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RESEARCH ARTICLE

PREVALENCE AND CORRELATION OF METABOLIC SYNDROME IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

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Abstract

Background: Chronic obstructive pulmonary disease (COPD) and metabolic syndrome (MetS) are prevalent chronic conditions with significant impacts on public health. Despite evidence suggesting a bidirectional relationship between COPD and MetS, data on the prevalence and correlation of MetS in COPD patients remain limited.This cross-sectional study aimed to investigate the prevalence of MetS in COPD patients admitted at Rural Medical College Loni and explore its correlation.

Methods: A total of 50 COPD patients aged 40 years and above were recruited. Demographic and clinical data were collected through face-to-face interviews and medical record review. Diagnosis ofMetS was done based on the International Diabetes Federation criteria. Logistic regression analysis was performed to identify factors associated with MetS in COPD patients.

Results: The mean age of the study population was 60.92 ± 8.97 years, with 76% being male. The prevalence of MetS among COPD patients was42%. The majority of patients with MetS exhibited grade 3 dyspnea based on modified medical research council grading (MMRC). MetS was most prevalent among patients with GOLD stage III disease.

Conclusion: Metabolic syndrome is highly prevalent among COPD patientsadmitted at Rural Medical College Loni andpatients with MetS present with more severe disease and frequent exacerbations. Identification of MetS in COPD patients is crucial for comprehensive disease management and warrants integrated care approaches targeting both respiratory and metabolic health. Further research is needed to elucidate the underlying mechanisms linking COPD and MetS and develop tailored interventions to improve outcomes in this population.

Introduction:-

Chronic obstructive pulmonary disease (COPD) is a leading cause of morbidity and mortality worldwide, characterized by persistent respiratory symptoms and airflow limitation due to airway and/or alveolar abnormalities [[1]]. The primary factor triggering COPD is the inflammatory reaction to inhaled particles such as cigarette smoke and air pollution, leading to a myriad of destructive effects. Additionally, COPD extends beyond pulmonary

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implications, manifesting in systemic effects like skeletal muscle atrophy and dysfunction, heightened susceptibility to cardiovascular diseases, osteoporosis, anxiety, depression, anemia, and other chronic conditions.

Metabolic syndrome (MetS) is a cluster of metabolic abnormalities, including central obesity, dyslipidemia, hypertension, and insulin resistance, which collectively increase the risk of cardiovascular disease and type 2 diabetes [2]. COPD and MetS share common risk factors, such as smoking and physical inactivity, and accumulating evidence suggests a bidirectional relationship between these conditions [3,4]. A connection between MetS and COPD has been observed in several studies, and metabolic syndrome is an independent risk factor for worsening respiratory symptoms, increasing lung function impairment, pulmonary hypertension, and asthma.[5]Several recent hypotheses regarding pathogenesis have emerged, drawing from the clinical features of Metabolic Syndrome (MetS). Firstly, hyperlipidemia is theorized to induce inflammation via fatty acids, consequently triggering the innate immune system. Secondly, heightened abdominal adiposity is believed to elevate leptin levels while reducing adiponectin levels, potentially resulting in hyperplasia of airway smooth muscle and subepithelial fibrosis. Lastly, elevated blood sugar levels and insulin resistance are thought to induce mechanical and functional alterations in airway smooth muscle, ultimately contributing to bronchial hyper-responsiveness and airway obstruction.[3]

It has been suggested that obesity, smoking, sedentary lifestyle, and systemic inflammation may contribute to its development.[2] Severity of systemic inflammation is found to be more in COPD patients with MetS as compared to patients with COPD alone.[6] Systemic inflammation promotes insulin resistance, which contributes to the development of MetS in people with COPD.[9] Indian data on the prevalence of MetS or its components in COPD are sparse. Dave **et al**.[5] reported incidence of MetS in 42% of their patients with COPD. COPD patients with MetShave more dyspnea and have a higher risk of hospitalization either due to acute exacerbations or other its other complications. In India detection of COPD patients withMetS at the primary level by primary physicians can reduce the risk of hospitalization.

This study was conducted to find out the proportion of MetSin COPD cases and its correlation between severities of COPD.

Methods:-

Study Design and Participants:

This cross-sectional study included COPD patients aged 40 years and above admitted at Rural Medical College Loni. Patients with a confirmed diagnosis of COPD based on spirometry (post-bronchodilator forced expiratory volume in 1 second/forced vital capacity ratio < 0.70) were eligible for inclusion.

