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The Association between Diabetes Mellitus and Covid-19: A Systematic Review

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ABSTRACT
Diabetes is recognised as a risk factor for COVID-19-related problems. Among the most serious conditions associated with the severity of coronavirus infections is diabetes. Serious adverse effects such as multiple organ failure, extended hospital stays, adult respiratory distress syndrome, and death are more common in diabetic patients.
Investigated the features, clinical signs of the infection, clinical severity, biological evaluation upon admission, therapy, outcomes, and death in COVID-19-positive diabetic casesto shed light.Patients with diabetes were more likely than those without the disease to have the highly severe COVID-19 variants. Patients with diabetes need greater oxygen therapy, experience weight loss, require more mechanical breathing, and are admitted to the intensive care unit (ICU) more frequently. It remained unknown how much of the increased death and morbidityrelated to diabetes.
Obesity, co-morbidities, sex, age, and ethnicity all seem to increase the likelihood of the worst outcomes. The SARS caused by the coronavirus may exacerbate and potentially provoke severe metabolic problems in diabetes individuals, affecting β-cell function and ultimately leading to hyperglycaemia and diabetic ketoacidosis.
More than 20% of critically ill patients in ICUs have diabetes and are infected by the COVID-19 pandemic, which presents serious difficulties for hospital workers who are responsible for their care.Strict glycaemic control reduces adverse outcomes in acute illness. It necessitates close glucose monitoring, SC and IV insulin treatment and prompt intervention in the event of hypoglycaemia patients. These duties are needed when it is suggested by healthcare workers, who often operate in environments with a shortage of personal protective equipment, restrict their interactions with patients to prevent prolonged exposure to COVID-19.Medications that may impact glycaemic management are addressed, including hydroxychloroquine and glucocorticoids. It has been proposed that hospitalized patients could spend less time with their doctors by using continuous glucose monitoring devices however, there are serious issues that need to be addressed.
Keywords: Coronavirus, Co-morbidities, Diabetes Mellitus, Diabetic ketoacidosis, Hyperglycaemia, Severe acute respiratory syndrome.

I. INTRODUCTION

As a result of its corolla-like appearance, coronavirus is additionally referred to as coronavirus. The world is now aware of severe acute respiratory syndrome coronavirus SARS-CoV-2and Middle East respiratory syndrome coronavirus (MERS-CoV). There are also coronaviruses with titles such as OC43, 229E, and human intestinal coronavirus.[1]

The first reveal of a SARS-CoV-2 infection was found in Wuhan, China. begun on December 2019 and quickly expanded over the world, leading the WHO to announce the pandemic on March 11, 2020. By the last day of June 2020, the virus had infected almost 13 million people, and more than 500,000 had died from it. An infection known as COVID-19 is extremely transmissible and varies in severity among patients. The illness may be severe or present with no signs at all. The critical patients have a bad outlook, respiratory distress syndrome, or organ failure requiring resuscitate therapies.[2]

When the Infection Is Transmitted Coughing and sneezing are the main ways that human coronaviruses spread from someone with the disease to a healthy person by the air. close physical interaction, such as handshakes or rubbing. A person may contract one or more coronaviruses in their body during their lifetime. Infants are equally susceptible to infection.

Around the world, diabetes is a major health issue. Often, poor insulin utilization by body cells or insufficient insulin generation by the pancreatic β cells are the causes of increased BGL.Type 1 diabetes and type 2 diabetes are its two major types. Chronic diabetes destroys multiple organs, especially the kidney, heart, brain, and eyes, and raises the risk of other diseases

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caused by macrovascular and microvascular damage.[3]

Diabetes is seen as a danger factor for COVID-19 difficulties.[2]However, it appears that there is a mutual interaction between these two entities. The ongoing COVID-19 epidemic is having a significant effect on patients' capacity to control their blood sugar levels. There are two categories of outcomes from these impacts: direct effects and indirect effects.

The COVID-19 virus has significantly affected patients' metabolisms, producing substantial rises in blood glucose levels. It appears to be triggered by the enhanced release of inflammatory mediators and cytokines, which worsens insulin resistance and the resulting hyperglycaemia. This COVID-19 may damage the ACE2 receptors in the pancreatic islets, which could cause severe diabetes mellitus (DM) in certain individuals.

