

Comparative study assessing a group of COPD patients according to the new combined (ABCD) assessment tool in Al-Yarmouk Teaching Hospital

Dr. Marwan Majeed Ibrahim

CABM internal medicine ,FICM respiratory medicine

Tikrit University College of Medicine

Dr. Abdulhameed Alqaseer

Prof of Internal Medicine, Almustansirya University College of medicine

List of abbreviations

DLCO : diffusion capacity of Carbon monoxide

GOLD : global initiative of chronic obstructive pulmonary disease

FEV1 : forced expiratory volume in first second

FVC : forced vital capacity

ICS : inhaled corticosteroid

LABA : long acting beta agonist

LAMA : long acting anti muscarinic

mMRC modified medical research council

SABA : short acting beta agonist

SAMA : short acting anti muscarinic

ABSTRACT

Background: COPD is one of the commonest respiratory illnesses that lead great morbidity and disability and one of the leading causes of mortality worldwide, also it is a growing field of researches regarding reclassification and treatment review there are several methods of classification of COPD patients: GOLD system and the newer ABCD assessment tool which is the main field of this research.

Objective: The aim of the study is to evaluate the patients with COPD using the new ABCD assessment tool and comparing it with GOLD classification system in the way of early detection and diagnosis of COPD.

Patients and methods: A cross-sectional study was conducted at Al-Yarmouk Teaching Hospital - Department of Respiratory medicine involving 110 COPD patient evaluated depending on history , physical examination , radiological imaging , spirometry and six minute walk test. Then the patients had been grouped according to GOLD and ABCD classification systems then comparism between two modalities had been done.

Results: The study involved 110 patients aged between 42 and 81 years old ; 92 male and 18 female, male : female ratio 5:1.

We assess the patients according to GOLD module, then the patient had been redistributed according to ABCD assessment tool using FEV1, dyspnea scale utilizing mMRC , and number of exacerbation per year reveal the following: No patient (0%) GOLD 1, 36 patient (32.7%) GOLD2, 42 patient (38.2%) GOLD3, and 32 patient (29.1%) GOLD 4 ; while redistributing the patients according to ABCD module reveals the following: Twenty seven patient (24.5%) were class A, 10 patients (9%) were class B , 6 patients (5.5%) class C and 67 patient (61%) of class D ; so there is a significant difference between the different categories of ABCD assessment tool as compared to GOLD groups due to the impact of dyspnea scale and number of exacerbations on the reclassification.

Conclusions: ABCD assessment tool may be more accurate and practical than GOLD classification ; ABCD assessment tool can be of benefit in early detection and management of early COPD cases more than the GOLD system.

Recommendations: utilization of ABCD assessment tool in early detection , diagnosis , and follow up of patients with COPD.

INTRODUCTION:

Overview of COPD

Chronic obstructive pulmonary disease (COPD) is a general name for the chronic air flow obstruction that develops most often as a result of chronic tobacco smoking, but also after exposure to biomass fuels. The pathology of COPD encompasses a variety of pathologic lesions in the airways, lung parenchyma, and pulmonary vasculature, and these lesions can be correlated, to a greater or lesser degree, with changes in pulmonary function tests and clinical appearances. In general, although the mechanisms involved are complex, airflow obstruction can be attributed largely to a marked increase in airway resistance secondary to a variable mix of structural abnormalities involving all or many of the compartments of the airway. However, in individual cases, it may be difficult to prove associations between physiologic abnormalities and pathologic changes.

COPD is a disorder that is characterized by slow emptying of the lung during a forced expiration. In practice, this is measured as the forced expiratory volume in 1 second/forced vital capacity (FEV1/FVC) ratio, and the arbitrary definition of airflow obstruction is generally taken to be an FEV1/FVC ratio lower than 0.70.(1)

The diagnosis of COPD is usually limited to individuals who have chronic airflow obstruction associated with tobacco smoke or some other noxious inhalant, and it is usually not difficult to distinguish it from other causes of chronic airflow obstruction. The most commonly associated clinical disorders associated with COPD are emphysema and chronic bronchitis. Emphysema is defined anatomically by airspace enlargement due to disappearance of alveolar septae. This leads to the characteristic loss of elastic recoil, which, in turn, causes slowing of airflow from the lungs, hyperinflation, and air trapping .

Chronic bronchitis is characterized by chronic cough and sputum production, which is present in about one out of three people with early COPD. Chronic cough and sputum production in cigarette smokers is often, but not always, associated with chronic airflow obstruction. When chronic mucus hypersecretion is associated with airflow obstruction, it is often called chronic obstructive bronchitis. (2)

Patients with COPD also have small- and medium-sized airway involvement with inflammation, narrowing, tortuosity, mucus plugging, and fibrosis that contributes to the airflow limitation.

As the disease evolves, there is obliteration of small airways. Some patients with a long-standing history of asthma develop airflow obstruction that is not completely reversible, episodes of cough and wheeze, and chronic sputum production. These individuals are often classified as having chronic asthmatic bronchitis and tend to have a somewhat better prognosis for survival than those with typical tobacco-related COPD.

Natural History of COPD

COPD results from an increase in the rate of decline in lung function over time. Normal nonsmoking adults lose FEV1 at a rate of 30 mL/year, thought to be the consequence of the aging-related loss of elastic recoil of the lung. Persons who develop COPD may start in early adulthood with lower levels of lung function and also have increased rates of decline. Studies of patients with COPD show an average annual decline in FEV1 of 45 to 69 mL/yr.

However, there may be considerable heterogeneity between patients and over time.(3)

People who discontinue smoking with mild to moderate degrees of airflow obstruction cease the rapid decline in FEV1, and have better survival (4)

Because there are many years of asymptomatic decline in lung function, it is possible to diagnose COPD with forced expiratory spirometry before the disease is apparent and implement aggressive smoking intervention programs.