Patients with asthma, other chronic respiratory diseases, active pulmonary tuberculosis, malignancy, and serious comorbidities were excluded from the study.

Data Collection:

Demographic (age, sex, smoking status) and clinical (disease severity, comorbidities, medication use) data were collected through face-to-face interviews and medical record review. Using standardized procedures, anthropometric measurements (height, weight, waist circumference, blood pressure) were obtained. Routine relevant investigations like lipid profile and fasting and 2-h post-prandial blood sugar (FBS and 2-h PPBS, respectively) were performed.

Diagnosis of Metabolic Syndrome:

MetS was diagnosed based on the International Diabetes Federation criteria, which require the presence of central obesity (waist circumference ≥ 94 cm in men or ≥ 80 cm in women) plus any two of the following four factors: elevated triglycerides (≥ 150 mg/dL or specific treatment for dyslipidemia), reduced high-density lipoprotein cholesterol (< 40 mg/dL in men or < 50 mg/dL in women or specific treatment for dyslipidemia), elevated blood pressure (systolic ≥ 130 mmHg or diastolic ≥ 85 mmHg or treatment of previously diagnosed hypertension), and elevated fasting glucose (≥ 100 mg/dL or previously diagnosed type 2 diabetes) [3].

Statistical Analysis:

Data were analyzed using SPSS version 20. Descriptive statistics were used to summarize the characteristics of the study population. The prevalence of MetS among COPD patients was calculated with 95% confidence intervals (CI). Logistic regression analysis was performed to identify factors associated with MetS in COPD patients, and odds ratios (ORs) with 95% CIs were reported.

Results:-

A total of 50 COPD patients (mean age: 60.92 ± 8.97years, 76 % male) were included in the study. The prevalence of MetS among COPD patients was 42% (95% CI).The average age of the cases with MetS (59.9 ± 8.03 years) was lower than those without MetS(61.63 ± 9.63 years). The prevalence of COPD in females was 24 %, but MetS was observed in 75 % of female patients. The average BMI in patients with MetSwas higher than that of patients without MetS.

Table 1:-Demographic and Functional Profile of COPD Patients.

DEMOGRAPHIC AND FUNCTIONAL PROFILE	COPD WITH METABOLIC SYNDROME	COPD WITHOUT METABOLIC SYNDROME	TOTAL
NO. OF CASES	21 (42%)	29 (58%)	50
SEX	M-12(31.5%) F-9(75%)	M-26(68.5%) F-3(25%)	M-38(76%) F-12(24%)
AGE (years)	59.9 ± 8.03 years	61.63 ± 9.63 years	60.92 ± 8.97 years
BMI(BODY MAS INDEX)	28.56±4.33	20.09±3.19	24.29±4.30
NUMBER OF EXACERBATIONS IN LAST 2 YEARS	3.38±1.95	2.27±1.30	2.82±1.59
WAIST CIRCUMFERENCE (cm)	86.04±13.60	72.5±10.14	78.21±13.45
SYSTOLIC BLOOD PRESSURE (mmhg)	135.69±14.34	126.93±16.45	130.61±16.10
FASTING BSL (mg/dl)	128.72±43.47	100.91±2.33	112.61±33.13
SERUM TRIGLYCERIDE (mg/dl)	158.56±32.99	123.82±35.51	138.45±38.36
Serum HDL (mg/dl)	38.75±9.40	49.84±9.20	45.17±10.75

The study revealed that the metabolic parameters were on the higher side in COPD cases with MetS than those without MetS, whereas serum HDL level in patients with MetSwas noticed to be lower than that in the cases without MetS.Females exhibited higher levels of all metabolic parameters.

Table 2:-Prevalence of Components of Metabolic Syndrome Between Males and Females with Metabolic Syndrome.

COMPONENTS OF METABOLIC SYNDROME	MALE	FEMALE	TOTAL
INCREASED WAIST CIRCUMFERENCE	16.9%	70.6%	28.9%
HIGH BLOOD PRESSURE	55.9%	70.6%	59.2%
HIGH GLUCOSE	35.6%	52.9%	39.5%
HIGH SR.	28.9%	35.3%	36.8%

TRIGLYCERIDES			
LOW HDL	32.2%	58.8%	38.1%
METABOLIC SYNDROME %	31.5%	75%	42%

The present study revealed that the number of exacerbations and hospitalizations due to COPD in MetS cases were more than those for patients without MetS.

