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Acute Coronary Syndrome in Patients with Chronic Obstructive Pulmonary Disease: A Cross-Sectional Descriptive Study

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ABSTRACT

This study aimed to determine risk factors for acute coronary syndrome (ACS) in 100 COPD patients at AL-Yermouk Teaching Hospital. 44% of patients had ACS. Compared to COPD-only patients, those with COPD and ACS exhibited significantly lower lung function (FEV1 and FEV1/FVC) and higher PCV values, suggesting these as potential risk indicators.

I. Introduction

Chronic Obstructive Pulmonary Disease (COPD), as defined by the GOLD report (NHLBI/WHO), is a preventable and treatable lung condition characterized by persistent, irreversible airflow limitation. This limitation, which typically worsens over time, is caused by an abnormal inflammatory response to inhaled irritants.(1)Previous COPD definitions differentiated between emphysema and chronic bronchitis. Emphysema involves the irreversible expansion of air spaces past the terminal bronchioles, along with the destruction of the air sac walls, without substantial fibrosis.(2)Chronic bronchitis is diagnosed when a patient experiences a persistent cough with mucus production for at least three months per year, over two consecutive years, after ruling out other causes of chronic cough. This condition can also lead to complications outside the lungs, such as poor nutrition, weight loss, and muscle weakness.(3) Asthma patients with persistent airflow obstruction, despite treatment, are diagnosed with COPD, and their COPD may have different origins than classic COPD. Asthma patients with fully reversible airflow obstruction are excluded from a COPD diagnosis.(4, 5)The common link of tobacco use means that CAD and COPD often coexist. Distinguishing between a heart-related event and a COPD flare-up can be difficult for clinicians, as both present with dyspnea, leading to uncertainty about the most urgent treatment. (6)Low blood oxygen levels (hypoxemia) can elevate the risk of irregular heart rhythms (cardiac arrhythmias). Studies have observed a significant occurrence of both ventricular and supraventricular arrhythmias in COPD patients, regardless of whether their condition is stable or worsening. (7)

II. Patients and Methods

This study, conducted between March and December 2024, included 100 patients (71 men, 29 women, aged 50-70) diagnosed with COPD based on clinical and pulmonary function tests. Participants underwent examinations to detect acute coronary syndrome, including clinical evaluation, ECG, and cardiac enzyme analysis.To be included, patients had to exhibit a slowly progressive respiratory disorder with irreversible airflow limitation, as

evidenced by an FEV1/FVC ratio exceeding 70% on spirometer. We excluded patients with diabetes or hypertension using medical history, clinical evaluation, and lab results.

All patients underwent comprehensive assessments, including packed cell volume (PCV) measurement, chest X-ray (CXR), electrocardiogram (ECG), cardiac enzyme (troponin) testing, and echocardiography. Pulmonary function tests (PFTs) were conducted to evaluate forced expiratory volume in one second (FEV1) and the FEV1/forced vital capacity (FVC) ratio. PFTs, specifically spirometry, were used to diagnose COPD, assess airflow obstruction severity, and monitor disease progression. Spirometry involved three phases: maximal inhalation, forceful exhalation into the spirometer, and continued exhalation. FEV1 was expressed as a percentage of predicted values to determine severity, and the FEV1/FVC ratio was used to identify airway obstruction.

Statistical analysis: Statistical analysis using t-tests and chi-square tests revealed significant differences ($p < 0.05$) between the COPD with ACS and COPD without ACS groups across age, smoking history, ECG, CXR, PCV, FEV1, and FEV1/FVC ratio.

III. RESULTS:

There were seventy one males and twenty nine females. M: F ratio was 2.4:1 Age ranges from(50- 70)years. All patients presented with clinical and PFT evidence of COPD and ECG and cardiac enzymes are done to all patients to diagnose acute coronary syndrome.

Results were as follow : there were 44 cases (44%) of ACS including 12 cases with MI (27%) and 32 cases with UA (72%). There were 56cases (56%) with COPD alone.

Pulmonary function test is done to all patients and results were as follow: There were 51 patents (51%) with moderate COPD by pulmonary function test defined as ($50\% \leq FEV_1 < 80\%$ predicted),22 patients (22%) have severe COPD defined as ($30\% \leq FEV_1 < 50\%$ predicted),27 patients (27%) with very severe COPD defined as ($FEV_1 < 30\%$ predicted). we divided our patients into two groups: the COPD with ACS group and the COPD without ACS group.The mean ± S.D of the age in ACS group was 63.18±5.51 where as in COPD group was 59.38±4.18.Therefore the difference between the two groups was statistically significant. P value was < 0.011 as shown in **table (1).**There was no statistically significant difference in sex between the two groups .P value was > 0.062, as shown in **table (1).** The mean ± SD of pack years of smoking was 40.34±9.in ASC group while in COPD alone group was 27.04 ± 10.42 . Therefore the difference was statistically significant as shown in table (1). P value was <0.0001 Thus patients with ACS was more heavy smokers than the other group.