There is a consensus that smokers with respiratory symptoms should be tested for COPD with spirometry. However, there is debate whether it is of value to screen for COPD among all cigarettes smokers.(5)

Patients with advanced COPD may restrict their activities to a bed-and-chair lifestyle because of severe exercise incapacitation. This limitation can lead to social isolation, depression, and skeletal muscle deconditioning, which, in turn, further restrict activity and impair quality of life. Protein and calorie malnutrition occurs as the consequence of impaired nutritional intake caused by dyspnea. Malnutrition is augmented by increased metabolic demands caused by increased basal oxygen consumption, inefficient skeletal muscle oxygen utilization, and cachexia-producing cytokines such as tumor necrosis factor-α (TNF-α). (6)

Several factors have been identified that predict poor survival in COPD. These include low FEV1, active smoking status, hypoxemia, poor nutrition, the presence of cor pulmonale, resting tachycardia, low exercise capacity, severe dyspnea, poor health–related quality of life, anemia, frequent exacerbations, comorbid illnesses, and low DCO. (7)

Aim of the study:

The aim of the study is to evaluate the patients with COPD using the ABCD assessment tool and comparing it with GOLD classification system extrapolating advantages and disadvantages of both systems, evaluation of treatment modalities , compliance with treatment , and suggesting future plans to improve management and follow up of COPD patients.

Patients and methods:

A cross-sectional study was conducted at Al-Yarmouk Teaching Hospital - Department of Respiratory medicine in Baghdad -Iraq (from the period of January 2017 to January 2018) involving 110 patient with COPD.

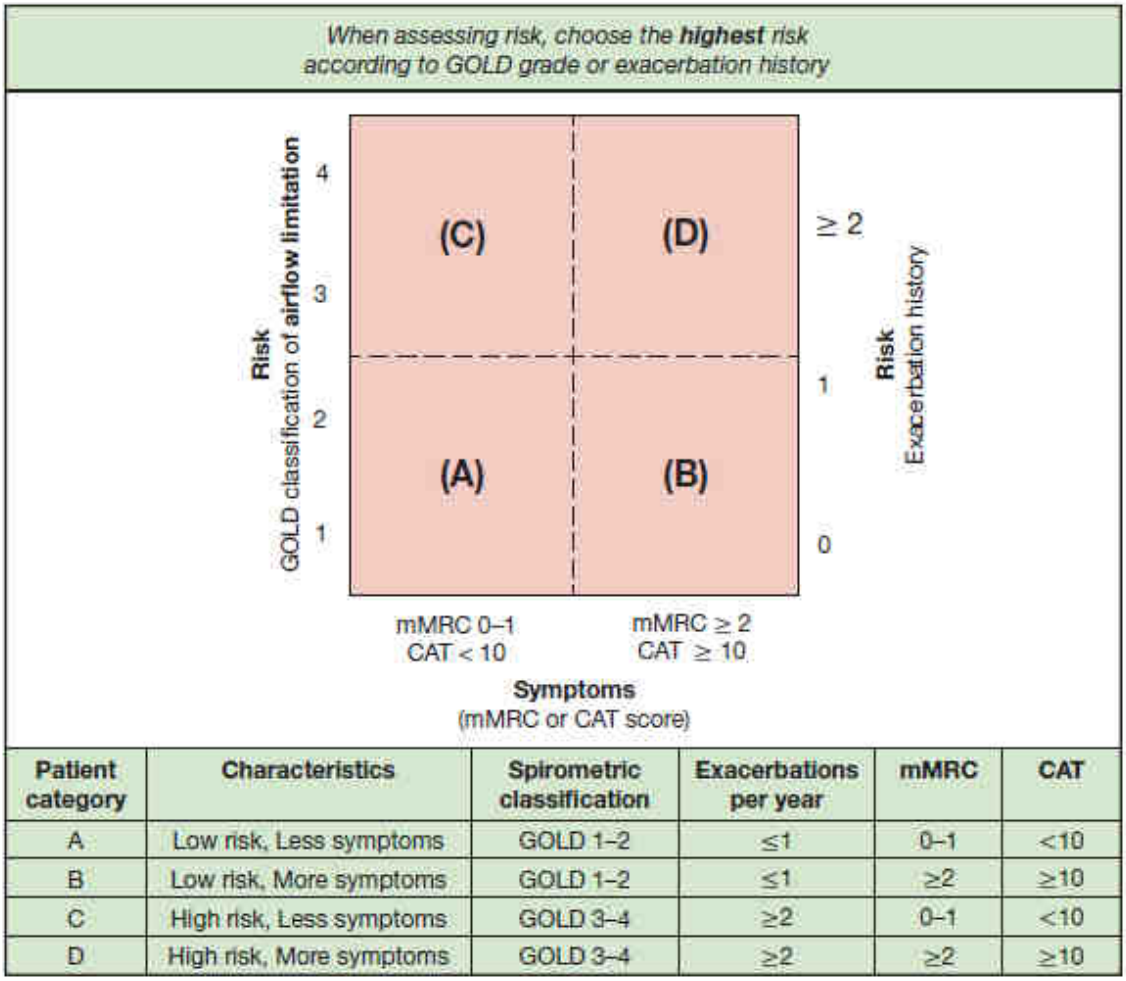
Detailed medical history, history of exposure to smoking or noxious materials, history of exacerbations and physical examination had been taken . All patients had been investigated with chest imaging , electrocardiography ,echocardiography to exclude comorbidities; and the diagnosis of COPD, classification of its severity, and progression of the disease had been done with *spirometry*. The FEV1/FVC ratio, reflecting the rate of emptying of the lung, is used to define the presence of an obstructive ventilatory defect, commonly defined as a ratio less than 0.70 or below the lower limit of normal. Once airflow obstruction is established, the severity of the airflow limitation is classified by the reduction of FEV1 compared with a healthy reference population , Table1 (8)

TABLE 1 Classification of Severity of Airflow Limitation in COPD

GOLD Classification	Characteristics
I Mild COPD[a]	FEV_1 ≥80% predicted
II Moderate COPD[a]	FEV_1 50–79% predicted
III Severe COPD[a]	FEV_1 30–49% predicted
IV Very severe COPD[a]	FEV_1 <30% predicted or <50% predicted with room air Pa_{O_2} <60 mm Hg (8.0 kPa)

[a]*Postbronchodilator FEV_1/FVC less than or equal to 0.70.*
Source: Data from the 2011GOLD COPD guidelines, www.goldcopd.com; Celli BR, MacNee W. ATS/ERS Task Force. Standards for the diagnosis and treatment of patients with COPD: A summary of the ATS/ERS position paper. Eur Respir J. 2004;23(6):932–946.

