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Detection of Chronic Obstructive Pulmonary Disease in Patients with Diabetes Mellitus

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DECLARATIONS

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ABSTRACT

Background: Diabetes mellitus and chronic obstructive pulmonary disease are interrelated conditions with significant impacts on quality of life and mortality. Diabetes mellitus can exacerbate pulmonary function decline in patients with pulmonary disease through systemic inflammation and impaired metabolic control. **Objective:** This study aimed to evaluate the association between chronic obstructive pulmonary disease and diabetes mellitus and its clinical-laboratory features among diabetic patients. **Methodology:** A cross-sectional study was conducted over six months at the Pulmonology Department of Gulab Devi Hospital, Lahore. A total of 250 diabetic patients aged 35 to 60 years, with at least 5 to 10 years of DM history, were selected through convenience sampling. Written informed consent was taken from patients. In the Pulmonology ward, the features of patients run as follows: gender, age, Diabetes, etc. Data was collected from different patients and samples for different tests were also taken. Data was also extracted from medical records, including patient demographics, medical history, laboratory results, imaging studies, treatment interventions, and in-hospital outcomes. Data collection tools included fasting and random blood sugar tests, HbA1C, arterial blood gas analysis, and spirometry. Data were analyzed using SPSS version 25, employing descriptive statistics and the chi-square test ($p \leq 0.05$). **Results:** The participants were 47.78±7.39 years old, with the mean chronic obstructive pulmonary disease duration equaling 4.84±2.93 years and average DM duration equaling 7.42±1.69 years. According to spirometry, 35.6% of the patients had mild airflow obstruction, 32.4% moderate, and 32.0% severe. This analysis showed that 36.8% of the patients had low oxygen levels according to the arterial blood gas levels. Significant associations were found between glycemic control and pulmonary function ($\chi^2=0.001$). **Conclusion:** The study established a significant association between poor glycemic control and impaired pulmonary function in diabetic patients. Early diagnosis and integrated management of diabetes mellitus and chronic obstructive pulmonary disease are crucial to mitigating disease progression.

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INTRODUCTION

COPD was described as several slowly progressing pulmonary diseases that affected breathing and included emphysema and chronic bronchitis. It was linked with the condition of airflow obstruction and was not reversible to the extent of other disorders. Features like coughing, sputum, and breathing became progressively aggravated with the disease; therefore, patients lost a great deal of their quality of life.[1] Chronic obstructive pulmonary disease is defined as one of the significant causes of mortality in the world, and annually, millions of people suffer from it. It is mainly raised for long-term exposure to hazardous products, including cigarette smoke, polluted air, dust or chemical content at the workplace, etc. These factors led to a rise in morbidity and mortality. Awareness and use of early and proper management resulted in slowed effects of disease and better results for patients. Although recognized globally, its management remained suboptimal and often neglected, especially in Low Middle-Income Countries.[2, 3]

Diabetes Mellitus impacted nearly 537 million adult population in the age group of 20–79 years in 2021, which is 10.5% of the total adult population of the global community. This number was expected to reach 783 million in 2045, meaning that the rate of occurrence had escalated. Type 2 diabetes accounted for approximately 90-95% of all cases; Type 1 diabetes and gestational diabetes taken together constituted the rest.[4] Diabetes was ranked tenth among the thirty leading causes of mortality, which was estimated to have caused over 1.5 million deaths in the world. These contributed a further 32 percent of deaths related to diabetes, of which cardiovascular disease formed the central part. The total costs of care related to diabetes, which were more than 966 billion USD in 2021, have increased by about 316% within the past 15 years. More broadly, the lifetime prevalence in South Asia ranged from 11–15%, according to specific reports and in big cities.[5]

The incidence of COPD for diabetic patients was inconsistent across different countries depending on demographic, genetic, and environmental factors. According to the presented data, 10-20% of diabetic patients also had COPD, and these numbers also differed according to patients' age, gender, and living area. The conditions were more common among those over 60 because immune decline and metabolic alterations increased the risk of developing both illnesses. Conversely, in second and third-world countries like South Asia and Sub-Saharan Africa, the ratio was approximately 8-12%, heightened by biomass fuel and poor health systems. It was also established that men had a slightly higher coexistence rate due to smoking, while women in some areas faced indoor air pollution.[6] There was a complex association between COPD and Diabetes Mellitus.

