Original Research Article

A STUDY ON THE EFFECT OF DIABETES MELLITUS ON THE CLINICAL OUTCOME AMONG PATIENTS WITH COVID-19

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Abstract: *This study aimed to investigate how diabetes mellitus affects the clinical outcomes of patients with COVID-19. The study was conducted between November 2022 and April 2023 at the Department of Medicine in Khyber Teaching Hospital, Peshawar. We included 40 diabetic COVID-19 patients and 40 non-diabetic COVID-19 patients in our research and examined the incidence of sepsis, acute respiratory distress syndrome (ARDS), and mortality. The results showed that diabetic COVID-19 patients had significantly higher mortality, sepsis, and ARDS rates than non-diabetic COVID-19 patients. Mortality was reported in 22.5% of diabetic patients compared to 5% of non-diabetic patients (P = 0.01). The incidence of sepsis was 25% among diabetic patients and 5% among non-diabetic patients (P = 0.02). Similarly, ARDS was reported in 35% of diabetic patients compared to 10% of non-diabetic patients (P = 0.007). In conclusion, our study suggests that diabetes significantly worsens clinical outcomes among patients with COVID-19.*
Keywords: COVID-19, Diabetes, Mortality

Introduction

The emergence of the COVID-19 pandemic late in 2019 has presented a global health crisis unlike before. Although researchers and medical practitioners are making great strides in understanding this highly contagious virus, it is already apparent that some risk factors have a major impact on the disease's manifestation and prognosis (Ciotti et al., 2020; Giovanetti et al., 2023; Stawicki et al., 2020). Among these comorbidities, diabetes mellitus significantly contributes to adverse outcomes in COVID-19 patients.

Diabetes mellitus, commonly known as diabetes, is a medical condition marked by heightened blood glucose levels. This condition can result from inadequate insulin production or the body's inability to efficiently utilize insulin. (Gupta et al., 2020; Stoian et al., 2020). Diabetic consequences, such as cardiovascular disease, renal disease, and retinopathy, are widely recognized due to the chronic nature of diabetes. As the COVID-19 pandemic continues, researchers are paying special attention to how diabetes affects the health of affected people (Lim et al., 2021). The relationship between diabetes and COVID-19 outcomes is intricate and involves multiple factors. Diabetic individuals are at a heightened risk of experiencing severe COVID-19 for several reasons. Diabetes undermines the immune system's capacity to effectively combat infections. Elevated blood sugar levels, known as hyperglycemia, hinder the functioning of various immune cells, thus diminishing the body's ability to defend against viral intruders (Fang et al., 2020; Li et al., 2021).

Diabetes is often accompanied by hypertension, independently associated with worse outcomes in COVID-19 patients.[9] This clustering of risk factors can create a perfect storm, making diabetic individuals more susceptible to severe disease and complications[10]. Moreover, these comorbidities are more prevalent among diabetic populations, exacerbating the situation (Ng et al., 2021; Palaiodimos et al., 2020).

COVID-19 has been shown to cause endothelial dysfunction and promote clotting abnormalities (Man et al., 2020). Combined with the prothrombotic effects of diabetes, this can increase the risk of severe complications, including thrombosis and pulmonary embolism (Nicosia et al., 2021; Sardu et al., 2020).

Diabetes is a pivotal factor that significantly influences the clinical course of COVID-19 patients. The intricate relationship between diabetes and COVID-19 involves a multifaceted interplay of factors, including compromised immunity, other medical conditions, inflammation, dysfunction of the endothelium (the inner lining of blood vessels), glycemic control, and the effects of medications. Healthcare providers need to acknowledge the heightened susceptibility of individuals with diabetes, allowing them to tailor their approach to managing COVID-19 within this specific population.

This research aims to determine if patients with COVID-19 who seek treatment at a tertiary care hospital have better clinical outcomes if they also have diabetes mellitus. Reducing the likelihood of severe outcomes in COVID-19

patients with diabetes requires more surveillance, early intervention, and the introduction of individualized care techniques.