Many scholarly papers have examined the unintended consequences of the COVID-19 pandemic on various demographic groups during the lockdown. While some studies claim there has been a significant increase in glycaemic management, others find no difference at all indicating that this population's glycaemic control has gotten worse.[4]

Based on data from Italy, diabetes affected over two-thirds of COVID-19 patients who passed away. A Chinese study discovered that people who had diabetes had prolonged virus clearance rates.Objective of the study is to ascertain whether DM worsens the severity and prognosis of COVID-19 patients and to elucidate the basis of this relationship.[2]

During the 8-week lockdown period, 26% of the subjects had an increase in HbA1c > 0.3%. These individuals also had a prolonged elevation in blood triglycerides, which might be used as a predictor of deteriorating glucose control. Lockdown found that over 25% of type 2 diabetics who had previously had quality care experienced a significant short-term metabolic deterioration; the only characteristic that might predict this kind of disruption in glucose regulation was pre-lockdown triglycerides. Numerous studies show that regular workout and dieting have positive long-term effects for development of vascular issues in T2D, which is primarily controlled by lifestyle choices.

According to a recent study from Italy, nearly half of the assessment participants switched to extra adding to their dietin pregnancy and gaining weight as a result. Interestingly, participants also reported feeling more worried, which is linked to emotional eating and an increase in "comfort food," which is primarily composed of basic carbs.People with T2D are therefore more likely to gain weight than those without the disease because they have higher basal energy expenditure but lower active energy expenditure. Even in patients with good and relatively stable metabolic profiles, if some changes occur in daily routine like diet, exercise and other lifestyle can affect the patient's metabolism.[5]The international prevalence of obesity and T2Dis on the rise due to the growing adoption of lifestyles that involve excessive caloric consumption and poor energy expenditure, especially in developing and lower-income nations.[6]

Additionally, research has demonstrated that COVID-19 is linked to hyperglycaemia, especially in older people with T2D.In light of the numerous unknowns surrounding the virus, a special and main care has taken by the health care professionals mainly for COVID-19 patients with diabetes has been reported to manage these kinds of patients. Special and primary treatment can make use of this text as a manual.[7]However, a new study reported that isolation and lockdown could be favourable for the short-term management of T1D.[5]

Numerous treatments have been repurposed to address COVID-19. Glucocorticoids, for example, have a dramatic effect on BGL. Glucocorticoid medication use has been linked to a lower death rate in COVID-19-infected critically sick patients. It is commonly recognized that the use of glucocorticoids causes a substantial alteration in glucose homeostasis because of enhanced gluconeogenesis and concurrently increased insulin resistance in different tissues.[4]The goal is to investigate the COVID-19 patients who also had type 2 diabetes and ascertain how T2DM affected the disease's severity, treatment efficacy, and COVID-19 patient's mortality.[1]

Pathophysiology of diabetes mellitus and COVID-19

Diabetes mellitus and SARS-COVID infection increase mortality, which sets off a series of events that predispose people to hyperglycaemia and increase viral growth.[8] deteriorating Through the promotion of oxidative stress that results in malfunction of glucose metabolism, hyperglycaemia affects inflammation, endothelial dysfunction, hypercoagulability, and thrombosis.[9] Reduced immunity may highlight thrombotic and ischemic sequelae that link multiple organ failure

