



## COVID-19 and Diabetes Mellitus Patients

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Coronaviruses (COVID-19) are encapsulated viruses with a self, positive-sense RNA genome that are proven to cause respiratory disease in humans. Coronaviruses (COVID-19) are a type of virus that infects the respiratory tract [1]. In most immunocompetent individuals, infection with human COVID-19 results in a moderate upper respiratory infection in the majority of cases. The outbreaks of severe acute respiratory syndrome (SARS) in Guangdong province, China, in 2003 and Middle East respiratory syndrome (MERS) in Middle Eastern countries a decade later were caused by two highly virulent COVID-19. SARS-CoV and MERS-CoV were discovered to be the causative agents of SARS and MERS, respectively [2]. In December of this year, a novel coronavirus, SARS-CoV-2, was discovered as the pathogen responsible for coronavirus disease (COVID-19) in Wuhan, China, according to the Chinese government [3]. It mostly affects the respiratory tract, as well as the severity of the illness can range from undiagnosed or moderate or severe disease in some patients. Despite the fact that the current case mortality rate for COVID-19 is estimated to be less than 5 percent, up to 15–18 majority of patients may have become severely or severely unwell, with some requiring intensive care unit (ICU) treatment and mechanical breathing [4]. Currently 266,163,340 cases discovered and 5,271,960 cases are died [5]. The likelihood of acute infection and consequent mortality in people with comorbidities rises with age. Increased acute illness, respiratory failure, and increased mortality are all related with diabetes mellitus (DM) as an unique comorbidity, according to the majority of the existing researches [6]. A study from China found that 173 of the 1099 confirmed COVID-19 patients had acute disease; patients with severe disease had a greater frequency of DM (16.2%) than those who acute disease (5.7%) [6]. Additionally, in the biggest series of COVID-19 cases reported by the Chinese Center for Disease Control and Prevention, which included 72,314 cases, diabetic patients had a greater fatality rate than those without diabetes (7.3% in DM compare to 2.3% overall) (7). In another study showed that 51% of COVID-19 patients have been diagnosed with hyperglycemia. (8) Diabetes prevalence has been shown to range between 5% and

20% in COVID-19 patients in several studies. Diabetes is also connected with an increased risk of severe to life-threatening disease in 14–32% of COVID-19 patients [9].

Diabetes is a documented risk factor for inferior clinical outcomes in COVID-19 patients. The link between these two things appears bidirectional [10]. Diabetes patients' blood glucose control has been impacted by the COVID-19 pandemic. Direct effects are directly related to the viral infection, while indirect effects are related to the pandemic's impact on blood glucose management or the use of proposed treatments that affect glucose homeostasis.

As a direct consequence, COVID-19 has altered patients' metabolism and raised blood glucose. Increased cytokines and inflammatory mediators caused insulin resistance and hyperglycemia [11]. COVID-19 may also cause pancreatic damage by targeting ACE2 receptors in pancreatic islets [12].

COVID-19 treatments have been modified from various therapeutic approaches. For example, glucocorticoids have a significant impact on blood glucose levels. Individuals who are critically ill with COVID-19 who are administered glucocorticoids have a reduced mortality rate. It is well-established that glucocorticoids alter glucose homeostasis by promoting gluconeogenesis and insulin resistance in numerous tissues [13].

#### Relating between age and DM in Covid-19 patients

While it is reasonable to expect that patients with DM are older than those without DM, and growing age has repeatedly been associated with increased mortality in COVID-19, the majority of the aforementioned studies did not control for age. Nonetheless, diabetes has consistently been linked to a poor outcome in various viral illnesses, most notably seasonal influenza, pandemic influenza A H1N1 (2009), Severe Acute Respiratory Syndrome (SARS), and Middle East Respiratory Syndrome (MERS) [14,15]. As a study has done in Mexico, the probability of death from DM reduced with

age in adult patients infected with COVID-19 in Mexico. There has been no correlation between diabetes and mortality in inpatients aged 80 years or older. This results should be replicated in more populations [16]. In another study have done in us, 26.8% aged 65 years and older, a group at higher risk of mortality from COVID-19, had DM [17]. Between January 1, 2020 and December 1, 2021, approximately 206,038 of the 779,402 deaths caused by COVID-19 in the United States were among people aged 85 years and older. This statistic depicts the number of deaths caused by coronavirus disease 2019 (COVID-19) in the United States from January 2020 to December 2021, by age group [18]. Also indicated, age was identified as a predictive factor for intubation [19]. However in another study done by Coronado seems On day 7, there was no evidence that age was a significant predictor for orotracheal intubation and/or death [20]. In a study is done in Iran showed that Patients with COVID-19 who were older than 60 years and younger than 20 years had 3.4 and 1.9% greater odds of death, respectively, as compared to patients in the 20-to-40-year age range, indicating a higher risk of mortality in elderly and younger patients with diabetes, according to the study. Male diabetic patients had a death rate that was 34 percent higher than female diabetic patients [21].

**Is diabetes mellitus related with COVID-19-related mortality and severity?**

As a meta-analysis study done, diabetes showed a substantially linked with acute COVID-19 as well as COVID-19 death. In the first place, because diabetes can cause severe COVID-19 in diabetics, prevention is essential. In order to avoid contracting a coronavirus infection, diabetic individuals should be advised by their doctors to practice social seclusion and good hand cleanliness.

Second, diabetic individuals should be tested for COVID-19 more frequently in out-patient clinics, and the threshold for testing should be lowered.