Based on symptoms and risk of exacerbations, individuals are grouped into one of four different patient categories (see Fig. 1). The categories are informative for determining prognosis and treatment of COPD .(1)



Patient category	Characteristics	Spirometric classification	Exacerbations per year	mMRC	CAT
A	Low risk, Less symptoms	GOLD 1–2	≤1	0–1	<10
B	Low risk, More symptoms	GOLD 1–2	≤1	≥2	≥10
C	High risk, Less symptoms	GOLD 3–4	≥2	0–1	<10
D	High risk, More symptoms	GOLD 3–4	≥2	≥2	≥10

Figure 1 Combined COPD assessment. An understanding of the impact of COPD on an individual patient combines assessment of symptoms and future risk of exacerbation. To use this figure, first assess symptoms with the modified medical research council (mMRC) or COPD assessment test (CAT) scale and determine if the patient has less symptoms (mMRC <2 or CAT <10) or more symptoms (mMRC ≥2 or CAT ≥10). Next, assess the risk of future exacerbation by determining prior exacerbation history and severity of airflow limitation with high risk of future exacerbation in individuals with GOLD airflow classification 3 to 4 or ≥2 exacerbations in the prior year (future risk should be determined by the method indicating higher risk). With this figure, individuals are stratified into one of four categories (A, B, C, D). which helps describe the burden of disease and informs potential treatments. *(Reproduced with permission from Global Strategy for the Diagnosis, Management, Prevention of COPD, © Global Initiative for Chronic Obstructive Lung Disease (GOLD), all rights reserved. Available from http://www.goldcopd.org.)*

Inclusion criteria involving those patient aging 40 years or more who are current or x-smokers or under long time of exposure to noxious stimuli with (post bronchodilator FEV1/FVC <=70% of predicted) documented on spirometry.
The exclusion criteria are:
1-Ashtma and asthma COPD overlap. 2- Bronchogenic carcinoma,3-Advance congestive heart failure, 4-Severe pulmonary hypertension , 5-Patient incapable of ambulation due to limb amputation or orthopedic problems in which six minutes walk test and mMRC cannot be appreciated 6-Broncheictasis. 7- Interstitial lung disease. 8-Active pulmonary tuberculosis. 9-Patient with acute exacerbation of COPD.

The patients had been evaluated using GOLD classification and the new ABCD assessment tool utilizing FEV1, mMRC dyspnea scale and number of exacerbations per year.

Treatment of the patients according to their GOLD and ABCD groups and compliance with COPD medications and vaccination history had been evaluated.

RESULTS

The study involved 110 patients between the ages 42 and 81 years old ; 92 male and 18 female, male : female ratio 5:1

Seventy nine patient (71.8%) are current smokers and 31 (28.2%) were x-smokers , there is no patient who had been non smoker.

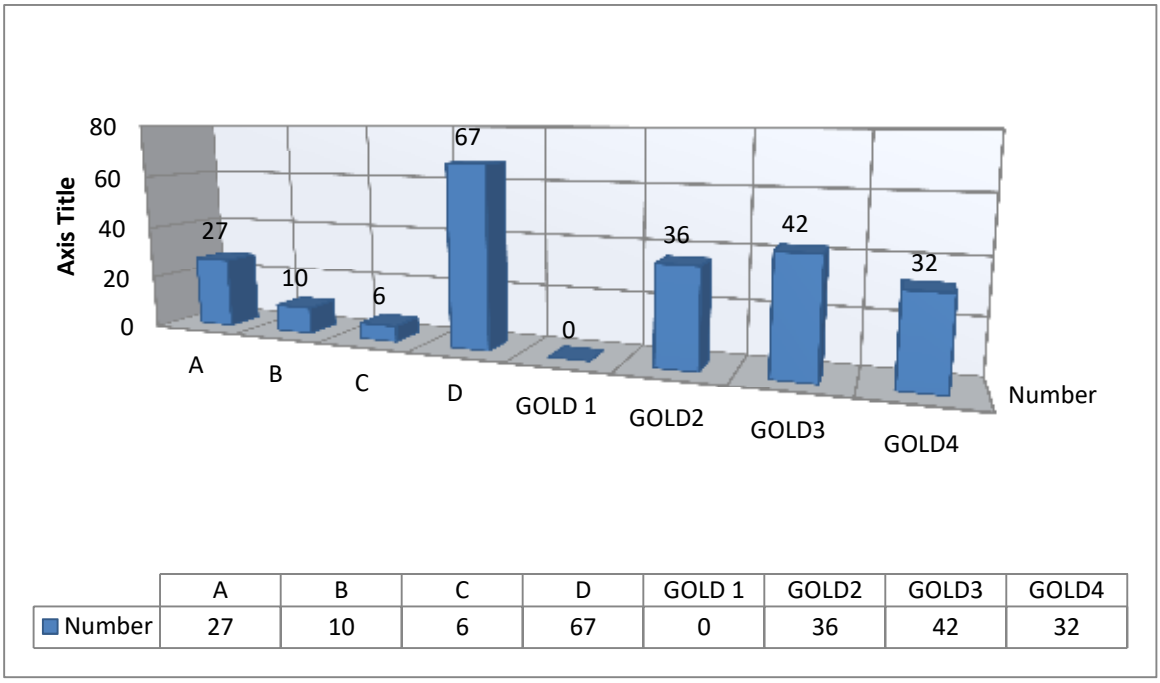
Thirty two patients was inpatients (29.1%) while 78 (70.9%) were outpatients.