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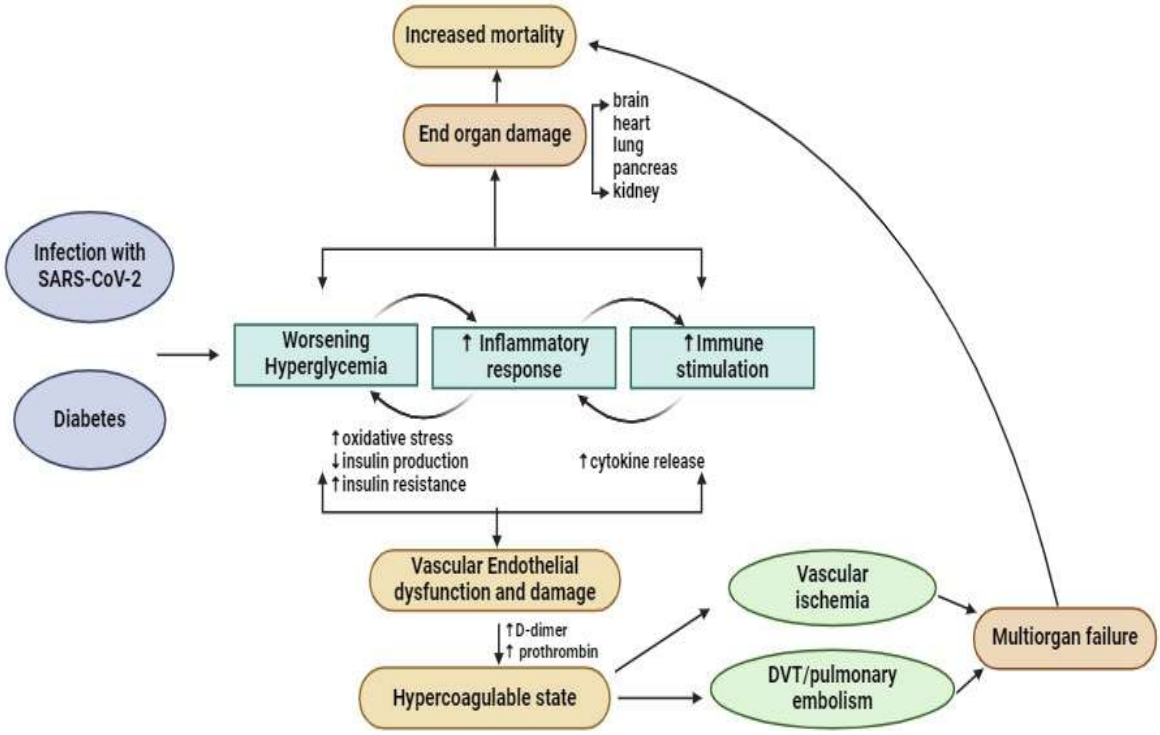
to a higher mortality risk. The hyperglycaemia linked to COVID-19 may be made worse by aberrant signalling pathways such as Advanced Glycation End Products (AGEs) and oxidative damage, which accelerate macro- and microvascular damage. Thehyperglycaemia linked to COVID-19 may be made worse by aberrant signalling pathways such as Advanced Glycation End Products (AGEs) and oxidative damage, which accelerate macro- and microvascular damage.[10] Furthermore, endothelial cells in both small and large vessels alter in response to metabolic anomalies based on the production of superoxide in mitochondria. Eventually, increased superoxide generation results in the long-term development of pro-inflammatory pathways, even when blood glucose regulation occurs.[11] The effects of chronic hyperglycaemia are worsened by active immunological responses, which can exacerbate hyperglycaemia and increase systemic insulin resistance during acute viral infections.[12] Elevated BGL are strongly associated with the development of severe COVID-19.[13]It is still uncertain how diabetes and COVID-19 are related, and cause death anddifferent organ failure although abnormal immune responses may postpone the disease's onset by hastening the thrombotic and ischemic effects.[8] Furthermore, a study revealed a direct metabolic connection between SARS-COVID and diabetes, indicating that the virus infects pancreatic islets that express ACE-2, resulting in the rapid development of T2DM and abrupt cell death.[14]



Characteristics of COVID-19 patients with Diabetic

Patients who have verified COVID-19 had an overall increased mortality rate and a worse prognosis compared to those with a clinical diagnosis. Compared to individuals with a clinical diagnosis patients of COVID-19, those without diabetes and confirmed COVID-19 had more malignant first laboratory indices. Still, there was no discernible variation in the preliminary laboratory results between diabetic patients with verified COVID-19 and those with a clinical diagnosis of COVID-19. The percentages of verified COVID-19 cases in our research sample were comparable for those with and without diabetes. Thus, we conclude that the general state of the COVID-19 patients with comorbid diabetes was worse than that of the non-diabetic individuals, and that it was comparable to that of the clinically diagnosed and confirmed cases.

