

Impact of Comorbid Disease Risk Factors on Mortality Rates in COVID-19 Patients: A Retrospective Analysis

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A B S T R A C T

Background: The COVID-19 pandemic has underscored the critical role of comorbid diseases in influencing patient outcomes, with pre-existing conditions such as cardiovascular disease, diabetes, hypertension and obesity significantly impacting mortality rates. Individuals with these comorbidities are at an elevated risk of severe illness and death from COVID-19, highlighting the need for targeted clinical management and public health strategies.

Objective: To analyze the influence of comorbid disease risk factors on mortality rates among 'COVID-19' patients, identifying which pre-existing conditions most significantly affect patient outcomes.

Methodology: This research is an analytical observation using a case-control study design. The study involved 190 COVID-19 patients which were treated at Khyber Teaching Hospital, Peshawar from January 2020 to December 2020. These patients were divided into two groups on the base of presence or absence of comorbidities, 95 participants included in case group and 95 participants as control group. We analyzed the data using odds ratios (OR) to explore the relationship between comorbidities and the mortality rate among these patients due to COVID-19.

Results: This study found that comorbidities significantly influence mortality rates in 'COVID-19' patients. Among 190 participants, 55.7% had diabetes, 31.5% had hypertension, and 8.4% had cardiovascular disorders. An analysis revealed that 74.7% of deceased patients had comorbid conditions, with an Odds Ratio of 7971, indicating a markedly increased risk of mortality.

Conclusion: Comorbid conditions notably influence mortality rates in 'COVID-19' patients, with cardiovascular diseases, hypertension and diabetes presenting the greatest risk. These results highlight the need for focused management approaches for individuals with these pre-existing conditions to reduce negative outcomes.

Keywords: COVID-19; Co-morbidities; Disease Outcomes

Introduction

The SARS-CoV-2 virus, responsible for COVID-19, has sparked a significant global health crisis, affecting millions of people worldwide.¹ The rapid spread of the virus has overwhelmed healthcare systems, leading to extraordinary public health measures and an urgent push for vaccine development and distribution. The pandemic has underscored the critical need for effective disease management strategies, including early detection, treatment, and preventive measures, as well as the importance of international collaboration in tackling global health threats.

The disease presents with a range of symptoms from mild flu-like symptoms to severe respiratory distress and can lead to significant complications, especially in individuals with pre-existing health conditions. Comorbidities, or the presence of one or more additional health conditions alongside a primary disease, have been identified as significant determinants of disease severity and mortality in COVID-19 patients.^{2,3}

Understanding the impact of comorbidities on COVID-19 outcomes is vital for several reasons. First, patients with pre-existing conditions such as cardiovascular disease, diabetes and hypertension are known to experience more severe complications when infected with SARS-CoV-2 which is the virus responsible for COVID-19. These comorbidities can compromise the immune system, exacerbate inflammation, and impair organ function, thereby increasing the risk of severe disease progression and death.⁴

Recent studies have consistently demonstrated that individuals with such pre-existing health issues are more likely to experience severe symptoms and higher mortality rates from COVID-19.⁴⁻⁶ For instance, cardiovascular diseases and diabetes have been identified as significant risk factors, with patients suffering from these conditions often experiencing more severe respiratory complications and a higher likelihood of fatal outcomes. The increased risk is largely due to the complex interactions between the virus and pre-existing health conditions, which can intensify the inflammatory response and place additional stress on vital organs.

The identification and analysis of these risk factors can inform clinical decision-making and public health strategies. By elucidating which comorbid conditions are most strongly associated with increased mortality, healthcare providers can better prioritize resources, tailor treatment approaches, and implement targeted preventive measures. Furthermore, understanding these risk factors can help in developing guidelines for monitoring and managing high-risk populations during future outbreaks.

This study aims to analyze the relationship between comorbid disease risk factors and mortality rates in COVID-19 patients. By utilizing a comprehensive dataset

that includes clinical, demographic, and comorbidity information, this research seeks to quantify the impact of various pre-existing conditions on patient outcomes. Through advanced statistical analyses, we will identify which comorbidities are most strongly associated with increased mortality and how these factors interact to influence patient prognosis.

The findings from this analysis will contribute to the broader understanding of impact of COVID-19 on patients with pre-existing conditions and offer insights into effective management strategies. Ultimately, this research seeks to enhance the ability of healthcare systems to address the needs of the most vulnerable populations, thereby improving patient outcomes and informing future public health responses.

