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ORIGINAL ARTICLE

Association of Metabolic Syndrome with Chronic Obstructive Pulmonary Disease (COPD)

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Abstract:

Background: *Chronic obstructive pulmonary disease (COPD) is thought to have increased association with metabolic syndrome (MS) which represents a cluster of factors that increase the risk of cardiovascular diseases and diabetes mellitus. However, the extent of association of COPD with MS and its individual components are still an unsettled issue, and it is likely to vary from population to population. This study was undertaken to assess association of COPD with metabolic syndrome.*

Methods: *This cross-sectional study conducted at the Department of Respiratory Medicine in National Institute of Diseases of the Chest and Hospital from January 2019–December 2019. A total of 91 patients with chronic obstructive pulmonary disease (COPD) were enrolled in this study.*

Results: *Out of 91 patients with COPD, more than one third (34.1%) patients were belonged to age 51-60 & 61-70 years respectively with mean age 60.4±10.9 years ranging from 42 to 90 years. Majority (85.7%) patients were male. Male to female ratio was 6:1. Twenty seven (29.7%) were service holder and most of the patients 76(83.5%) were smoker. Mean BMI was 20.6±4.0 kg/m^2, mean waist circumference was 86.9±6.8 cm, mean SBP 120.1±17.5 mmHg and mean DBP 76.3±11.1 mmHg. Mean FEV_1/FVC post bronchodilator was 51.2±9.5 percent. Mean triglycerides was 149.9±38.4 mg/dl, mean HDL-C was 39.4±9.8 mg/dl, mean fasting glucose was 104.1±28.0 mg/dl. Metabolic syndrome was found in 19(20.9%) patients. Age, sex, occupational status, smoking, BMI, waist circumference, hypertension, triglycerides, HDL-C, fasting glucose and metabolic syndrome were not statistically significant (p>0.05) when compared grade of COPD.*

Conclusion: *In conclusion, the present study demonstrated that metabolic syndrome present in 20.9% of COPD patients. Age, sex, occupational status, smoking, BMI, waist circumference, hypertension, triglycerides, HDL-C, fasting glucose and metabolic syndrome were not statistically significant when compared grade of COPD. Thus, considering COPD as a systemic disease and screening for components of metabolic syndrome could form a part of routine work-up of these patients.*

Keywords: *Metabolic syndrome (MS), Chronic obstructive pulmonary disease (COPD).*

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Introduction:

The metabolic syndrome (MS) represents a cluster of risk factors that increases the risk for developing diabetes mellitus[1], nonfatal and fatal cardiovascular disease[2]. The common risk factors are raised fasting plasma glucose, abdominal obesity, dyslipidemia, and high blood pressure[3]. This syndrome has outspread as epidemic worldwide[4]. Some studies from USA and Australia found 20–25% of the adult population suffering from MS[5,6]. Different international expert committees developed varied clinical criteria for the diagnosis of metabolic syndrome. Among them, definition prepared by International Diabetic Federation (IDF), National Cholesterol Education Program–Third Adult Treatment Panel (NCEP ATP III), and WHO were wildly accepted[7]. As a gross, all the Expert Committee agreed that obesity, insulin resistance, dyslipidemia, and hypertension are the important markers of MS[8]. The exact pathogenesis of MS is unknown, but it is predicted that obesity, insulin resistance associated with systemic inflammation are the causative factors[9].

Chronic obstructive pulmonary disease (COPD) is a major cause of health care burden throughout the world–wide, and the only leading cause of death that is increasing in prevalence[10]. COPD has a great impact on public health. It is one of the leading causes of mortality and morbidity in Bangladesh. The reduction of mortality and morbidity among COPD patients must remain in public health priority. COPD is a preventable and treatable disease with some significant extrapulmonary effects that may contribute to the severity in individual patients. Its pulmonary components are characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lung to noxious particles or gases[11]. COPD is not only a lung disease but also has some systemic effects. With the progression of this disease, systemic inflammation occurred among the COPD patients, and the patients suffered from different symptoms of chronic diseases, for example, dyslipidemia, diabetes mellitus, hypertension, coronary and peripheral artery diseases, anemia, osteoporosis, and rheumatoid arthritis. They are called as the comorbidities of the COPD. The exact pathological way of these systemic inflammation is not known but is believed to be related to enhance systemic inflammation and oxidative stress. These mechanisms may be multifactorial. The association between chronic inflammation and increased insulin resistance may be accounted for disruption of insulin receptor signaling by inflammatory mediators. Usually, insulin resistance occurs in combination with obesity, dyslipidemia, and hypertension. These together make up the "MS" which is a major determinant of cardiovascular morbidity and mortality[12]. Link between metabolic syndrome (MS) and COPD has been observed in several cross sectional and longitudinal studies, and the syndrome has been identified as an independent risk factor for worsening respiratory symptoms, increasing lung function impairment, pulmonary hypertension.