Most of the patients were farmers by occupation (60.2%) and belonged to a lower socioeconomic class (63.2%). The majority of the patients were smokers(66.4%).

Cough was complained by 96.8% of cases, followed by expectoration in 82.7% of patients and wheezes in 47.4% of cases. In this study, 50% patients of with MetS exhibited grade 3 dyspnea.

Patients with or without MetSpresented with GOLD stage III disease predominantly. All components of MetSwere highest in patients presenting with stage III disease.

Discussion:-

Chronic obstructive pulmonary disease (COPD) and metabolic syndrome are two prevalent chronic conditions that share common risk factors and pathophysiological mechanisms. Despite their clinical importance, limited research has investigated the prevalence and correlation of metabolic syndrome among COPD patients. This cross-sectional study aimed to address this gap by examining the prevalence and correlation of metabolic syndrome in a cohort of COPD patients.

The prevalence of metabolic syndrome among COPD patients in this study was found to be 42% based on the criteria outlined. This finding is consistent with previous research Dave **et al.**,[5] Díez-Manglano **et al.**,[8] and Acharyya **et al.**,[10] who reported 42%, 42.9%, and 46.7% cases of MetS among COPD cases in their study, respectively.

The mean age of COPD patients was 60.92 ± 8.97 years with a M: F ratio of 3.5:1. MetS was reported in 9 out of 12 (75%) female and 12 out of 38 (31.5%) male patients in the present study. This was in accordance with Díez-Manglano **et al**.[8] who found 40.8% male and 59.5% female cases having MetS.

There was a significant difference between cases with MetS and without MetS with respect to waist circumference, systolic BP, FBS, and serum TG. The serum concentration of HDL was also significantly lower in cases with MetS than that of the control group. There was a significant difference in the metabolic parameters in COPD patients with and without MetS. This finding was supported by Ameen **et al**.[11] However, Silviu **et al**.[14] noted a significant difference between the COPD patients with and without MetS with respect to both functional lung parameters.

Fifty percent of patients with MetS exhibited grade 3 dyspnea. The difference between the grade of dyspnea of cases with and without MetS was nonsignificant. This was consistent with the study by Díez-Manglano **et al**.[8] However, the study by Park **et al**.[15] found that people with MetS had more dyspnea than those without MetS

When metabolic parameters were compared among men and women, surprisingly, all parameters of MetS were more in females than male cases. A surprising finding in this study was 75% female and 31.5% male COPD patients had MetS. This was in contrast to the statement of Marquis **et al**.[9] who found 61% male and 27% female COPD cases with MetS. The high prevalence of MetS in females in this study may be due to lesser outdoor activity and exposure to smoke from non LPG stoves. The higher proportion of abdominal obesity among female as in this study would also have been a contributing factor.

The coexistence of COPD and metabolic syndrome is of clinical significance as both conditions are associated with increased cardiovascular risk and mortality [2]. Therefore, understanding the prevalence and correlates of metabolic syndrome in COPD patients is essential for optimizing their management and reducing the burden of comorbidities.

The identification of correlates of metabolic syndrome in COPD patients has important clinical implications. Healthcare providers should be vigilant for the presence of metabolic abnormalities in COPD patients, and should consider incorporating screening for metabolic syndrome into routine clinical practice. Lifestyle modifications, including smoking cessation, regular physical activity, and dietary interventions, may help mitigate the risk of metabolic syndrome and its associated complications in COPD patients [4]. Additionally, optimizing COPD management, including appropriate pharmacotherapy and pulmonary rehabilitation, may have beneficial effects on metabolic parameters and reduce the prevalence of metabolic syndrome.

Limitations of this study include its cross-sectional design, which precludes the establishment of causality, and the reliance on self-reported data for certain variables, which may introduce recall bias. Additionally, the study was conducted in a rural hospital limiting the generalizability of the findings to other populations. Further research using longitudinal designs and larger, more diverse cohorts is warranted to validate these findings and explore additional factors associated with metabolic syndrome in COPD patients.

Conclusion:-

Metabolic syndrome is highly prevalent among COPD patients. Identification of MetS in COPD patients is crucial for comprehensive disease management and warrants integrated care approaches targeting both respiratory and metabolic health. It also highlight the importance of screening for metabolic syndrome in COPD patients and addressing modifiable risk factors to prevent the development or progression of metabolic syndrome in this population.Further research is needed to elucidate the underlying mechanisms linking COPD and MetS and develop tailored interventions to improve outcomes in this population.

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