Objective

To analyze the influence of comorbid disease risk factors on mortality rates among COVID-19 patients, identifying which pre-existing conditions most significantly affect patient outcomes.

Methodology

This study is designed as a case-control analysis to assess the impact of comorbid diseases on mortality rates among COVID-19 patients in Peshawar. We included a total of 190 patients diagnosed with COVID-19 which were dividing them into two groups: 95 patients as a case group and 95 patients as a control group. The case group included individuals who had both COVID-19 and one or more comorbidities, while the control group consisted of individuals who had COVID-19 without any comorbid conditions.

The study adhered to strict inclusion and exclusion criteria to ensure the precision and reliability of the results. Inclusive criteria included patients confirmed with COVID-19 through PCR testing or other reliable diagnostic method along with comorbidities such as cardiovascular diseases, diabetes and hypertension, patients aged 18 and older to ensure adult population representation, availability of comprehensive medical records and data on comorbid conditions and cooperative patients.

Exclusive criteria included patients with incomplete medical records or missing data on comorbidities, patients who died from causes unrelated to 'COVID-19', Individuals under the age of 18, to focus on the adult population and cases where 'COVID-19' diagnosis was uncertain or based on unreliable testing methods.

Data was collected from medical records, patient interviews, and hospital databases. We gathered information on various comorbid conditions which included cardiovascular diseases, diabetes and hypertension. Additional demographic details, including age, sex, and the severity of 'COVID-19', were also recorded.

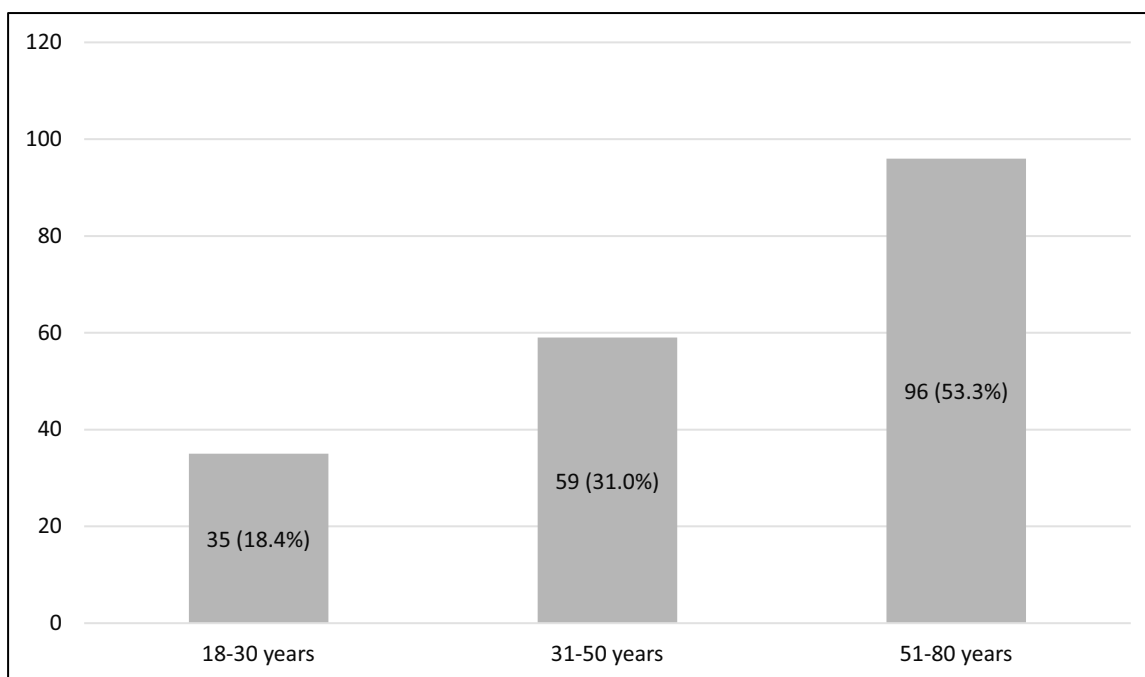


Figure 1. Distribution of study cases based on age

The analysis involved calculating odds ratios (OR) to measure the strength of association between each comorbidity and mortality. Logistic regression was used to control for confounding variables such as age, sex, and overall disease severity. This method allowed us to assess the independent effect of each comorbidity on the risk of death, isolating the impact of pre-existing health conditions.