Methodology

The present study was undertaken after obtaining approval from the hospital's ethical committee. This case-control study was undertaken at the Department of Medicine, Khyber Teaching Hospital, Peshawar, from November 2022 to April 2023. The sample for this study consisted of 80 COVID-19 patients further divided into diabetics (Cases) and non-diabetic (control) groups equally; those who had diabetes and were undergoing treatment with antidiabetic drugs, including oral pills and insulin, were included. The confirmation of COVID-19 was determined by utilizing a viral real-time reverse transcriptase-polymerase chain reaction test on samples taken from the nasal and pharyngeal regions. Patients having HbA1c > 6.5 %. The study did not encompass individuals under the age of 35 who were diagnosed with COVID-19. The clinical outcomes assessed were ARDS, sepsis, mortality, comorbidity, and symptoms such as hypertension, fever, dry cough, and smoking.

All the variables were analyzed with IBM SPSS 24. The Chi Square test was utilized to assess the outcomes between both groups, with $P < 0.05$ as significant.

Results

This research encompassed 40 individuals with diabetes (referred to as "cases") and 40 without diabetes (designated as the "control" group). The mean age in the cases group was 51.35 ± 7.89 years, while the control group had a mean age of 47.72 ± 8.58 years. In terms of gender distribution, the diabetic group consisted of 27 males (67.5%) and 13 females (32.5%), whereas the non-diabetic group had 24 males (60%) and 16 females (40%) (Figure 1).
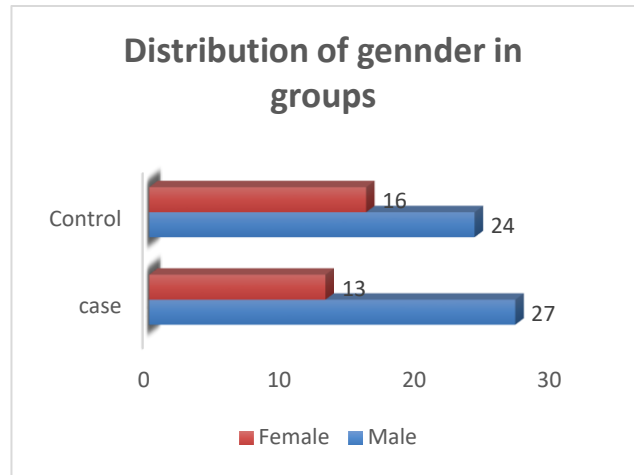
Figure 1: Distribution of gender in study groups:

From a clinical perspective, 25% of the diabetes group experienced sepsis, while only 5% of the non-diabetic group did (P = 0.02). Similarly, 35% of the people with diabetes and 10% of the non-diabetics developed ARDS, with the latter being significantly more likely to develop the condition (P = 0.007). The death rate was 22.5% in the diabetic group and 5% in the non-diabetic group, with the difference being statistically significant (P= 0.01).

Table 1: Comorbid and symptoms of COVID

Comorbid and symptoms		Groups				P value
		Cases (Diabetic)		Controls (Non-diabetic)		
		n	%	n	%	
Hypertension	Yes	16	40.0%	5	12.5%	0.005
	No	24	60.0%	35	87.5%	
Smoking	Yes	11	27.5%	8	20.0%	0.43
	No	29	72.5%	32	80.0%	
Dry cough	Yes	18	45.0%	13	32.5%	0.25
	No	22	55.0%	27	67.5%	
Fever	Yes	19	47.5%	21	52.5%	0.65
	No	21	52.5%	19	47.5%	

Table 2: Clinical outcomes of the study population

Clinical outcomes		Groups				P value
		Cases (Diabetic)		Controls (Non-diabetic)		
		n	%	n	%	
Sepsis	Yes	10	25.0%	2	5.0%	0.02
	No	30	75.0%	38	95.0%	
ARDS	Yes	14	35.0%	4	10.0%	0.007
	No	26	65.0%	36	90.0%	
Mortality	Yes	9	22.5%	2	5.0%	0.01
	No	31	77.5%	38	95.0%	

Discussion

COVID-19 has exhibited a wide array of disease severity, encompassing asymptomatic individuals and those with severe sickness that can ultimately result in mortality (Huang et al., 2020). Numerous variables influence the outcome of diseases, encompassing age and gender as significant determinants. Pre-existing chronic conditions,

such as hypertension and diabetes, have been linked to severe outcomes. Individuals diagnosed with diabetes, hypertension, obesity, and cardiovascular issues exhibit an increased susceptibility to contracting COVID-19 and are confronted with a heightened risk of death associated with the condition (Dong et al., 2020).