Diabetes patients are known to be extremely prone to infection. Indeed, among patients infected with other coronaviruses like SARS-CoV, hyperglycaemia is a significant risk factor for morbidity and fatality and the coronavirus is linked to Middle East respiratory

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syndrome.Our data demonstrated that death of COVID-19 without diabetes is less compared to with diabetes patients. High blood pressure is main co-existing of COVID-19, was very common in patients who have the virus with diabetes than whohave not.Diabetes-related COVID-19 individuals had more severe inflammatory reactions, acute renal damage, and secondary infection than those without the condition, according to an examination of laboratory markers.[15]

Risk Factors for Diabetes and COVID-19 patients

Our findings indicate that elderly diabetic individuals have a higher risk of dying.Moreover, hypertension was very common co-existing among patients with diabetes and COVID-19.Compared to without diabetes and with diabetes patients who also have COVID-19 had higher death rates.[15]It has been demonstrated that type 2 diabetes, hypertension, and CVS related diseases are the most common co-existing for SARS infection. A severe COVID-19individualshad worse results associated with several disorders.[16]Recent research from China and the US indicates that almost one-third of patients who died with COVID-19 had diabetes mellitus.[16,17] In particular, compared to patients without and with diabetes were more likely to require invasive mechanical breathing, be admitted in ICU and experience acute renal injury.[17] The substantial severity of COVID-19 in diabetes may be assigned to a number of factors, including a compromised immune system, a dysregulated innate immune response, and abnormalities in cell-mediated immunity.[18]Additionally, elevated levels of oxidative stress, platelet aggregation, and endothelial dysfunction are linked to T2D. Acute hyperglycaemia during an infection may also lead to a significant rise inmediators of inflammation, which may raise the risk of acute cardiovascular events and multiple organ failure.[19]

Research has indicated that a substantial risk factor for this illness may also be a family history of T2D.Type 2 diabetes have more the risk of early endothelial dysfunction in healthy individuals. Elevated levels of insulin and glucose detected in this group may encourage the production of ACE2 in different organs, such as microvascular endothelial cells, which is a receptor for the SARS-CoV-2 virus.[20]

In T1DM patients who also have COVID-19widespread varies from 0.15% to 28.98%. It has been noted that hyperglycaemia poses a risk for problems connected to COVID-19.In surveillance study to assess the clinical outcomes of COVID-19 in T1D patients,initial findings show that 48.5% of patients adopthyperglycaemia, fever, dry cough, excessive drain and vomiting,dyspnoea, nausea, and all type of aches.Furthermore, less than 15% of patients reported experiencing loose stools, chills, abdomen and chest pain, and loss of olfactory nerves.[4]

COVID-19 and glucose metabolism

Elevated glucose levels in human monocytes directly boost SARS-CoV-2 replication, and glycolysis and producing reactive oxygen species in the mitochondria. Consequently, hyperglycaemia may encourage the spread of viruses. Hyperglycaemia or T1DM and T2DM were found to be independent predictors of morbidity and death in SARS patients, supporting this idea.Furthermore, concurrent T2DM led to a dysregulated immune response in MERS-CoV-infected mice, causing significant and pervasive lung injury.People with diabetes mellitus typically have higher SARS-CoV-2 infection severity categories than people without the disease, and poor glycaemic management, hospitalization,medication requirements, more death.

Notably, glycaemic worsening is a common COVID-19 consequence in individuals with diabetes mellitus or poor glucose management. For example, in individuals with insulin dependence, though ketoacidosis is usually a concern closely linked to T1DM, T2DM individuals with COVID-19 can also have ketoacidosis.[21]

Increased COVID-19 severity

2 COVID patients hospitalized to intensive care units in the United States revealed a predominance of DM. These results demonstrate a link between DM and severe COVID-19.People with DM are thought to have an enhanced clinical severity of COVID-19 due to several causes.Drugs that are commonly used to treat COVID-19 patients therapeutically, like systemic corticosteroids or antiviral drugs, may make hyperglycaemia worse.

In a multicentre retrospective investigation from China, HFGLat admission were revealed to be an impartial forecaster of increased death in COVID-19 individualswithout T2D.For this reason, it is wise to treat worsening hyperglycaemia and keep an eye on glucose levels in individuals whose COVID-19 is progressing to severe stages.

