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Burden of Diabetes Mellitus among Laboratory-Confirmed COVID-19 Patients during the Second Wave of COVID-19 in North India: A Retrospective Observational Study

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ABSTRACT

Background: Diabetes mellitus is a leading comorbidity in COVID-19, with hyperglycaemia impairing immunity and amplifying inflammation, and India carries one of the world's largest diabetes burdens. We quantified the burden of diabetes mellitus among laboratory-confirmed COVID-19 patients during the second pandemic wave at a tertiary care centre in North India.

Methods: In this retrospective observational study, records of 7819 laboratory-confirmed COVID-19 patients tested at Government Medical College, Jammu during April 2021 were reviewed. Known diabetic status, hospital admission, invasive ventilation and in-hospital mortality were extracted and summarised as frequencies and proportions.

Results: Of 7819 confirmed cases, 3856 (49.3%) were known diabetics. Of 456 hospitalised patients, 198 (43.4%) were diabetic, of whom 8 (4.0%) required invasive ventilation. Of 141 deaths, 49 (34.8%) were diabetic. Diabetics were over-represented at every level relative to India's general-population diabetes prevalence (approximately 11.4%). Within the test-positive cohort, crude hospitalisation (5.1% vs 6.5%) and case-fatality (1.3% vs 2.3%) proportions were not higher among diabetics, reflecting selection in the tested denominator.

Conclusion: Diabetes mellitus constituted a substantial burden among COVID-19 positive, hospitalised and deceased patients, far exceeding its population prevalence. The descriptive, single-centre design cannot establish diabetes-attributable risk; denominator-matched studies are required. Persons with diabetes should remain a priority group for prevention, vaccination and vigilant monitoring.

Key-words: Comorbidity; COVID-19; Burden of Diabetes Mellitus, Diabetes mellitus; Prognosis; SARS-CoV-2; Severity

INTRODUCTION

Coronavirus disease 2019 (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), emerged in Wuhan, China in December 2019 and was declared a pandemic by the World Health Organization in March 2020.[1]

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India experienced a catastrophic second wave in April 2021, during which a surge in cases overwhelmed testing capacity, hospital beds, oxygen supply and critical-care services across the country, including the union territory of Jammu & Kashmir.

The clinical spectrum of COVID-19 ranges from asymptomatic infection to fulminant pneumonia complicated by acute respiratory distress syndrome, multi-organ dysfunction and death.[2] Early in the pandemic, advanced age and pre-existing non-communicable diseases were identified as principal determinants of severe disease and mortality.[3,4] Among comorbidities, diabetes mellitus emerged as one of the most consistently reported. Data from the Chinese Center for Disease Control and Prevention placed the

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case-fatality rate among patients with diabetes at approximately 7.3%, against an overall rate of 2.3%,[5] and subsequent meta-analyses reported an approximately two-fold higher likelihood of both severe disease and death in diabetic individuals.[6,7]

India carries one of the largest diabetes burdens in the world. The ICMR-INDIAB national cross-sectional study estimated a weighted diabetes prevalence of 11.4%, corresponding to more than 100 million adults living with the condition.[8] Several inter-related mechanisms render this population vulnerable to severe COVID-19. Chronic hyperglycaemia compromises neutrophil chemotaxis, phagocytosis and cell-mediated immunity, sustains a chronic low-grade pro-inflammatory state predisposing to cytokine dysregulation, and is associated with endothelial dysfunction and a prothrombotic milieu.[9,10] Hyperglycaemia-related glycosylation of the angiotensin-converting enzyme 2 (ACE2) receptor and the viral spike protein, together with renin–angiotensin system imbalance, may facilitate viral entry and contribute to lung injury, favouring viral replication and accelerating clinical deterioration.[11]

Despite the global literature, granular data from northern India and from Jammu & Kashmir in particular, remain limited. The present study was therefore undertaken to quantify the burden of diabetes mellitus among laboratory-confirmed COVID-19 patients and to describe its distribution across hospitalisation, requirement of invasive ventilation, and in-hospital mortality at a tertiary care centre during the peak of the second wave.

MATERIALS AND METHODS

Study Design and Setting- This retrospective, record-based observational study was conducted in the Department of Microbiology, Government Medical College, Jammu, a tertiary care teaching hospital and designated COVID-19 referral centre for the Jammu region. The study covered the period of April 2021, corresponding to the peak of the second wave of the COVID-19 pandemic in India.

