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COVID-19 outcome among diabetic patients admitted in a tertiary care hospital: An observational study

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Abstract
Background: Diabetes is known to confer increased risk for infections. Coronavirus disease-19 (COVID-19) has caused significant morbidity and mortality worldwide and in India. Diabetes mellitus (DM) and related comorbidities have a significant impact on clinical presentation and outcomes. Diabetic patients are at a higher risk of developing the severe form of COVID-19. Increased severity of COVID-19 in diabetic patients could be attributed to many factors. Limited data is available about diabetes characteristics in hospitalized patients with COVID-19 and its outcome from India. Hence the present study was carried out to study the outcome of COVID-19 infection among diabetic patients admitted in a tertiary care hospital.
Methods: It was a retrospective cross-sectional study conducted during March 2020 to October 2022 in a tertiary care hospital. Data was obtained from the electronic and written records of 3240 covid-19 patients admitted. Data was collected from medical records that included age, gender, symptoms, comorbid conditions, admission to the intensive care unit (ICU), number of hospitalization days, recovery and mortality.
Results: Total 3240 patients were admitted, out of this 37% were females and 13.9% were diabetics with mean age of 58 years. The rates of ICU admission and days of hospitalization was significantly higher among diabetic patients with COVID-19 than non- diabetics. Further the mortality was also higher among them.
Conclusion: People with diabetes with COVID-19 are at a greater risk of worse prognosis and mortality. Careful assessment of the many components that contribute to poor prognosis with COVID-19 in patients with diabetes might represent the best.

Keywords: COVID-19, diabetes mellitus, recovery, mortality

Introduction
World Health Organization declared COVID-19 a global pandemic on March 11, 2020 after the rapid spread of COVID-19. As a result, various containment measures were adopted worldwide by health-care systems to cope with a growing number of acutely ill covid-19 patients. Among those with severe COVID-19 and those who died, there is a high prevalence of comorbid conditions like diabetes, cardiovascular disease, hypertension, obesity, and chronic obstructive pulmonary disease [1, 2]. A greater risk of viral infection was observed in people with diabetes as per reports from previous disease epidemics [3]. This does not seem to be the case for COVID-19, though diabetes is associated with an increased risk and severity of coronavirus disease 2019 (COVID-19). While interacting with various other risk factors, high blood sugar was found to reduce immunity and increase the replication of SARS-CoV-2. COVID-19 infection primarily modulates immune and inflammatory responses, and may cause a cytokine storm, resulting in possible lethal outcomes in diabetics [4]. People with diabetes have of 2 to 3 times higher risk of all-cause mortality. Diabetes is responsible for various complications and the link between increased risk of infections and diabetes is well established [5].
As per a systematic review by Abdi *et al*, it was concluded that the cumulative prevalence of DM in COVID-19 individuals was 14.5%. They also reported that those with diabetes were more prone to developing severe COVID-19 and increased mortality [6]. Kumar *et al* concluded that diabetes in individuals with COVID-19 was associated with a two-fold increase in mortality and severity of SARS-CoV-2 compared to non-diabetic people [7]. Present evidence indicates that people with diabetes are more prone to COVID-19 infection and also the risk of severity is greater in them as compared non-diabetics.

Hyperglycaemia is a strong prognostic predictor of outcome in hospitalized patients with COVID-19. Earlier studies showed that hyperglycaemic patients with COVID-19 displayed higher cumulative incidence of severe disease than normoglycemic controls [8]. Possible mechanisms for this increased mortality include hyperglycaemia induced changes in the immune system and increases in inflammatory cytokines. Studies from different countries have demonstrated a varying prevalence of diabetes, other comorbidities, and mortality among patients infected with COVID-19. Overall, it was reported that the proportion of people affected by diabetes among COVID-19 patients was from 5.3% to 20% [9]. Diabetes does not seem to increase the risk of COVID-19 occurring, although diabetes is more frequent in patients with severe COVID-19. In fact, diabetes has been implicated as the most important cause for mortality in COVID-19 hospitalized patients [10]. Furthermore, COVID-19 has been implicated in the development of new-onset diabetes mellitus [11]. Limited data is available on characteristics of diabetes patients and the outcome with COVID-19 in India. Hence this study was undertaken with objective to study the outcome of COVID-19 infection among diabetic patients admitted in a tertiary care hospital.

Materials and Methods

The present retrospective study obtained the medical records of 3240 patients aged 9 months to 95 years who were diagnosed with COVID-19 from March 2020 to October 2022. The study was reviewed and approved by the Institutional Ethics Committee. Because the study was retrospective, no informed consent was required. Data was collected from the electronic and written medical records from admission to the outcome of COVID-19 as recovered or died. The data obtained were age, gender, presenting symptoms, comorbid conditions, admission to the intensive care unit (ICU), number of hospitalization days, and mortality.