From the medical history we found that 17 patients (15.5%) with equal or more than two exacerbation per year, 40 patient (36.4%) had one exacerbation and 53 patients (48.2%) with no history of exacerbation ;Table 2

Table2 Age , sex , smoking status, admissions, and exacerbations

		No	%
Age (years)	40---49	14	12.7
	50---59	30	27.3
	60---69	36	32.7
	70---79	26	23.6
	=>80y	4	3.6
	Mean±SD(Range)	61.9±10.0 (42-81)	
Gender	Male	92	83.6
	Female	18	16.4
Smoking	Smoker	79	71.8
	X-Smoker	31	28.2
Admission	In-patient	32	29.1
	Out-patient	78	70.9
Exacerbation (No/years)	No	53	48.2
	One	40	36.4
	Two and more	17	15.5

We classify the patients according to GOLD system, then the patient had been redistributed according to ABCD assessment tool using FEV1, dyspnea scale utilizing mMRC , and number of exacerbation per year reveal the following: No patient (0%) GOLD 1, 36 patient (32.7%) GOLD2, 42 patient (38.2%) GOLD3, and 32 patient (29.1%) GOLD 4 ; while redistributing the patients according to ABCD assessment tool reveals the following: Twenty seven patient (24.5%) were class A, 10 patients (9%) were class B , 6 patients (5.5%) class C and 67 patient (61%) of class D ; so there is a significant difference between the different categories of ABCD system as compared to GOLD groups due to the impact of dyspnea scale and number of exacerbations on the reclassification Figure 2, figure 3 , table 3.



	A	B	C	D	GOLD 1	GOLD2	GOLD3	GOLD4
Number	27	10	6	67	0	36	42	32

Figure 2 reclassification of patients from GOLD to ABCD module

Table 3 reclassification of patient into subgroups

		ABCD			
		A	B	C	D
GOLD	1	-	-	-	-
	2	26	10	-	-
	3	1	-	6	35
	4	-	-	-	32

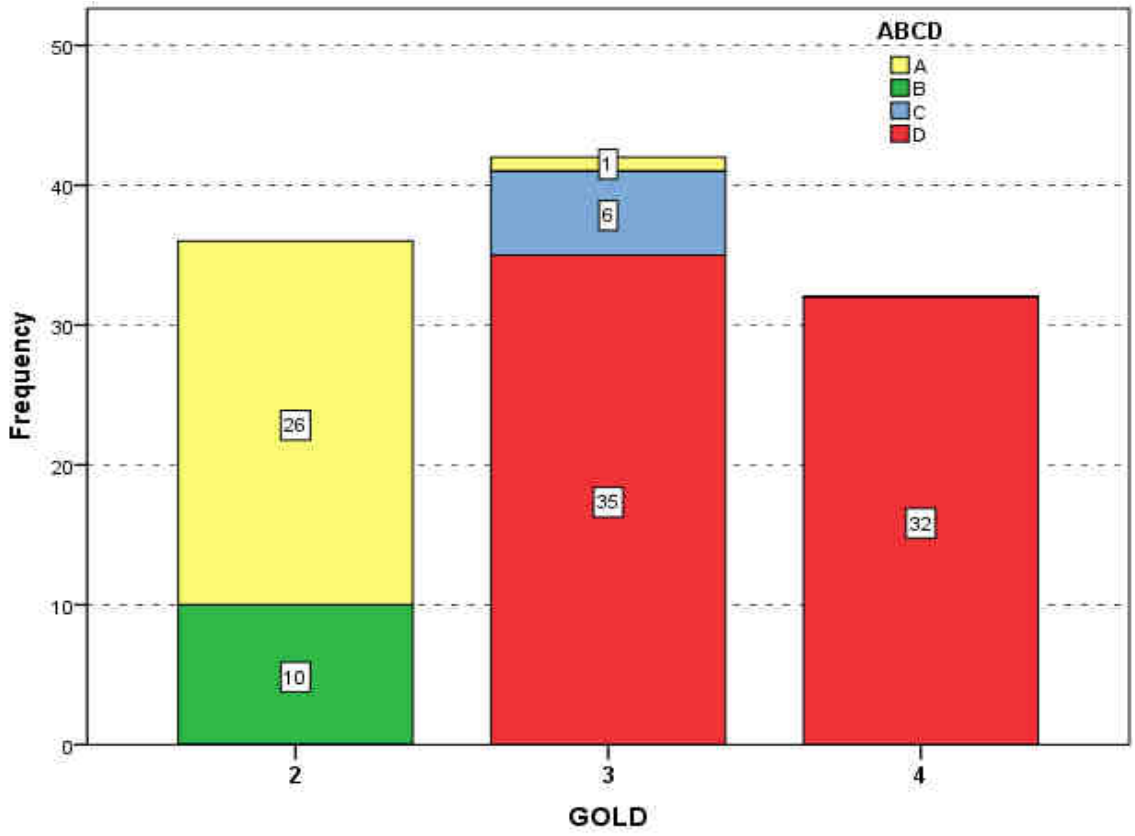


Figure 3: schematic presentation of redistribution of patients from GOLD to ABCD classification system.