Any COVID-19 patient who also has diabetes should be considered potentially dangerous, even if he or she has only mild or no symptoms at the time of admission. These individuals will necessitate more frequent monitoring and a lower threshold for hospitalization and ICU admission [22]. in another study showed that, Age seemed to be a risk factor for death and orotracheal intubation in both the total cohort and diabetic patients in univariate and multivariate analyses. These findings corroborate earlier research. Older age has also been linked to a higher prevalence of various comorbidities [23]. Another important point is that diabetic patients were shown to be more likely than non-diabetic patients to have more comorbidities and worse clinical conditions. Their need for intubation and fatality rates were found to be connected not just with cardiovascular and renal comorbidities, but also with smoking/past smoking and neurologic disorders, among other factors. Interesting, in univariate analysis, the presence of chronic kidney disease (CKD) and the necessity for prisma were both found to be risk factors for death and intubation outcomes in diabetic individu-

als. Furthermore, in multivariate analysis, chronic kidney disease (CKD) is found to be an independent risk factor for intubation [24]. The particular underlying processes that contribute to the increased mortality rate seen in participants who were infected with DM-SARS-CoV2 are still unknown. Several aspects connected to diabetes have been taken into consideration. Persons suffering from diabetes have pulmonary dysfunction due to decreased lung volume and lower pulmonary diffusing capacity. They also have difficulty controlling their breathing and have low bronchomotor tone and noradrenergic innervation [25]. Another factor is associated is D-dimer which according to the findings, a decreased lymphocyte and platelet count, as well as elevated D-dimer levels, were the most accurate predictors of an overall higher mortality. The D-dimer test is the most accurate predictor of overall mortality among the latter components. Emerging evidence suggests that, in addition to deep venous thrombosis (DVT), elevated D-dimer levels in COVID-19 patients may be the expression of capillary microthrombi, which are caused by pulmonary capillary endothelial injury, and that this may contribute to the increased risk of death in these patients [26].

**Symptoms in diabetic covid-19 patients**

A systematic review and meta-analysis of clinical symptoms associated with COVID19 revealed that fever, cough, and dyspnea were the most frequent symptoms [27]. Among this study, it appears that dyspnea symptoms are more common in diabetes inpatients (45.6 percent versus 58.25 percent), however this difference is not statistically significant. Because it is placed within a 95 percent confidence interval of the prevalence of meta-analysis, it is considered reliable. Other symptoms, on the other hand, are less severe than in recent trials (fever: 24.6 percent vs 88.7 percent, cough: 44.58 percent vs 57.6 percent). According to the findings of this study, only fever is considerably lower in diabetes patients when compared to the results of the meta-analysis, which may be due to an immunological response [21]. COVID-19 patients typically show symptoms 5-6 days after infection. SARS-CoV-2, like SARS-CoV and MERS-CoV, causes mild symptoms for 2 weeks but can progress to serious infection, along with a systemic inflammatory response syndrome, acute respiratory distress syndrome, multi-organ involvement, and shock [7].

**Pathophysiology of diabetes mellitus and COVID-19**

SARS-CoV-2 infection in diabetics starts a chain of events that increase death risk. COVID-19 infection causes hyperglycemia, which boosts ACE2 glycosylation and virus replication [28]. Oxidative stress from hyperglycemia worsens inflammation, endothelial dysfunction, and thrombosis. Oxidative stress impairs glucose metabolism and causes hypercoagulability. A severe infection in vasculopathy patients with reduced immune function might worsen thrombotic and ischemic outcomes, leading to multiorgan failure and higher fatality rates.

All cases of diabetes mellitus have abnormal glucose metabolism signaling. Diabetes mellitus (DM) causes macrovascular and

microvascular problems, resulting in vasculopathy. Chronic hyperglycemia and insulin resistance cause vasculopathy in many ways. AGE-RAGE signaling abnormalities and oxidative damage may contribute to this condition. Advanced glycation end products (AGEs) and RAGE activation in the AGE-RAGE axis may accelerate vascular damage [29]. Oxidative stress alters mitochondrial superoxide expression in big and small artery endothelial cells. Superoxide production gradually alters epigenetics, maintaining proinflammatory pathways even when blood glucose levels normalize [30].

Chronic hyperglycemia causes aberrant cytokine responses, leukocyte recruitment inhibition, and neutrophil dysfunction. Acute viral infections worsen persistent hyperglycemia by activating immune responses and increasing insulin resistance [31]. Severe COVID-19 increases blood glucose [32]. Instead of HbA1c, blood glucose levels are better indicators of increasing hyperglycemia in SARS-CoV-2-infected diabetics. The above findings show that acute hyperglycemia may accelerate clinical worsening in vasculopathy and endothelial dysfunction patients.

Diabetes mellitus (DM) and COVID-19 are linked by atypical immune reactions that accelerate thrombotic and ischemic consequences, leading to multiorgan failure and higher mortality rates.

Conclusion

COVID-19 is a continuing epidemic, with new information on the disease emerging on a regular basis. Diabetes is an important comorbid condition for COVID-19, and diabetic patients must take the required precautions to avoid infection. Diabetes and COVID-19 are both medical disorders that affect people all over the world. Diabetes individuals are more vulnerable to the severity of COVID-19 than the general population.

Diabetes is related with a two-fold increased risk of mortality and a two-fold increased risk of COVID-19 severity in patients with COVID-19. Our advice is broken into two parts:

Prevention

- Create home learning and remote-control systems.
- Gliptin medicines should be used in moderation.
- Blood glucose levels must be monitored and attempted to be controlled.
- Limit the use of ACEI medication classes.
- To reduce infection, avoid needless hospitalizations.
- Improve your nutrition and eat a healthy diet.

Following an infection

- Keep an eye on the symptoms.
- Every 8 hours, the blood glucose level is monitored.
- ARDS surveillance
- Reduced occurrences of harmful drug reactions
- Nutritional considerations
- Long-term monitoring of Covid-19 side effects.

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