Statistical analysis

All data collected was entered in the excel spreadsheet and data was analysed further. The values represent mean ± Standard deviation (SD) for the continuous variables, or percentage relative to the total number of patients in each group for the categorical variables. Appropriate tests of significance were used and a *p*-value<0.05 was considered statistically significant.

Results

The study population consisted of 3240 patients, of whom 37% were females and the mean age was 58 years (range 9 months-92 years). Among the entire study population, 451(13.9 %) had diabetes mellitus. Out of the diabetics, 160 were females and remaining 291 were males. At the time of admission to the hospital, 40.1% diabetes patients with COVID-19 were critical as compared to only 6.6% non-diabetic patients. The ICU admission rates were also higher among diabetic patients with covid-19(49.8%) than non-diabetic patients. COVID-19 outcomes were more severe in diabetic patients than in non-diabetic patients, as evidenced by a larger proportion of ICU admitted cases (severe), which was close to being statistically significant (p=0.071) as shown in Table 1. Similarly, the mortality rate was higher (23.2%) among COVID-19 patients with diabetes than non-diabetics (10.0%).

Table 1: Characteristics of COVID-19 patients with or without diabetes mellitus

Variable group	Total (n= 3240)	Non-diabetic (n= 2789)	Diabetic group (n=451)	p-value
Age (years)[a]	58.0 ± 10.1	54.1 ± 13.7	60.3 ± 12.7	< 0.05
Gender				
Male	2039	1748(62.7)	291(64.6)	> 0.05
Female	1201	1041(37.3)	160(35.4)	
Admission to ICU	717	492 (17.6)	225 (49.8)	<0.05
Mortality/deaths	385	280(10.0)	105 (23.2)	<0.05
Recovery	2855	2509 (90.0)	346 (76.8)	<0.05
Hospitalization days[a]	12.3 ± 3.7	10.2 ± 6.1	14.6 ± 5.4	<0.05

[a]data presented as mean ± SD; figures in brackets are in percentages.

Discussion

People with diabetes are one of the high-risk groups for COVID- 19 because their immune system is debilitated. The reason for worse prognosis in people with diabetes is likely to be multifactorial. People with diabetes with COVID-19 are at a greater risk of worse prognosis and mortality. Diabetes mellitus (DM) is one of the most frequently reported comorbidities in COVID-19 patients that determine their risk of morbidity and mortality [12].

The present study found 13.9 % of covid-19 patients had diabetes as comorbidity. This proportion ranged between 5 to 20% by various studies [13, 14, 15]. The contribution of new-onset diabetes in COVID-19 patients also has been observed globally [16]. Characterization of COVID-19 patients in India through initial publications shows 28.6% of the patients have comorbidities like hypertension or diabetes mellitus [17]. Certainly, diabetes mellitus is one of the important comorbidities in COVID-19 patients. It was found that the covid-19 patients with diabetes had a longer duration of stay in the hospital. Similar findings were also reported by Kumar A and *et al*. [7].

The rate of ICU admission was also higher in the present study for covid-19 patients with diabetes than without diabetes. Same findings were reported by a study done in Kuwait [18]. Mortality rate in our study was higher than the reported rate for the UAE [19] and in concordance with another study by kumar A *et al*, [7] and other studies also [20, 21]. Diabetes mellitus was found to negatively impact most of the outcomes analyzed in our study like hospital stay, ICU admission, and mortality were all adversely influenced by the presence of diabetes among covid-19 patients. In several studies and meta-analyses, also demonstrated consistent association with severe disease and adverse outcomes in COVID-19 infection among diabetes patients [22, 23, 24, 25]. Clinical outcomes are dependent on many other factors including therapies received during hospitalization as well as associated comorbidities. Considering the ongoing COVID-19 pandemic situation, it's important to

estimate the epidemiological burden of mortality among hospitalized COVID-19 patients with diabetes to ensure the implementation of evidence based public health initiatives.

Conclusion

Patients with diabetes mellitus admitted to hospital with COVID-19 have poorer outcomes. As the prevalence of diabetes mellitus is high in India, the diabetic people form a large vulnerable part of the COVID-19 population. People with diabetes are likely to have a worse prognosis as a result of immune dysfunction, restrictive type of lung dysfunction, other complications associated with diabetes, increased risk of secondary infection and susceptibility to COVID-19. To conclude, patients with COVID-19 with diabetes have a worse prognosis, most probably because of the concurring effect of multiple factors.

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