COPD was identified as a risk factor for Development Mellitus and COPD, which increases the prevalence and severity of the disease. Patients with diabetes were at a higher risk of developing COPD owing to inflammatory changes in the lungs and resulting oxidative stress in the body. On the other hand, one of the found risk factors was an increased risk of glucose metabolism disorders in COPD patients, which might develop into diabetes. For instance, aging, smoking, sedentary activities, and obesity, which are considered to increase the risks of some diseases, had similarities to those of cancer and CVDB.[7] This study aimed to understand the diagnosis of COPD in diabetic patients. The literature focused on the pathophysiological interactions between DM and COPD and risk factors. Identifying COPD in patients with diabetes during the initial stage was useful in slowing disease progression, managing better, and improving overall quality of life. The study is also helpful to the community as it encourages a more coordinated approach to screening that makes interventions possible at the right time and minimizes healthcare costs.

METHODOLOGY

A cross-sectional study was conducted over six months at the Pulmonology Department of Gulab Devi Hospital, Lahore. A total of 250 diabetic patients aged 35 to 60 years, with at least 5 to 10 years of DM history, were selected through convenience sampling. Written informed consent was taken from patients. In the Pulmonology ward, the features of patients run as follows: gender, age, Diabetes, etc. Data was collected from different patients and samples for different tests were also taken. Data was also extracted from medical records, including patient demographics, medical history, laboratory results, imaging studies, treatment interventions, and in-hospital outcomes. Data collection tools included fasting and random blood sugar tests, HbA1C, arterial blood gas analysis, and

spirometry. Data were analyzed using SPSS version 25, employing descriptive statistics and the chi-square test ($p \leq 0.05$).

RESULTS

A total of 250 patients were included in this study. The participants were 47.78 ± 7.39 years old, with the mean COPD duration equaling 4.84±2.93 years and average DM duration equaling 7.42±1.69 years. According to spirometry, 35.6% of the patients had mild airflow obstruction, 32.4% moderate, and 32.0% severe. This analysis showed that 36.8% of the patients had low oxygen levels according to the ABG levels. Significant associations were found between glycemic control and pulmonary function (χ^2=0.001). Table 1 presents the descriptive statistics of quantitative demographic variables. The mean age of participants was 47.78±7.39 years, the duration of COPD was 4.84±2.93 years, and the duration of DM was 7.42±1.69 years. Table 2 shows qualitative demographics: 49.6% male, 50.4% female. Distribution of patients by BSR and HBA1C were fairly comparable and ranged between 33 to 36 percent across the identified groups. Low Arterial Blood Gases were present to some degree in 36.8%, and spirometry confirmed mild in 35.6%, moderate in 32.4%, and severe in 32.0% participants.

DISCUSSION

This study aimed to understand the association between glycemic control and respiratory status in patients with chronic diseases using Blood Sugar Random Test, HBA1C levels, ABGs, and Spirometry results. The participants' results identified significant correlations and the primary metabolic factors influencing respiratory measures. In the present study, an average of 47.78±7.33 years of age participated, with 49.6% male and 50.4% females. These findings corroborate research done by other studies that show that middle-aged populations tend to suffer from diseases such as COPD and diabetes. WANG et al. (2024), in their survey, identified the typical age of COPD patients with comorbidities such as diabetes, ranging between the mid-forty to the mid-fifty age group.[8] Moreover, the gender distribution in this study is similar to other studies that examined COPD and diabetes comorbidities.

In a cross-sectional survey of COPD patients reported by Lee et al. (2021), diabetes was noted to have nearly similar incidence in males and females, tendencies which may be due to changes in other risk factors such as smoking and diet.[9] On the other hand, some researchers have pointed out that maybe COPD and diabetes are more common in male patients. Similarly, a cross-sectional study done among patients with type 2 diabetes by Perez et al. (2022) indicated that COPD was more prevalent among men than women.[10] In the present study, years from diagnosis of COPD were (4.84±2.93) and years from diagnosis of diabetes were (7.42±1.69). These values are consistent with the results of prior studies about the association between COPD and diabetes.