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Glucocorticoid treatment likely inhibits the generation of cytokines and shields individuals with severe COVID-19 from their harmful consequences. To validate this finding, further extensive research is needed, especially with individuals with diabetes mellitus.[21]

Special considerations on use of diabetes drugs

While achieving optimal glucose management is crucial in lowering the danger ofCOVID-19, particular attention should be paid to treatment options (panel). Patients experiencing severe COVID-19 symptoms should cease taking SGLT-2 inhibitors drugs to reduce the risk of rapid metabolic decompensation.It should be noted that diabetic outpatients without evidence of a substantial COVID-19 course or without infection-related symptoms are not recommended to stop taking these drugs as a precautionary step. Furthermore, there is currently not enough data to justify stopping DPP-4 inhibitors. Additional examinations of impacted individuals receiving different diabetic therapies and COVID-19 may clarify the impact of DPP-4 inhibitors. Crucially, insulin is the preferred alternative therapy in situations where stopping medication is practical.

Because of the several stressors linked to COVID-19, including respiratory failure, abnormalities in insulin secretion, and the high incidence of sepsis and diarrhoea, the majority of patients will require insulin.This is particularly relevant given the several instances of extraordinarily high insulin usage that have been documented; these cases will require intravenous infusion for management.Fluid balance must be carefully maintained since excessive fluid intake may worsen pulmonary oedema in the severely injured lung.Furthermore, because hypokalaemia is a common symptom of COVID-19 and may worsen after starting insulin, potassium balance needs to be carefully taken into account when administering insulin.[7]

Effects of hyperglycaemia on complications of COVID-19

Because hyperglycaemia increases the chance of infection, especially pneumonia, it is a recognized and proven risk factor for death. Nearly 1.65 million people worldwide have died from pneumonia, a defining feature of COVID-19. According to a retrospective observational study that included adult patients with COVID-19 and uncontrolled hyperglycaemia (BG>180 mg/Dl in 24 hours), the mortality rate among adults without diabetes or hyperglycaemia was 28.8%.Furthermore, patients with uncontrolled hyperglycaemia died at a rate of 41.7%, compared to 14.8% for diabetes individuals.Additionally, compared to without hyperglycaemia, the median length of stay for those with these conditions was longer.A recent COVID-19 outcomes in patients with hyperglycaemia found that 23% need ventilation, 17% of patients died, and 11% were admitted to the ICU.[22]

Drug therapy of DM among COVID-19 patients

Insulin, oral, injectable anti-diabetics and its relationship to COVID-19 management(Table 1)

Anti-diabetic drug	Potential benefit
Metformin	Reported that if applied to individuals having COVID-19 infection with T2D, it is a powerful medication that lowers mortality.
Pioglitazone	Potential decline in indicators of inflammation.
Sulfonylureas	Possible lessening of the severity of the condition.
DPP-4 inhibitors	DPP-4 may interact with SARS-CoV-2's receptor binding domain. Moreover, it might have immunomodulatory, anti-fibrotic, and anti-inflammatory properties. Its application as a repurposed COVID-19 agent has been suggested by several researchers.

Table 1. Antidiabetics and COVID-19

Metformin: Metformin is taken by most T2DM patients using oral hypoglycaemics, either on its own or in combination with other medications. It is the first drug prescribedto treat T2Duse this drug is related to lactic acidosis.Patients with sepsis, serious infections, or renal impairment may suffer lactic acidosis, albeit it is rare without other risk factors.

Pioglitazone: It is possible that pioglitazone could make COVID-19 worse because it increases the rat tissues ACE2 because of this receptor for SARS-CoV-2 enters cells.

Sulfonylureas: Because sulfonylureas might cause hypoglycaemia, it is safer to limit their benefit in people with COVID-19who do not take enough oral medicine. Furthermore, using

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hydroxychloroquine concurrently may make hypoglycaemia more likely.

Dipeptidyl peptidase 4 (DPP-4) inhibitors: In COVID-19 patients, DPP-4 inhibitors are tolerated well and can be taken continuously without risk. They are linked to a minimal chance of hypoglycaemia. Since several coronaviruses may bind to DPP-4 as a receptor, DPP-4 inhibitors may prevent this binding and lessen the risk of COVID-19 infection.