Methods:

This cross-sectional study was conducted in the Department of Respiratory Medicine of National Institute of the Diseases of the Chest & Hospital (NIDCH), Mohakhali, Dhaka, Bangladesh, from January 2019 to December 2019. A total of 91 patients with COPD were selected by purposive sampling who attended in the above mentioned hospital (both outpatients and admitted patients) were included this study according to the inclusion and exclusion criteria of the study. In first phase, the eligible participants were explained the study purpose and written informed consent was obtained from the patients and the relevant socio-demographic characteristics and history of the smoking were collected by face to face interview using predesigned datasheet. After completion of interview the patient was examined physically, all information and findings were recorded in the preformed proforma. The relevant investigations, like- Complete blood count (CBC), Fasting Blood Sugar, Fasting lipid profile, Serum Creatinine, Serum Bilirubin, SGPT, Serum Electrolytes, ECG, Chest X-Ray P/A view, Spirometry with reversibility, USG of Whole abdomen were done and recorded. Patients diagnosed with COPD based on GOLD guidelines, on history, clinical examination, and pulmonary function test (FEV1/FVC <0.7), age >40 years. Presence of asthma or other chronic respiratory diseases, presence of malignancy or serious comorbidities that would

prevent the study completion, patients with active pulmonary tuberculosis and patients with acute exacerbation of COPD requiring ICU admission were excluded from the study.

Results:

A total ninety one patients with COPD were included in this study based on inclusion and exclusion criteria. The findings obtained from data analysis are presented below:

Table-I

Demographic characteristics of the study patients (n=91)

Demographic characteristics	Number of patients	Percentage
Age (years)		
≤50	20	22.0
51-60	31	34.1
61-70	31	34.1
71-80	5	5.5
>80	4	4.4
Mean ± SD	60.4±10.9	
Range (min-max)	42.0-90.0	
Gender		
Male	78	85.7
Female	13	14.3
Occupational status		
Service	27	29.7
Farmer	23	25.3
Business	13	14.3
Shop keeper	9	9.9
Teacher	6	6.6
House wife	5	5.5
Day labour	3	3.3
Rickshaw puller	3	3.3
Clark	1	1.1
Village police	1	1.1
Smoking		
Yes	76	83.5
No	15	16.5

Table-II

Distribution of the study patients according to waist circumference (n=91)

Waist circumference (cm)	Number of patients	Percentage
Abnormal (Male >102 cm; female >88 cm)	3	3.3
Normal (Male ≤102 cm; female d”88 cm)	88	96.7
Mean±SD	86.9±6.8	
Range (min-max)	74.0-104.0	

Table-III

Distribution of the study patients according to blood pressure (n=91)

Blood pressure	Mean±SD
SBP (mmHg)	120.1±17.5
Range (min-max)	90.0-160.0
DBP (mmHg)	76.3±11.1
Range (min-max)	60.0-100.0

Table-IV

Distribution of the study patients according to triglycerides (n=91)

Triglycerides (mg/dl)	Number of patients	Percentage
≤150 (Normal)	59	64.8
>150 (Abnormal)	32	35.2
Mean±SD	149.9±38.4	
Range (min-max)	65.0-311.0	

Table-V

Distribution of the study patients according to HDL-C (n=91)

HDL-C (mg/dl)	Number of patients	Percentage
≥40 (Normal)	41	45.1
<40 (Abnormal)	50	54.9
Mean±SD	39.4±9.8	
Range (min-max)	28.0-78.0	

Table-VI

Distribution of the study patients according to fasting glucose (n=91)

Fasting glucose (mg/dl)	Number of patients	Percentage
≤100 (Normal)	57	62.6
>100 (Abnormal)	34	37.4
Mean±SD	104.1±28.0	
Range (min-max)	78.0-290.0	