The steady transition of FEV1 among subclasses of GOLD is less clear in ABCD assessment tool in which there is integration among the groups because there were another criteria for the classification of patients rather than depending on one criterion i.e FEV1. Figure 4; but the transition is still significant statistically in both systems, table 4

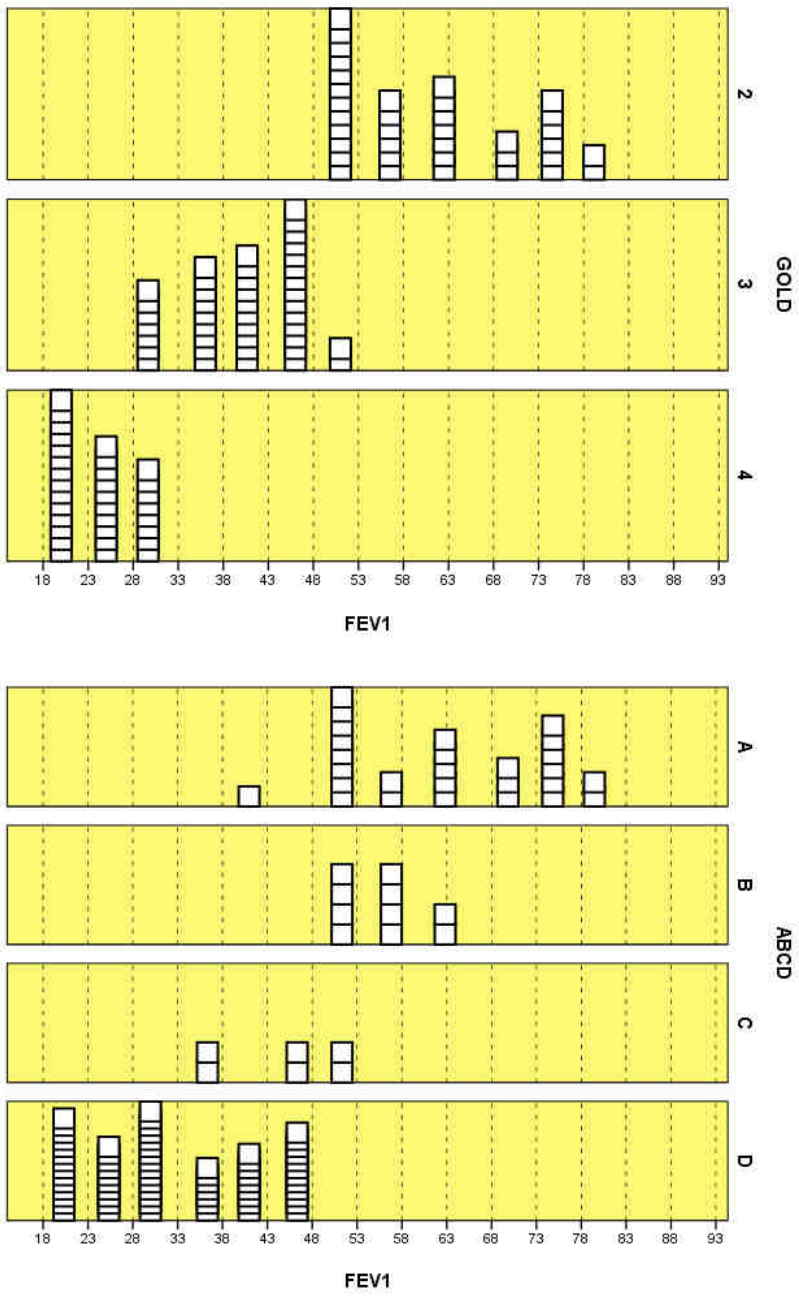


Figure 4 Comparative trend of FEV1 between the GOLD and ABCD classification systems

Table 4 range and significance of FEV1 among all groups

		FEV1	P value
GOLD	1	-	0.0001*
	2	61.2±9.8 (50-78)	
	3	40.0±6.0 (30-49)	
	4	23.5±3.9 (18-29)	
ABCD	A	62.9±10.8 (42-78)	0.0001*
	B	54.7±4.7 (50-64)	
	C	44.7±5.2 (38-49)	
	D	31.7±9.3 (18-48)	

*Significant difference among four independent means using ANOVA test at 0.05 level.

GOLD	P value		ABCD	P value
1x2	-		AxB	0.015*
1x3	-		AxC	0.0001*
1x4	-		AxD	0.0001*
2x3	0.0001*		BxC	0.015*
2x4	0.0001*		BxD	0.0001*
3x4	0.0001*		CxD	0.003*

*Significant difference between two independent means using Students-t-test at 0.05 level.

Seventy nine patient (71.8%) were on regular treatment according to GOLD module , the other 31 patient (28.2%) were on no regular therapy; Figure 5

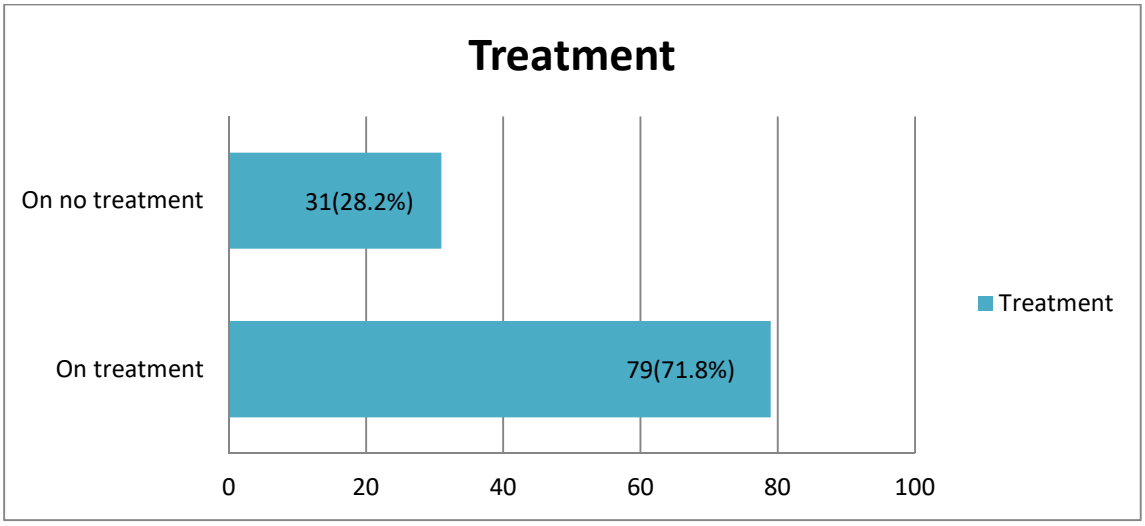


Figure 5: classification of patients according to treatment (treated vs non-treated)

Of those patient on regular treatment the majority were non-compliant with treatment 45 patient (57%) and 34 patient (43%) are compliant; figure 6.