A notable proportion of senior patients, who are particularly vulnerable to mortality resulting from COVID-19, exhibit a comorbidity of diabetes mellitus, with a prevalence rate of 26.8%. The precise causes for this heightened risk have not yet been determined; nevertheless, several aspects may contribute to the greater vulnerability of individuals with type-2 diabetes mellitus to infections (Chan et al., 2020). One potential contributing factor to the heightened susceptibility of individuals with diabetes and obesity is the compromised innate and adaptive immune response. This condition is marked by persistent and mild inflammation, which can result in significant systemic metabolic disturbances. Patients diagnosed with diabetes or hyperglycemia who had previously contracted SARS exhibited elevated rates of death and morbidity compared to patients who maintained metabolic control (Liu et al., 2019).

Our results suggest that individuals diagnosed with diabetes exhibited more pronounced adverse outcomes when infected with COVID-19, as evidenced by a higher mortality rate. These findings corroborate the observations in a prior cohort study involving COVID-19 patients, which revealed a 7.3% increased mortality risk among those with diabetes, compared to the 2.3% risk observed in the general population (Wu and McGoogan, 2020). Furthermore, another study revealed that individuals diagnosed with uncontrolled diabetes who contracted COVID-19 exhibited a significantly elevated mortality risk compared to those without diabetes (Williamson et al., 2020). We also observed that the frequency of ARDS and sepsis was also higher in the diabetic group as compared to the non-diabetic group. A study also reported that mortality, sepsis, and ARDS were significantly more prevalent in cases as compared to the controls (non-diabetic) (Alshukry et al., 2021).

The link between uncontrolled diabetes, particularly elevated blood sugar levels (hyperglycemia), and a less favorable COVID-19 prognosis consistently presents itself. Several studies have suggested a possible connection between hyperglycemia and the increased production of interleukin-6 (IL-6), which could contribute to heightened lung inflammation and the severity of COVID-19. Consequently, researchers have strived to illustrate that specific glucose-lowering medications might improve outcomes for individuals with diabetes who contract COVID-19. In one study, it was demonstrated that among a group of 59 patients, 26 of whom had a pre-existing diabetes diagnosis, those who received intravenous insulin treatment had better outcomes compared to those who did not receive this intervention (Marfella et al., 2020). However, another discovered that COVID-19 patients administered insulin had distinct inflammatory indicators, such as elevated levels of C-reactive protein (CRP), procalcitonin, and erythrocyte sedimentation rate. Nevertheless, these patients did not demonstrate a significant disparity in disease severity compared to individuals not receiving insulin treatment (Chen et al., 2020).

The observed variations in the severity and consequences of COVID-19 across individuals with diabetes can be attributed to this metabolic disorder's complex and multifaceted nature. Within our study group, it was observed that individuals diagnosed with diabetes had a greater prevalence of hypertension. In contrast, non-diabetic patients displayed lower rates of hypertension. These results are consistent with the findings documented in a study, which revealed percentages of 56.9% and 20.9% for the relevant variables (Abu-Farha et al., 2020; Shi et al., 2020).

Conclusion

From our study, it can be concluded that diabetes significantly worsens the clinical outcome among COVID-19 patients in terms of higher rates of mortality, ARDS, and sepsis compared to non-diabetic patients.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department Concerned.
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Conflict of interest

The authors declared absence of conflict of interest.

Author Contributions:

MS MMG ZN conceived the idea,
MMG AU SUK drafted the study,
MS RN SUK collected data,
MS MMG RN did statistical analysis and interpretation of data,
MS AU SUK critically reviewed the manuscript.

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