Ethical considerations were rigorously followed to ensure that patient privacy was protected. All patient data was anonymized, and the study was conducted with approval from the relevant ethical review board. Informed consent was obtained from all participants or their guardians where applicable.

Results

The present study included 190 COVID-19 cases, with participants ranging in age from 18 to 80 years. Majority of study cases 96 (53.3%) were from age group 51 to 80 years whereas lower number of cases 35 (18.4%) were from age group 18 to 30 years (Figure 1).

Among the cases present in the case group of the study, majority of patients had diabetes mellitus (55.7%), followed by hypertension (31.5%), coronary heart disease (8.4%), and obesity (4.2%). Additionally, 95 respondents (50%) reported no comorbid conditions and these were those cases which formed the control group of the study (Figure 2).

This study showed that presence of significantly impacts

Table 1. Role of comorbidities in mortality rates among the study cases (n=95)

Category		Case		Control		Total		OR	CI
		N	%	N	%	Frequency	%		
COVID-19	Dead	71	74.7	12	12.6	83	43.6	7971	3.910 – 17.411
	Not Dead	24	25.2	83	87.3	107	56.3		
Total		95	100	95	100	190	100		

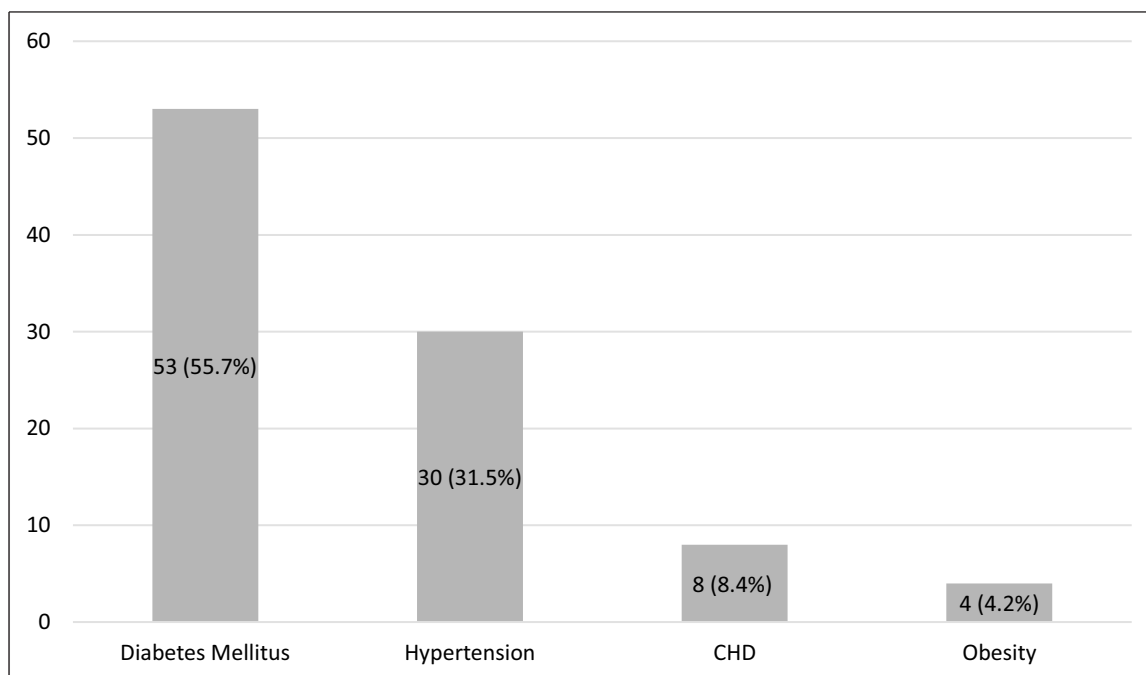


Figure 2. Frequency of comorbidities found among cases of case group (n=95)

patient outcomes and mortality rates. It shows that 74.7% of patients who died had comorbidities, compared to just 12.6% in the control group. The calculated Odds Ratio of 7971 highlights an increased risk of mortality associated with comorbid conditions, with a confidence interval ranging from 3.910 to 17.411, indicating strong evidence of this association (Table 1).