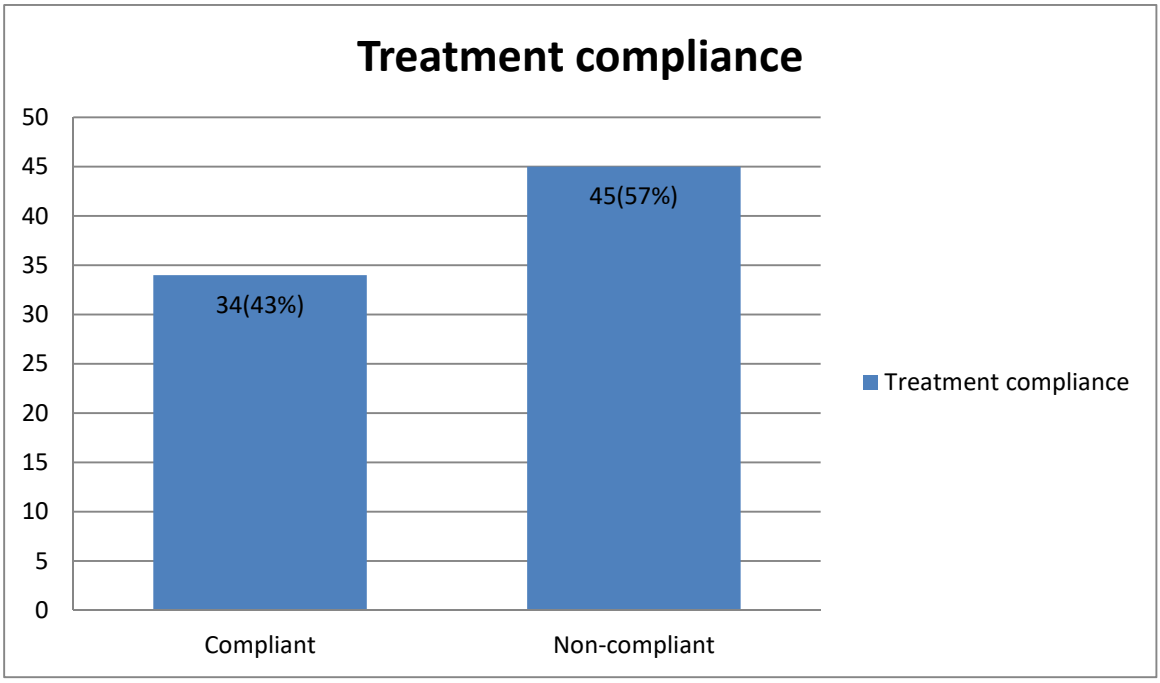
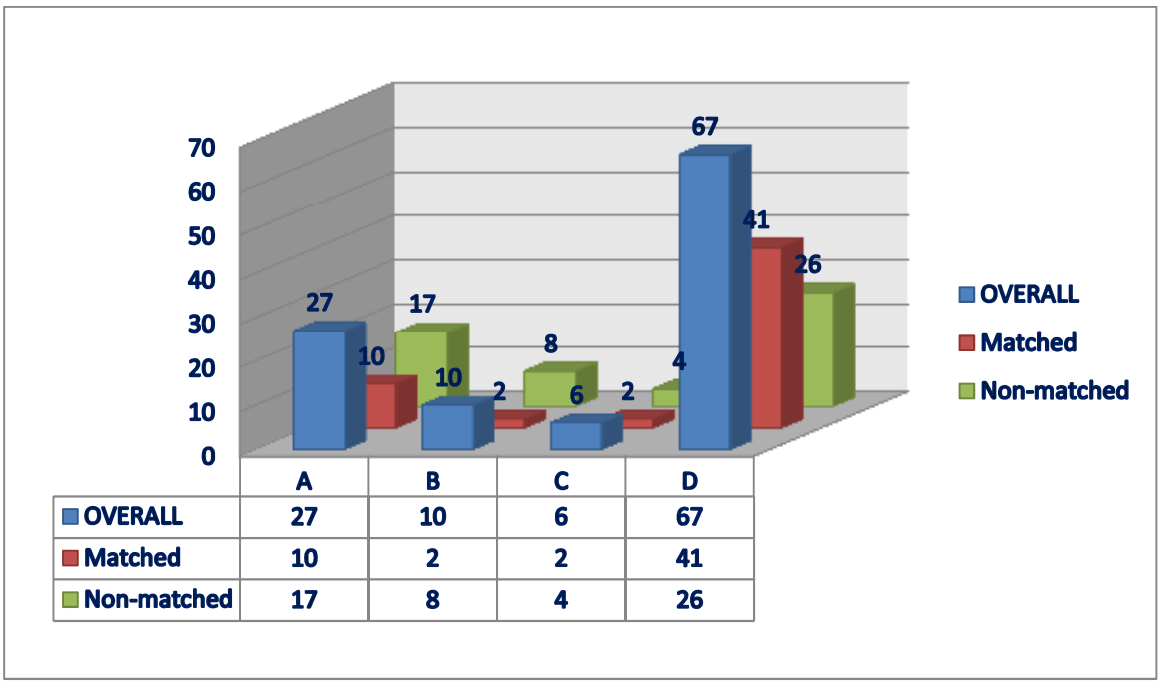


Figure 6 : illustration of patients compliance with treatment.