Table (2) shows no statistically significant difference in occurrence of arrhythmia between the two groups. P values were not significant.

The mean ± SD of PCV in ACS group was 50.39±2.97 and in COPD alone group was 46.50±4.09. P value was highly significant as shown in **table (3)**. Thus patients with ACS had higher PCV with more severe hyperviscosity. The mean ±SD of FEV_1 in ACS group was 28.84%±9.65 of the predicted value in the ACS group while in COPD alone group was 56.09%±9.07 of the predicted value.

Therefore the difference between the two groups was statistically highly significant,(p value was < 0.0001) as shown in **table (4)**.thus patients with COBD and ACS have lower (FEV1)values than those with COPD alone .

The mean ± SD of FEV_1 /FVC ratio was 59.38%±2.16 of the predicted value in ACS group while in COPD alone group was 64.11%±2.05 of the predicted value and the difference was statistically significant (p value was <0.0001) as shown in **table (5)**.

There was no statistically significant difference in the drug history of bronchodilators (salbutamol and theophylline) between the two groups. P values were 0.99,0.72 respectively as shown in **table (6)**, but there was significant difference in drug history of inhaled steroids. There were 8 patients with ACS on regular inhaled steroids while there was only one patient with COPD alone on steroids p value was < 0.005.

Table (1) Comparison of age, sex , smoking and pack per year No. between the two groups

Variables	COPD with ACS		COPD without ACS		P value
	No	**%**	**No**	**%**	
Age (years) <55	**1**	**2.3**	**5**	**8.9**	**0.011***
55--59	**10**	**22.7**	**26**	**46.4**	
60--64	**19**	**43.2**	**18**	**32.1**	
65--69	**7**	**15.9**	**6**	**10.7**	
=>70-	**7**	**15.9**	**1**	**1.8**	
Mean±SD (Range)	**63.18±5.51**	**52-75**	**59.38±4.18**	**51-70**	
Sex Male	**32**	**72.7**	**49**	**87.5**	**0.062**
Female	**12**	**27.3**	**7**	**12.5**	
Smoking Ex-smoker	**1**	**2.3**	**2**	**3.6**	**0.0001***
light smoker < 15 cigarette/day	**6**	**13.6**	**41**	**73.2**	
Heavy smoker ≥ 15 cigarette/day	**37**	**84.1**	**13**	**23.2**	
Pack per year No <20	**2**	**4.5**	**11**	**19.6**	**0.0001***
20--	**2**	**4.5**	**32**	**57.1**	
30--	**15**	**34.1**	**7**	**12.5**	
40--	**18**	**40.9**	**3**	**5.4**	
50--	**7**	**15.9**	**3**	**5.4**	

Mean±SD(range) of pack per year in COPD with ACS is 40.34±9.56 (19-62%)

Mean±SD(range) of pack per year in COPD without ACS is 27.04±10.42 (16-68%)

Table (2) Comparison of ECG and Cardiac enzymes between the two groups

Variables	COPD with ACS		COPD without ACS		P value
	No	**%**	**No**	**%**	
ECG AF	**1**	**2.3**	**5**	**8.9**	**0.164**
LBBB	**4**	**9.1**	**-**	**-**	**-**
v. ectopics	**9**	**20.5**	**7**	**12.5**	**0.281**
Tachycardia	**8**	**18.2**	**7**	**12.5**	**0.430**
No arrhythmia	**22**	**50.0**	**37**	**66.1**	**0.105**
Cardiac enzymes	**12**	**27.27**	**-**	**-**	**-**
Positive					
Negative	**32**	**72.72**	**56**	**100.0**	**-**

*Significant difference between proportions using Pearson Chi-square test at 0.05 level of significance.