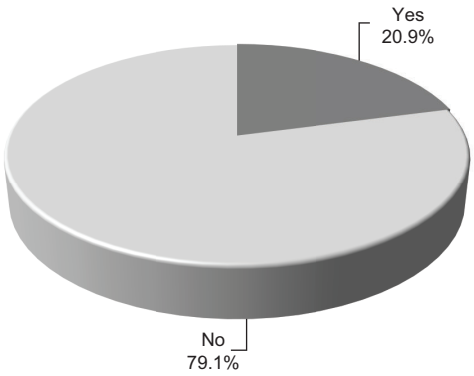

Fig.-1: *Pie chart showing metabolic syndromem of the study patients (n=91).*

Table-VII

Association between demographic characteristics with COPD (n=91)

Demographic characteristics	COPD				P value
	Grade III (n=41)		Grade II (n=50)		
	N	%	n	%	
Age (years)					
≤50	6	14.6	14	28.0	
51-60	12	29.3	19	38.0	
61-70	17	41.5	14	28.0	
71-80	3	7.3	2	4.0	
>80	3	7.3	1	2.0	
Mean±SD	62.8±11.0		58.4±10.6		[a]0.058
Range (min-max)	43.0-90.0		42.0-90.0		
Gender					
Male	37	90.2	41	82.0	[b]0.263
Female	4	9.8	9	18.0	
Occupational status					
Service	10	24.4	17	34.0	
Farmer	14	34.1	9	18.0	
Business	4	9.8	9	18.0	
Shop keeper	5	12.2	4	8.0	
Teacher	5	12.2	1	2.0	[b]0.105
House wife	0	0.0	5	10.0	
Day labour	1	2.4	2	4.0	
Rickshaw puller	2	4.9	1	2.0	
Clark	0	0.0	1	2.0	
Village police	0	0.0	1	2.0	
Smoking					
Yes	37	90.2	39	78.0	[b]0.117
No	4	9.8	11	22.0	

[a]P value reached from unpaired t-test; [b]P value reached from chi square test

Table-VIII

Association between BMI with COPD (n=91)

BMI (kg/m^2)	COPD				P value
	Grade III (n=41)		Grade II (n=50)		
	N	%	n	%	
<18.5	15	36.6	13	26.0	
18.5-24.9	22	53.7	32	64.0	
25.0-29.9	2	4.9	5	10.0	
≥30.0	2	4.9	0	0.0	
Mean±SD	20.0±4.0		21.0±3.1		0.179
Range (min-max)	12.9-33.7		14.9-28.2		

P value reached from unpaired t-test

Table-IX

Association between waist circumference with COPD (n=91)

Waist circumference (cm)	COPD				P value
	Grade III (n=41)		Grade II n=50)		
	n	%	n	%	
Abnormal (Male >102 cm; female >88 cm)	2	4.9	1	2.0	
Normal (Male ≤102 cm; female ≤88 cm)	39	95.1	49	98.0	
Mean±SD	88.1±7.4		85.9±6.0		0.116
Range (min-max)	74.0-104.0		75.0-101.0		

P value reached from unpaired t-test

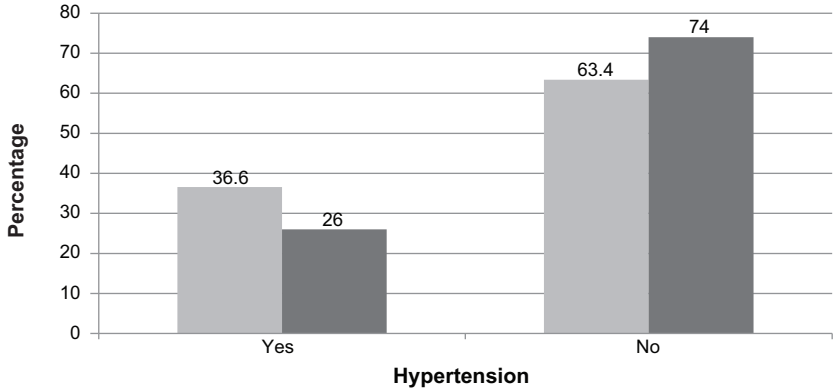

Fig.-2: *Bar diagram showing hypertension of the study patients (n=91)*

Table-X

Association between triglycerides with COPD (n=91)

Triglycerides (mg/dl)	COPD				P value
	Grade III (n=41)		Grade II (n=50)		
	N	%	N	%	
≤150 (Normal)	25	61.0	34	68.0	
>150 (Abnormal)	16	39.0	16	32.0	
Mean±SD	153.7	±42.9	146.7	±34.3	0.385
Range (min-max)	92.0	-311.0	65.0	-260.0	

P value reached from unpaired t-test

Table-XI

Association between HDL-C with COPD (n=91)