Regarding patient receiving treatment higher percent of patients matching class therapy is group D in which 41 patient (61.2%) patients are matched compared with only (10) patient 37%, (2) patients 20% and (2) patients 33.3% for class A, B and C respectively; Figure 7.



	A	B	C	D
OVERALL	27	10	6	67
Matched	10	2	2	41
Non-matched	17	8	4	26

Figure7 : therapy match among ABCD group

Regarding the treatment of the patients, 45 patient (40.9%) of patient use SABA, 6 patients (5.5%) use SAMA, 53 patient (48.2%) use LABA/ICS, 8 patients (7.3%) use LAMA, 10 patients (9.1%) use oral steroids, and 12 patient (10.9%) use theophylline . Table 5

Table 5 : Treatment of the patients and significance with therapy

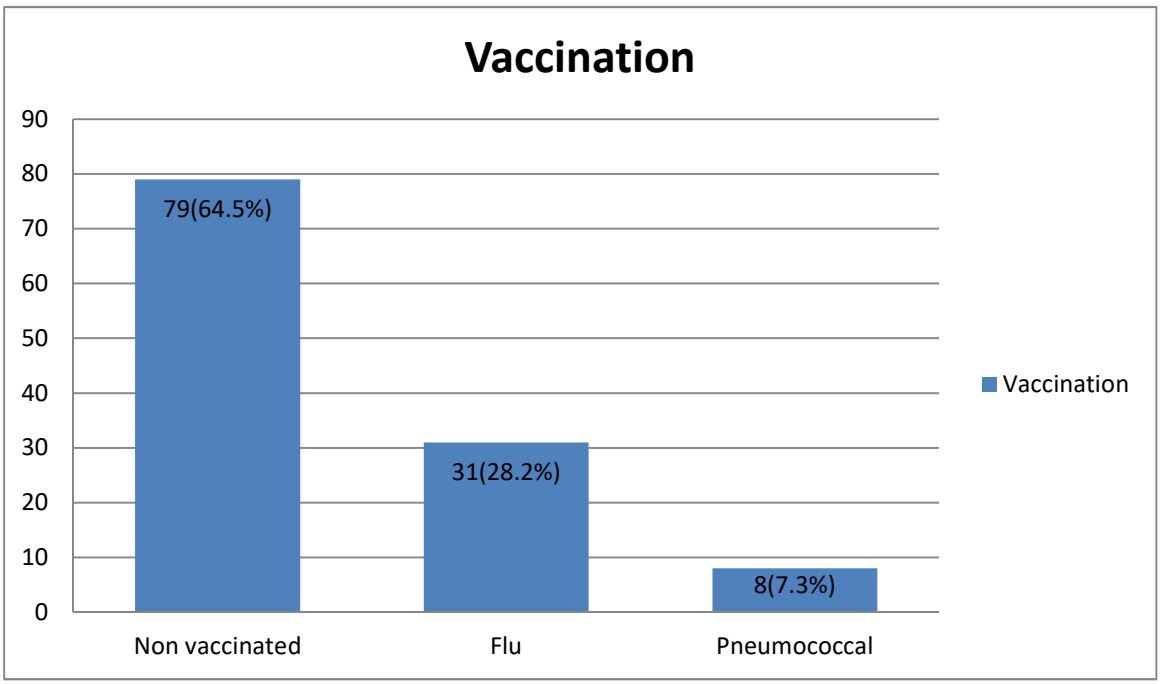
	SABA	SAMA	LABA/ICS	LAMA	ORAL STEROID	THEOPHYLLINE
A	3	0	7	0	2	4
B	2	0	2	0	0	0
C	1	0	2	0	0	0
D	39	6	42	8	8	8
OVERALL	45	6	53	8	10	12

		No	%
Treated with SABA	Yes	45	40.9
	No	65	59.1
SAMA	Yes	6	5.5
	No	104	94.5
LABA/inhaled steroids	Yes	53	48.2
	No	57	51.8
LAMA	Yes	8	7.3
	No	102	92.7
Oral steroids	Yes	10	9.1
	No	100	90.9
Theiophylline	Yes	12	10.9
	No	98	89.1

P value		Treated with SABA	SAMA	LABA/STR	LAMA
GOLD		0.0001*	0.011*	0.003*	0.019*
ABCD		0.001*	0.254	0.002*	0.429

Regarding vaccination programs only 31 patient (28.2%) had been vaccinated for Influenza vaccine but only 8 patients (7.3%) had received pneumococcal vaccine. figure 8

Figure 8 Vaccination in patients with COPD



Six minute walk test had been applied for COPD patients and revealed higher durability i.e >350m is among category A (81.5%) compared with only (3%) among category D; meanwhile (59.7%) of category D cannot maintain >150 m.; table 6

Table6: six minute walk test among patients classes of ABCD

SIX MINUTE WALK TEST	<150	150-249	250-349	>350
A	_	2	3	22
B	2	4	2	2
C	_	2	_	4
D	40	16	9	2

Discussion

This study demonstrate that there is significant difference in male:female ratio in COPD which was almost 5:1 compared with the usual figures published in most references which reveals that male:female ratio is almost equal, this difference possibly referred to the fact that most of the published studies focused on the incidence in developed countries, the social limitations that make most of the female subject deny smoking, lower level of smoker females compared with smokers male in our society in the past decades and possibly small sample size.
This study also disclose that there is no subject fitting the criteria of GOLD 1 possibly due to delay in presentation of COPD patients until he/she had been symptomatic , complaining of acute exacerbations , under estimation of respiratory cause of dyspnea in smokers with comorbidities , and lack of screening programs for early detection of COPD.