Khateeb et al. (2019) revealed that patients with COPD and diabetes had a mean duration of

Table 1: Descriptive Statistics of Demographic Variables

Variables		Mean	SD
Age (years)		47.78	7.399
Duration of COPD		4.84	2.933
Duration of DM		7.42	1.695
Variables	**Construct**	**Frequency**	**Percentage**
Gender	Male	124	49.6
	Female	126	50.4
Blood Sugar Random (BSR)	Diabetes	83	33.2
	Normal	84	33.6
	Pre-Diabetes	83	33.2
HBA1C Level Category	Diabetes	89	35.6
	Normal	90	36
	Pre-Diabetes	71	28.4
Arterial Blood Gases	Low	92	36.8
	Normal	82	32.8
	Very Low	76	30.4
Spirometry Test	Mild	89	35.6
	Moderate	81	32.4
	Severe	80	32

Table 2: Crosstabulation of HBA1C level and spirometry test

HBA1C Level Category Spirometry Test Results Category Crosstabulation					
HBA1C Level Category	**Spirometry Test Results Category**			**Total**	χ^2
	Mild	**Mode rate**	**Severe**		
Diabetes	33	30	26	89	0.001
Normal	33	28	29	90	
Pre-Diabetes	23	23	25	71	
Total	89	81	80	250	

diabetes of 7.5 years, which indicates that these two diseases are usually present in the same patient for several years without proper diagnosis.[11] The duration of COPD and diabetes in our study accurately reflects the chronicity of the diseases. Poot et al. (2021) reported that patients with COPD and diabetes had had their disease for 4-8 years, thus increasing the complexity of the disease management.[12] This study's HBA1C level was significantly related to spirometry test results ($p<0.001$). On spirometry, most diabetic patients presented moderate to severe defects; pre-diabetic patients revealed worse results. These observations indicate that worse glycemic control, evaluated with the HBA1C marker, is related to a deterioration in lung function. The findings of the present studies are consistent with the prior studies on the connection between HBA1C levels and spirometry parameters.

Lee et al. in 2021 recorded a p-value of 0.004 when comparing HBA1C levels to reduced lung function, similar to the current study's p-value of 0.001.[13] Another of their findings was that patients with diabetes had lower spirometry scores than patients with normal glucose levels. This also aligned with our findings, whereby participants with diabetes presented with only mild to moderate spirometry alterations. Liu et al. (2021) established a moderate and positive relationship ($p=0.003$) between poor glycemic control indicated by HBA1C.[14] In contrast, other studies had not observed a connection between HBA1C levels and spirometry indices.

According to the survey by Gutierrez et al. in 2019, the p-value is 0.07, which means that the two variables in question are not related to the subjects, mainly in the early stages of diabetes; hence, the impact on lung functions could not be strongly felt.[15] However, factors outside of HBA1C, including pollution from the surrounding environment or the use of certain medicines, including beta-blockers, might reduce lung function in patients with diabetes nonetheless.(19) In addition, another study by Antwi et al. (2023) did not observe a potential moderating effect of HBA1C levels on spirometry results in personnel with asthma and diabetes ($p=0.09$); this implies that differences in glycemic control affect respiratory function inversely depending on the form of respiratory disorder under review.[16]

CONCLUSION

It was found that diabetic and pre-diabetic patients had a considerably higher frequency of respiratory disorders with COPD and decreased Arterial Blood Gases. These study results showed the relationship between glycemic control and respiratory outcomes, and a recommendation was made for the multidisciplinary care management of such conditions.

DECLARATIONS

Consent to participate: Written consent had been taken from patients. All methods were performed following the relevant guidelines and regulations.

Availability of data and materials: Data will be available on request. The corresponding author will submit all dataset files.

Competing interests: None

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