HDL-C (mg/dl)	COPD				P value
	Grade III (n=41)		Grade II (n=50)		
	N	%	N	%	
≥40 (Normal)	15	36.6	26	52.0	
<40 (Abnormal)	26	63.4	24	48.0	
Mean±SD	39.3	±11.0	39.4	±8.7	0.959^{ns}
Range (min-max)	28.0	-78.0	28.0	-74.0	

P value reached from unpaired t-test

Table-XII

Association between fasting glucose with COPD (n=91)

Fasting glucose (mg/dl)	COPD				P value
	Grade III (n=41)		Grade II (n=50)		
	N	%	N	%	
≤100 (Normal)	24	58.5	33	66.0	
>100 (Abnormal)	17	41.5	17	34.0	
Mean±SD	108.7	±36.9	100.3	±17.2	0.158^{ns}
Range (min-max)	78.0	-290.0	80.0	-192.0	

P value reached from unpaired t-test .

Table XIII

Association between metabolic syndrome with COPD (n=91)

Metabolic syndrome	COPD				P value
	Grade III (n=41)		Grade II (n=50)		
	N	%	N	%	
Yes	10	24.4	9	18.0	0.456
No	31	75.6	41	82.0	

P value reached from chi square test

Discussion:

This cross-sectional study was carried out with an aim to assess association of COPD with metabolic syndrome.

In this study it was observed that more than one third (34.1%) patients belonged to age 51-60 & 61-70 years respectively. The mean age was 60.4±10.9 years ranging from 42 to 90 years. The reason for the difference of age at presentation in various regions of the world may be due to geographic/ ethnic influence.

In our study it was observed that majority (85.7%) patients were male and 13(14.3%) patients were female. In a study of Pasha et al. (2018) observed that among each group there were forty-three (84.3%) males and eight (15.7%) females.

Our study showed that 27(29.7%) were service holder, 23(25.3%) farmers. This difference across various studies may be due to different demographic and geographic distribution of the population.

In this present study it was observed that 76(83.5%) were smoker. In present study, maximum proportions of smokers were in GOLD stage-3 (70.6%) followed by stage-2 (60%) followed by stage-4 (57.1%) and in GOLD stage-1 smokers were 40% but the difference was not significant (p>0.05).

In our study it was observed that majority (59.3%) patients had BMI 18.5-24.9 kg/m^2. Mean BMI was found 20.6±4.0 kg/m^2 with range from 12.9-33.7 kg/m^2. Mean BMI of study population was 26.22±7.22 kg/m^2.

In this current study it was observed that 3(3.3%) patients were found abnormal (male >102 cm; female >88 cm) waist circumference. Mean waist circumference was found 86.9±6.8 cm with range from 74.0-104.0 cm. Almost similar study conducted by Acharyya et al. (2016) which showed mean waist circumference was 87±17 cm. Kumar et al. (2020) in their found that mean WC of study population was 88.30±14.61 cm.

This study showed that mean SBP was found 120.1±17.5 mmHg with range from 90.0-160.0 mmHg. The mean DBP was found 76.3±11.1 mmHg with range from 60.0-100.0 mmHg.

In this study it was observed that 32(35.2%) patients had triglycerides >150 mg/dl. Mean triglycerides was found 149.9±38.4 mg/dl with range from 65.0-311.0 mg/dl.

In this present study it was observed that 50(54.9%) patients found HDL-C <40 mg/dl. Mean HDL-C was found 39.4±9.8 mg/dl with range from 28.0-78.0 mg/dl.

Our study showed that 34(37.4%) patients had fasting glucose >100 mg/dl. Mean fasting glucose was found 104.1±28.0 mg/dl with range from 78.0-290.0 mg/dl.

Our study showed that metabolic syndrome was found in 19(20.9%) patients. In a study of Pasha et al. (2018) observed that metabolic syndrome was 16(31.4%) patients.

In this study it was observed that age, sex, occupational status and smoker were not statistically significant (p>0.05) between two group.

In this current study it was observed that mean BMI was found 20.0±4.0 kg/m^2 in COPD grade III and 21.0±3.1 kg/m^2 in COPD grade II. The difference was not statistically significant (p>0.05) between two group.

In my study it was observed that mean waist circumference was found 88.1±7.4 cm in COPD grade III and 85.9±6.0 cm in COPD grade II. The difference was not statistically significant (p>0.05) between two group.

In this present study it was observed that 15(36.6%) patients were found hypertension in COPD grade III and 13(26.0%) in COPD grade II. The difference was not statistically significant (p>0.05) between two group.