Study Population- All individuals with laboratory-confirmed SARS-CoV-2 infection tested at the institution during the study period was included. Confirmation was based on real-time reverse-transcription polymerase chain reaction (RT-PCR) and/or rapid antigen testing performed according to prevailing national guidelines.

Inclusion Criteria- All patients with laboratory-confirmed COVID-19 during April 2021 were included in the study.

Exclusion Criteria- Cases with incomplete records regarding diabetic status, hospitalisation, ventilatory support, or outcome were excluded from the analysis.

Data Collection and Study Variables- Data were retrieved from laboratory registers and hospital records in anonymised form. A known diabetic was defined as a patient with a pre-existing physician-documented diagnosis of diabetes mellitus or receipt of antidiabetic therapy. Disease severity was assessed using the requirement for hospital admission and invasive ventilatory support. Prognosis was evaluated based on in-hospital mortality during the study period.

Statistical Analysis- The analysis was descriptive. Categorical variables were summarised as frequencies and proportions (percentages), with the denominator (n) stated for every proportion. The proportion of diabetic patients was determined within the overall laboratory-confirmed cohort (n = 7819) and within the hospitalised (n = 456) and deceased (n = 141) strata, and was compared descriptively against the reported general-population diabetes prevalence for India. Inferential testing of association was not undertaken: because the test-positive cohort was not a representative sample of the source population and matched non-diabetic denominators with covariate data were unavailable, formal risk estimation would be confounded and potentially misleading. Data were compiled and analysed using Microsoft Excel.

Ethical considerations- As a retrospective analysis of anonymised, aggregate institutional records, the study were conducted in accordance with the ethical standards of the institution and the Declaration of Helsinki. Institutional Ethics Committee approval/waiver was obtained, and patient confidentiality was maintained throughout.

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RESULTS

During April 2021, a total of 7819 patients were laboratory-confirmed positive for SARS-CoV-2 at the institution. Of these, 3856 (49.3%) were known diabetics and 3963 (50.7%) had no recorded history of diabetes (Table 1).

Of the 456 patients who required hospital admission, 198 (43.4%) were diabetic and 258 (56.6%) were non-diabetic.

Among the 198 admitted diabetic patients, 8 (4.0%) required invasive ventilatory support; comparable ventilation data for non-diabetic admissions were not available in the records. Of the 141 in-hospital deaths recorded during the study period, 49 (34.8%) occurred in patients with diabetes and 92 (65.2%) in patients without diabetes.

Table 1: Distribution of diabetic and non-diabetic patients across strata of COVID-19 severity and outcome, April 2021 (n = 7819)

Stratum	Diabetic, n (%)	Non-diabetic, n (%)	Total, n
Laboratory-confirmed positive	3856 (49.3)	3963 (50.7)	7819
Hospitalised	198 (43.4)	258 (56.6)	456
Deceased	49 (34.8)	92 (65.2)	141

Percentages are calculated row-wise (proportion diabetic versus non-diabetic within each stratum).

The proportion of diabetic patients at every level — 49.3% of all positives, 43.4% of hospitalised patients and 34.8% of deaths — substantially exceeded the general-population diabetes prevalence in India of approximately 11.4%.[8] When referenced against the test-positive denominator (Table 2), the crude hospitalisation proportion (5.1% in diabetics vs 6.5% in non-diabetics) and the crude case-fatality proportion (1.3% vs 2.3%) were not higher among diabetics; this pattern reflects the composition of the test-positive cohort rather than a protective effect of diabetes and is considered in the Discussion.

Table 2: Crude outcome proportions within the laboratory-confirmed cohort, by diabetic status

Outcome	Diabetic	Non-diabetic
Hospitalisation, n/N (%)	198/3856 (5.1)	258/3963 (6.5)
Invasive ventilation among admitted, n/N (%)	8/198 (4.0)	Not available
In-hospital death, n/N (%)	49/3856 (1.3)	92/3963 (2.3)

n/N denotes events over the corresponding denominator. Invasive-ventilation data were available only for admitted diabetic patients.