Discussion

This study examined the impact of comorbidities on mortality rates among 190 COVID-19 patients in Peshawar. Results of the present study revealed that COVID infect individual with any age group and in this study the majority of patients were aged between 51 and 80 years, accounting for 53.3% of the cohort. A study by Bacerra et al, 2021 also mentioned that majority of effected individuals were of older age.⁷ Another study conducted in Khedr et al in 2020 also point out that older aged people were more effected by COVID.⁸ This is because that aged people are more affected by COVID-19 because their immune systems weaken with age, reducing their ability to fight infections. They are also more likely to have chronic conditions like diabetes and heart disease, which increase vulnerability. Additionally, age-related changes in lung function can exacerbate respiratory complications from the virus.

Different co-morbidities found among the study cases, 55.7% had diabetes mellitus, 31.5% had hypertension, 8.4% had coronary heart disease, and 4.2% were obese.

Notably, the analysis indicated that 74.7% of patients who died had comorbidities, with an Odds Ratio of 7971, suggesting a dramatically increased risk of mortality associated with these conditions. Similar findings have been reported in various studies worldwide. For instance, research conducted by Khedr et al 2020⁸, Dai et al 2020⁹, and Ejaz et al¹⁰ in the year 2020 also point out this important finding that different comorbidities strongly negatively affected the final outcome of COVID patients and cause severe results and delay recovery. The prevalence of diabetes in our study aligns with global trends, as multiple studies have documented the significant elevation in risk for severe illness and mortality in COVID-19 patients with diabetes. A study conducted by Saeedi et al. (2020) reported that diabetes prevalence is rising globally, and individuals with diabetes face a significantly elevated risk of severe COVID-19 outcomes and mortality.¹¹ As well as, a study conducted by Zhu et al. (2020) reported similar findings that patients with pre-existing type 2 diabetes exhibited poorer clinical outcomes and higher mortality rates, highlighting the need for careful management of blood glucose levels in COVID-19 patients to improve survival chances.¹² Hypertension has also been identified as a strong predictor of worse outcomes, potentially due to the vascular damage associated with high blood pressure. A study by Guan et al. (2020) identified hypertension as a significant predictor of severe outcomes in COVID-19 patients, noting that individuals with high blood pressure were more likely to experience complications and higher

mortality rates.¹³

The calculated Odds Ratio of 7971 in our analysis underscores the critical link between comorbidities and increased mortality rates. This finding is corroborated by a study conducted in Italy by Onder et al 2020, which reported that patients with comorbidities faced a higher risk of mortality, particularly those with multiple chronic conditions.¹⁴ They point out that patients with comorbidities, particularly those with chronic diseases such as hypertension, diabetes, and cardiovascular conditions, had a significantly higher case fatality rate due to COVID-19. Their study underscored the importance of understanding the relationship between pre-existing health issues and COVID-19 outcomes, indicating that these factors greatly influence mortality risk and necessitate focused healthcare strategies for vulnerable populations.¹⁴ The confidence interval of 3.910 to 17.411 reinforces the reliability of our results, indicating that the presence of comorbidities is a crucial factor in predicting mortality risk among COVID-19 patients. Patients with these different co-morbidities face an increased risk of severe symptoms, prolonged illness, and higher mortality. For example, diabetes and hypertension can impair immune responses and exacerbate inflammation, making it harder for the body to fight the virus. Cardiac issues further complicate the disease by increasing the likelihood of cardiovascular stress, which can lead to respiratory failure or multi-organ damage. These underlying health issues not only slow recovery but also elevate the chances of critical illness and death among COVID-19 patients, highlighting the need for tailored care and early intervention in individuals with comorbidities.

Our study reinforces the link between comorbidities and elevated mortality rates in COVID-19 patients. The high prevalence of diabetes, cardiovascular disorders, and hypertension within our study population highlights the necessity for ongoing monitoring and proactive intervention for chronic diseases during the pandemic. Future research should explore the mechanisms through which these comorbidities exacerbate COVID-19 outcomes to develop targeted therapeutic strategies.

Conclusion

In conclusion, our study demonstrates a clear association between comorbidities and increased mortality rates in 'COVID-19' patients, particularly highlighting the significant roles of diabetes, cardiovascular disorders, and hypertension. The findings emphasize the importance of ongoing monitoring and targeted interventions for individuals with these chronic conditions, especially in the context of the pandemic. Addressing these comorbidities can help mitigate the risks associated with 'COVID-19' and improve patient outcomes. Future research should focus on elucidating the underlying mechanisms by which these health issues impact 'COVID-19' severity, paving

the way for more effective therapeutic strategies and public health measures.

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