Our study showed that mean triglycerides was found 153.7±42.9 mg/dl in COPD grade III and 146.7±34.3 mg/dl in COPD grade II. The difference was not statistically significant (p>0.05) between two group.

In this study observed that mean HDL-C was found 39.3±11.0 mg/dl in COPD grade III and 39.4±8.7 mg/dl in COPD grade II. The difference was not statistically significant (p>0.05) between two group.

In my study it was observed that mean fasting glucose was found 108.7±36.9 mg/dl in COPD grade III and 100.3±17.2 mg/dl in COPD grade II. The difference was not statistically significant (p>0.05) between two group.

Our study showed that 10(24.4%) patients was found metabolic syndrome in COPD grade III and 9(18.0%) in COPD grade II. The difference was not statistically significant (p>0.05) between two group. Incidence of metabolic syndrome is not related to severity of COPD. It may increase with any stage of COPD.

Conclusion:

In conclusion, the present study has demonstrated that metabolic syndrome were 20.9% patients. Age, sex, occupational status, smoker, BMI, waist circumference, hypertension, triglycerides, HDL-C, fasting glucose and metabolic syndrome were not statistically significant. Thus, considering COPD as a systemic disease and screening for components of metabolic syndrome could form a part of routine work-up of these patients. These findings suggest that physicians should screen COPD patients for associated metabolic syndrome. Management of these disorders may reduce the risk of overall morbidity and mortality in patients with COPD.

References

1. Wilson, P.W., D'Agostino, R.B., Parise, H., Sullivan, L. and Meigs, J.B., 2005. Metabolic syndrome as a precursor of cardiovascular disease and type 2 diabetes mellitus. *Circulation*, *112*(20), pp.3066-3072.

2. Isomaa, B.O., Almgren, P., Tuomi, T., Forsen, B., Lahti, K., Nissen, M., Taskinen, M.R. and Groop, L., 2001. Cardiovascular morbidity and mortality associated with the metabolic syndrome. *Diabetes care*, *24*(4), pp.683-689.

3. Alberti, K.G.M.M., Zimmet, P. and Shaw, J., 2006. Metabolic syndrome-a new world wide definition. A consensus statement from the international diabetes federation. *Diabetic medicine*, *23*(5), pp.469-480.

4. Gotto, A.M., Blackburn, G.L., Dailey III, G.E., Garber, A.J., Grundy, S.M., Sobel, B.E. and Weir, M.R., 2006. The metabolic syndrome: a call to action. *Coronary artery disease*, *17*(1), pp.77-80.

5. Dunstan, D.W., Zimmet, P.Z., Welborn, T.A., De Courten, M.P., Cameron, A.J., Sicree, R.A., Dwyer, T., Colagiuri, S., Jolley, D., Knuiman, M. and Atkins, R., 2002. The rising prevalence of diabetes and impaired glucose tolerance: the Australian Diabetes, Obesity and Lifestyle Study. *Diabetes care*, *25*(5), pp.829-834.

6. Ford, E.S., Giles, W.H. and Dietz, W.H., 2002. Prevalence of the metabolic syndrome among US adults: findings from the third National Health and Nutrition Examination Survey. *JAMA*, *287*(3), pp.356-359.

7. Das, M., Pal, S. and Ghosh, A., 2011. Prevalence of cardiovascular disease risk factors by habitat: a study on adult Asian Indians in West Bengal, India. *Anthropologischer Anzeiger*, pp.253-264.

8. Expert panel on detection, evaluation, and treatment of high blood cholesterol in adults, 2001. Executive summary of the third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III). *JAMA*, *285*(19), pp.2486-2497.

9. Grimble, R.F., 2002. Inflammatory status and insulin resistance. *Current Opinion in Clinical Nutrition & Metabolic Care*, *5*(5), pp.551-559.

10. Hurd, S., 2000. The impact of COPD on lung health worldwide: epidemiology and incidence. *Chest*, *117*(2), pp.1S-4S.

11. Rabe, K.F., Hurd, S., Anzueto, A., Barnes, P.J., Buist, S.A., Calverley, P., Fukuchi, Y., Jenkins, C., Rodriguez-Roisin, R., Van Weel, C. and Zielinski, J., 2007. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary. *American journal of respiratory and critical care medicine*, *176*(6), pp.532-555.

12. Despres, J.P. and Lemieux, I., 2006. Abdominal obesity and metabolic syndrome. Nature, 444(7121), pp.881-887.