Table (3) Comparison of PCV between the two groups

Variables	***COPD with ACS***		***COPD without ACD***		***P value***
	No	**%**	**No**	**%**	
PCV <40	**-**	**-**	**7**	**12.5**	**0.0001 ***
40--44	**3**	**6.8**	**1**	**1.8**	
45--49	**12**	**27.3**	**42**	**75.0**	
≥50	**29**	**65.9**	**6**	**10.7**	

mean±SD(range)of PCV in COPD with ACS is 50.39±2.97 (43-54%)

mean±SD(range)of PCV in COPD with out ACS is 46.50±4.09(34-54%)

Table (4) comparison of FEV1 between the two groups

	COPD with ACS		COPD without ACS		P value
	No.	**%**	**No.**	**%**	
FEV1 <20 %	**8**	**18.2**	**-**	**-**	**0.0001***
20--29%	**17**	**38.6**	**2**	**3.6**	
30--39%	**13**	**29.5**	**2**	**3.6**	
40--49%	**5**	**11.4**	**2**	**3.6**	
50--59%	**1**	**2.3**	**24**	**42.9**	
≥60%	**-**	**-**	**26**	**46.4**	

mean±SD(range)of FEV1 in COPD with ACS is 28.84±9.65 (18-50.2%)

mean±SD(range)of FEV1 in COPD without ACS is 56.09±9.07(22.6-64.8%)

Table(5) , Comparison of FEV1/FVC ratio between the two groups.

	COPD with ACS		COPD without ACS		P value
	No.	**%**	**No.**	**%**	
FEV1/FVC <56 %	**1**	**2.3**	**1**	**1.8**	**0.0001***
56--57%	**8**	**18.2**	**-**	**-**	
58--59%	**27**	**61.4**	**2**	**3.6**	

60--61%	**3**	**6.8**	**1**	**1.8**
62--63%	**2**	**4.5**	**16**	**28.6**
64--65%	**3**	**6.8**	**31**	**55.4**
≥66%	**-**	**-**	**5**	**8.9**

mean±SD(range)of FEV1/ FVC in COPD with ACS is 59. 38±2.16 (52.9-65.22%)

mean±SD(range)of FEV1/ FVC in COPD without ACS is 64.11±2.05(55.60 – 67.30%)

Table (6) comparison of drug history between the two groups .

Drug history	***COPD with ACS***		***COPD without ACS***		***P value***
	No.	**%**	**No.**	**%**	
Salbutamol	**9**	**34.6**	**5**	**41.7**	**0.99**
Theophylline	**4**	**15.4**	**4**	**33.3**	**0.722**
Salbutamol & Theophylline	**5**	**19.2**	**2**	**16.7**	**0.130**
Steroids	**8**	**30.8**	**1**	**8.3**	**0.005**

Discussion: Many of patients with COPD due to higher age, significant smoking history, hypoxia and polycythemia are at the risk of developing ischemic heart disease and subsequent left ventricular dysfunction especially during COPD exacerbations which is defined as acute symptoms of COPD beyond normal day to day variations(1, 3).

In our study the diagnosis of ACS is based on symptoms ,ECG changes , elevated troponin. Both COPD and ACS may have the same symptoms such as dyspnea and sometimes it is difficult to distinguish which organ is involved and in one study done in the university of Miami , they found that the diagnosis of ACS tend to be missed during exacerbation of COPD (6).

Supraventricular and ventricular arrhythmias are common among patients with COPD. In one study done in Copenhagen university hospital, they found that a reduced FEV_1 is an independent predictor of new onset atrial fibrillation in patient with COPD (8).

In our study ventricular ectopics occurred in 16% while sinus tachycardia in 14% , AF 6% and non sustained ventricular tachycardia in 4% compared with Copenhagen City Heart Study which found that arrhythmia was found in 84% of patients with COPD including atrial fibrillation in 8%, ventricular ectopics in more than 50% and non-sustained ventricular tachycardia in 22% (9).

In our study the severity of myocardial injury seems to be affected by the duration of COPD and the severity of reduction of FEV_1compared with SPRINT study which found that for every 10% decrease in $FEV_{1,}$ there is increase in cardiovascular mortality by 28% and nonfatal coronary events by almost 20% with those with very low FEV_1 have more extensive myocardial ischemic injury (10).

In our study we found that PCV was higher in ACS group which reflect more severe hypoxia and this higher PCV is associated with more hyperviscosity and worsening ischemia compared with another study done in Harvard university which found that there is no significant difference in PCV between patients with (COPD and IHD) and those with only COPD (11).

IV. Conclusion:

Patients with (COPD with ACS) may have lower FEV1 and FEV1 / FVC ratio than those with (COPD without ACS)**.** Patients with (COPD with ACS) may have higher PCV values than those with (COPD without ACS).

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