.0)
Acute exacerbation	9 (36.0)	16 (64.0)
Pulmonary edema	8 (32.0)	17 (68.0)
Pneumonia	7 (28.0)	18 (72.0)
Cardiac causes	5 (20.0)	20 (80.0)
Syncope	4 (16.0)	21 (84.0)
Respiratory failure	3 (12.0)	22 (88.0)
General infection	2 (8.0)	23 (92.0)
Seizure	1 (4.0)	24 (96.0)

Table 6. Treatment modalities administered during hospital admission (n = 25)

Treatment	Yes n (%)	No n (%)
Antibiotics	20 (80.0)	5 (20.0)
Bronchodilators	19 (76.0)	6 (24.0)
Systemic corticosteroids	15 (60.0)	10 (40.0)
Oxygen therapy	11 (44.0)	14 (56.0)
ICU admission	11 (44.0)	14 (56.0)

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Anticoagulants	6 (24.0)	19 (76.0)
Non-invasive ventilation	2 (8.0)	23 (92.0)
CPAP	2 (8.0)	23 (92.0)
Physiotherapy	2 (8.0)	23 (92.0)
Dialysis	1 (4.0)	24 (96.0)

Table 7. In-hospital complications among study participants (n = 25)

Complication	Yes n (%)	No n (%)
Renal failure	3 (12.0)	22 (88.0)
Respiratory failure	2 (8.0)	23 (92.0)
Sepsis	2 (8.0)	23 (92.0)
Pneumonia	1 (4.0)	24 (96.0)
Arrhythmia	1 (4.0)	24 (96.0)
Pneumothorax	1 (4.0)	24 (96.0)

Table 8. Arterial blood gas parameters at admission (n = variable due to unmeasured in some patients)

Parameter	Mean ± SD	Min	Max	n
Respiratory Rate (breaths/min)	33.0 ± 9.5	12	45	11
pH	7.34 ± 0.06	7.24	7.44	11
$PaCO_2$ (mmHg)	43.5 ± 9.5	30.5	63.0	12
PaO_2 (mmHg)	75.5 ± 34.0	24.0	146.0	13
O_2 Saturation (%)	91.0 ± 6.5	76	99	20

Table 9. Duration since diagnosis among study participants (n = 25)

Duration	N	%
Newly diagnosed / current admission	4	16.0
< 1 year	4	16.0
1–5 years	6	24.0
> 5 years	11	44.0
Total	25	100

Table 10. Clinical outcomes of study participants at discharge (n = 25)

Outcome	n	%
Partial recovery	17	68.0
Full recovery	4	16.0
Minimal improvement	3	12.0
No improvement	1	4.0

Table 11. Readmission status among study participants (n = 25)

Variable	Category	n	%
Readmission	Yes	5	20.0
	No	20	80.0

Discussion

This study demonstrates a high prevalence of comorbidities among COPD patients admitted to Zliten Medical Center, with diabetes mellitus and hypertension being the most common conditions. These findings are consistent with previous literature showing that metabolic and cardiovascular diseases frequently coexist with COPD due to shared risk factors such as smoking, aging, and systemic inflammation [8,9,10]. The predominance of male patients and the high proportion of active smokers in this study are also in agreement with earlier regional and international studies, where COPD is more common among men and strongly associated with tobacco exposure [2,11].

The high burden of non-respiratory comorbidities observed in this study supports existing evidence that comorbid conditions contribute significantly to COPD morbidity and mortality, often exceeding the direct impact of respiratory impairment itself [7,12]. Hypertension, diabetes mellitus, and renal disease have been widely reported as major comorbidities in COPD populations [12]. Similarly, cardiovascular manifestations

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such as atrial fibrillation and palpitations identified in this study reflect the systemic nature of COPD and its association with increased cardiovascular risk [8,13].

Renal failure showed a statistically significant association with ICU admission, highlighting its role as an indicator of disease severity and poor prognosis. This is consistent with previous findings suggesting that comorbid conditions are major determinants of hospitalization and adverse outcomes in COPD patients [7,14]. In addition, the association between lower limb edema and ICU admission may reflect underlying cardiac dysfunction or advanced disease status.

The leading causes of hospital admission in this study—dyspnea, acute exacerbations, pulmonary edema, and pneumonia—are in line with the natural course of COPD and are well-documented in the literature as major drivers of hospitalization and healthcare utilization [15-17]. Acute exacerbations, in particular, are known to worsen disease progression and increase mortality risk [15-17].

Furthermore, arterial blood gas findings indicating mild respiratory acidosis and elevated $PaCO_2$ levels suggest impaired gas exchange in a subset of patients, which is characteristic of advanced COPD [18]. The relatively high rate of ICU admission observed in this study further supports the presence of severe disease among hospitalized patients.

Despite these findings, this study has several limitations, including a small sample size and a single-center design, which may limit the generalizability of the results. Additionally, the reliance on clinical diagnosis without consistent spirometric confirmation reflects previously reported gaps in COPD diagnostic practices in Libya [4]. Nevertheless, this study provides valuable preliminary data on the burden and pattern of COPD comorbidities in the local setting, where evidence remains limited.

Conclusion

In conclusion, according to our finding that COPD patients have a significant incidence of comorbidities, with more than half of the described population being active smokers, and the most prevalent comorbidities being DM, HTN, chest pain, and renal failure. Twenty percent of cases have cardiovascular manifestations. According to these studies, dyspnea, acute exacerbation, pulmonary edema, and pneumonia are the main causes of hospitalization. Patients with lower limb edema were more likely to require ICU admission; nearly half of them did. Renal failure patients require higher ICU care. The most common associated complications are renal failure, respiratory failure, and sepsis, respectively.

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Conflicts of Interest

The authors declare no competing interests.

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