DISCUSSION

The principal observation of this study is the striking over-representation of diabetes mellitus across the entire severity spectrum of COVID-19. With diabetics constituting roughly one-third to one-half of positive, hospitalised and deceased patients — against a general-population prevalence of about 11%[8] — these data depict diabetes as a dominant comorbidity in the COVID-19 population of this region, consistent with the underlying biology of the disease.

Several mechanisms plausibly link diabetes to adverse COVID-19 outcomes. Chronic hyperglycaemia impairs innate and adaptive immune responses, including neutrophil and lymphocyte function, while sustaining a pro-inflammatory state predisposing to dysregulated cytokine release.[9,10] Hyperglycaemia-related glycosylation of ACE2 and the viral spike protein, altered ACE2 expression and renin–angiotensin system imbalance may enhance viral entry and contribute to lung and endothelial injury, while the associated prothrombotic and oxidative milieu can accelerate progression to respiratory failure.[11]

These mechanisms are reflected in the wider literature. The Chinese CDC reported a markedly higher case-fatality rate among diabetics,[5] and pooled analyses have

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quantified the association, with diabetes linked to roughly a two-fold increase in the odds of severe disease and of mortality.[6,7] The pooled prevalence of diabetes among COVID-19 patients in early meta-analyses was approximately 10%, broadly mirroring community prevalence.[6]

It is against this benchmark that the present cohort must be interpreted with caution. A diabetes prevalence of 49.3% among test-positive patients is several-fold higher than both the Indian population prevalence and the pooled prevalence reported among COVID-19 patients elsewhere, strongly suggesting that the test-positive cohort was not representative of all infected individuals: during the April 2021 surge, testing and the ascertainment of "known diabetic" status are likely to have been concentrated among symptomatic, hospitalised and comorbid individuals. This selection inflates the diabetic denominator and explains the apparent paradox, whereby crude within-cohort hospitalisation and case-fatality proportions were not higher in diabetics. Such crude comparisons cannot validly estimate diabetes-attributable risk, since the groups are not exchangeable and the denominators are differentially ascertained; the valid inference supported by these data is the heavy diabetes burden relative to the population rather than a quantified within-cohort risk.

From a clinical and public-health perspective, the findings reinforce the importance of treating individuals with diabetes as a priority group during respiratory-virus epidemics. In a country with one of the highest absolute diabetes burdens globally, this entails proactive vaccination, optimisation of glycaemic control, early clinical assessment and close monitoring of diabetic patients who acquire SARS-CoV-2, and the integration of comorbidity status into triage and surveillance systems.[12]

LIMITATIONS

Several limitations temper these findings. The retrospective, single-centre design restricted to a single month limits generalisability and precludes assessment of temporal trends. Most importantly, the test-positive cohort is subject to selection and ascertainment bias, with a diabetes prevalence far exceeding expected values, so crude within-cohort outcome rates should not be read as measures of risk. The aggregate data could not be adjusted for age, sex, glycaemic control (e.g., HbA1c), duration of diabetes, or coexisting comorbidities such as hypertension and cardiovascular or renal disease. "Known diabetic" status was based on documented history, so undiagnosed diabetes and stress- or steroid-induced hyperglycaemia were not captured, raising the possibility of misclassification. Finally, invasive-ventilation data were available only for admitted diabetic patients, precluding comparison.

CONCLUSIONS

Diabetes mellitus constituted a substantial burden among COVID-19 patients at this tertiary care centre during the second wave, being present in roughly one-third to one-half of positive, hospitalised and deceased individuals and far exceeding its general-population prevalence. This underscores the magnitude of the diabetes burden within the COVID-19 population and aligns with the established role of diabetes in severe disease. The descriptive, single-centre design and the selection bias inherent in the test-positive cohort preclude inference of an independent, diabetes-attributable risk, and crude within-cohort outcome rates did not differ in the expected direction. Persons with diabetes should nonetheless remain a priority group for prevention, vaccination and vigilant glycaemic and clinical monitoring during COVID-19.

Future prospects and implications: adequately powered, multicentre studies with denominator-matched comparison groups and adjustment for age, sex, glycaemic control and coexisting morbidities are needed to quantify the independent contribution of diabetes to COVID-19 outcomes in this region. Prospective registries linking glycaemic indices such as HbA1c to clinical trajectories, and the integration of comorbidity status into triage and surveillance systems, would strengthen preparedness for future respiratory-virus epidemics in a population carrying a high diabetes burden.

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