According to the results of this study the overall COPD case who had been treated and followed up depending on the GOLD module is preferred to be switched to the new modality i.e. ABCD assessment tool in which more variables had been applied to classify patient to treatment groups and *because at an individual level , FEV 1 is an unreliable marker of severity of breathlessness, exercise limitation, health status impairment.*(9)
In this study most of the cases shifted toward both extremes (either of A subgroup in which treatment is simple or D subgroup where the treatment and follow up is more complicated) (figure2 and 3); so the use of other variables other than only FEV1 will result in a possible improvement in evaluation , reclassifying, early detection of functional status impairment and by the end accurate management . By comparism with the latest study published study by Sonia Coton et al: *we compared the strengths of association of each classification with quality of life (QoL), MRC dyspnea score and the self-reported exacerbation rate. Agreement between classifications was only fair (10)* .
There is shifting toward early diagnosing COPD cases with the new modality (group A 27 patient Vs zero patient for GOLD 1) which reflect the fact that COPD had not been given importance for early detection and waiting COPD patient to be present to the physician only following development of symptoms of dyspnea or suffering from exacerbation to be noticed .
Because this study had not revealed any patient with GOLD 1 but still 27 of group A of ABCD , there may be better to utilize of ABCD assessment tool in detection of early COPD and hence early management.

If we compare this study to the latest Saudi COPD study *The prevalence of chronic obstructive pulmonary disease in Riyadh, Saudi Arabia: a study 2015 by M. Al Ghobain et al* (11), *which show that The prevalence of COPD stage 1 or higher based on LLN was (3.2%),*so there may be 3-4 % of our population had not been diagnosed if we still pursuit GOLD module, and these population need to be considered in the future COPD screening programs .

The impact of number of exacerbations / year and dyspnea scale mMRC shifted most of the patients from lower GOLD class 3 to group D of ABCD (35 of 42) and that advance enough cases i.e. GOLD 4 FEV1<=30% are all of group D in which the number of exacerbations and level of mMRC were high and is proportional to low FEV1, figure 3.

The two intermediate groups of GOLD system i.e. 2 and 3 had been affected as well by the effect of number of exacerbations and mMRC scale by the following:, shifting number of GOLD 2 from 36 to 10 group B , 42 patient of GOLD 3 to 6 of group C. fig 2 table 2.

All these facts urge against the use of FEV1 as a an only parameter for grouping COPD patients and considering other measures mentioned before.

This study also signify that high number of COPD patients had not been treated 31 patient (28.2%) ,figure 5, and among those on treatment 45 patient (57%) are non-compliant, figure 6, and still low percent of patients are under treated if they had been classified according to ABCD assessment tool especially in the first three groups (A,B and C), but still higher percent of patients in group D is matching their treatment (41 of 67) 61.2%, may be related to frequency of exacerbations and high burden of symptoms if we use ABCD assessment tool . figure 7

Regarding the treatment of the patients the use of SABA and combination of LABA/ inhaled steroids were the most frequently used among all ABCD groups (P value 0.001 and 0.002 respectively). But the use of SAMA and LAMA, is still not significant despite their efficacy and role of lowering exacerbation rates in managing COPD (P value 0.254 and 0.429 respectively) may be because of high cost and delay onset of action as compared with beta agonists. Table 5

Influenza vaccination can reduce serious illness (such as lower respiratory tract infection requiring hospitalization) and death in COPD patients. Only a few studies have evaluated exacerbations and they have shown significant reduction in the total number of exacerbations per vaccinated subject compared with those who received placebo (12) . In our study only small proportion were received flu vaccine 31 (28.2%) , and lower number received pneumococcal vaccine 8 (7.3%) . A systematic review of injectable vaccines in COPD patients identified seven studies for inclusion (two trials of a 14-valent vaccine and 5 trials of a 23-valent injectable vaccine) and observed reductions in the incidence of pneumonia and acute exacerbations that did not reach statistical significance (12,13).

Smoking is the most important etiological element in the development of COPD and all the patient were current or x-smoker, due to the lack of effective smoking control action, it is expected that COPD will be a major health problem in the near future, with a very high demand on health services, so still active smoking is associated with more exacerbations.

Finally an important limitation in our study is that lack of cases in GOLD 1 subgroup , the low number of female patients and the high incidence of comorbidities that results in exclusion of some presumed COPD cases from this study.

Conclusions

From this study we conclude the followings:

1- No patient of group 1 of GOLD system had been detected in this study.

2- Most of the patients in GOLD system had been reclassified into different treatment and prognostic groups by ABCD module.

3- ABCD assessment tool may be of more benefit in early detection and management of early COPD cases than the GOLD module.

4- Significant percentage of COPD patients are not treated appropriately or not treated at all.

5- Significant percent of treated patients are not compliant with their treatment.

6- The vast majority of COPD patient were not vaccinated and the majority still active smokers.

Recommendations

1- We my need a larger multicenter study involving more COPD patients for more accurate assessment of COPD in Iraq.

2- Better utilization of ABCD module in diagnosis and follow up COPD patients.

3- Optimization of COPD management and encourage patients to adhere to their medications.

4- Encourage vaccination for pneumococcal and flu vaccine in newly diagnosed and non- vaccinated COPD patients.

5- Encourage stop smoking in the society and keeping health authorities informed about strategic planning requirements to fight against the increase in smoking and worsening air pollution.

6- Educate the treating stuff in general practitioner, internal medicine, and chest clinics to better utilizing history of exacerbations , dyspnea scale as well as spirometry in diagnosing and follow up COPD patients.

Acknowledgement

TO MY SUPERVISOR Dr ABDULHAMEED ALQASEER FOR HIS ADVICES, TO MY PARENTS FOR THEIR PRAYS , FOR MY WIFE FOR HER SUPPORT, AND FOR THE PATIENTS FOR THEIR PARTICIPATION...

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