Patients with COVID-19 Who Require Insulin Therapy

Hospitalized patients are encouraged to give insulin therapy, including those with mild to severe COVID-19 disease.A basal plus bolus correction program with a target blood sugar range of 140–180 mg/dl is advised for non-critical inpatients.Serious sickness COVID-19 in the ICU, 19 diabetes patients are treated with an IV insulin infusion.It was discovered that intense insulin therapy reduced the levels of inflammatory markers in critically ill patients and had an anti-inflammatory effect when compared to normal insulin therapy.More research and analysis are required to determine whether or not COVID 19 patients benefit from insulin's anti-inflammatory effectsA GLP-1 agonist and insulin base can be administered as a single injection to patients with COVID-19 diabetes who are not in critical condition. Giving COVID-19 patients a single daily injection minimizes their exposure, which is the basis behind this treatment approach. Additionally, there may be an anti-inflammatory effect as well as a glucose-lowering effect from both insulin and GLP-1 agonists.[23]

Both non-critical care and critical care units can use these strategies to minimize nursing time while meeting targeted glycaemic objectives for COVID-19 patients. Hospital protocols differ in terms of what patients can be treated in these departments and whether or not IV insulin infusions are permitted in non-critical care units. Achieving desired glycaemic goals will require both planned insulin treatment and routine glucose measurement for hospitalized COVID-19 patients with type 1 or insulin-treated type 2 diabetes, as well as many patients who were on non-insulin agents prior to admission and had persistent blood glucose levels greater than 180 mg/dl (10 mmol/L).For patients who are dining, glucose is checked before meals and before bed; for those who are not eating or who have received enteral or parenteral feeding, it is done every 4 to 6 hours.

Few studies have examined the role that food intake plays in glycaemic management for individuals who are eating regular meals. In hospitals that provide on-demand food delivery, it might be challenging to adhere to guidelines for timing prandial insulin injection with meals.In one experiment, there were no additional differences in glycaemic measures, but patients who followed a continuous carbohydrate meal plan had more episodes of moderate hypoglycaemia than those who followed a food plan that is patient-controlled. Patients' diets were monitored by nutrition services.It is advised to give patients low-carb snacks in between meals to prevent hyperglycaemia.

IV insulin injections were advised for glycaemic management in the majority of patients with severe illness before to the COVID-19 pandemic. Aware that rigorous nursing care is required to check blood glucose every one to two hours and change insulin infusion rates often, certain organizations have effectively used protocols for planned SC insulin administration that were modified from earlier research. Some have adjusted alternative insulin strategies from studies to meet the higher insulin requirements in COVID-19 patients. Since SC insulin cannot achieve glycaemic control, IV insulin infusion techniques must be used, either alone or in conjunction with basal insulin.

As insulin sensitivity fluctuates during the course of the illness, patients with severe COVID-19 infections may require different amounts of insulin. Regardless of glucocorticoid medication, caregivers for these patients have reported considerable variation in dosages, ranging. Insulin requirements may be significantly impacted by the use of glucocorticoids or vasopressors when dosages are changed over time.This necessitates constant modifications to insulin therapy in addition to paying special attention to sudden changes in glycaemic measurements.[24]

Noninsulin therapies in patients with diabetes and COVID-19

Individuals who have diabetes should cease taking non-insulin medications and begin insulin therapy as soon as they are admitted to the hospital.[25,26,27] More current research has examined the effectiveness and safety of these earlier suggestions as well as the use of non-insulin medicines in hospitals.[28.29]Several small studies have demonstrated the effectiveness and safety of sitagliptin and linagliptin, dipeptidyl peptidase 4 inhibitors (DPP4i), in some T2D hospitalized

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people.Based on this earlier research, several hospitals prescribe these drugs to hospitalized patients with T2D and milder forms of hyperglycaemia (BG < 180 mg/dl [10 mmol/L]) throughout the healing process of infected individuals without contraindications.

When using DPP4i as an inpatient, there are a number of crucial factors to take into account.It was found that the DPP4 enzyme does not co-receptor for SARS-CoV or CoV-2, but it does for MERS-CoV.[30,31] There is currently no information indicating the helpful or detrimental effects of these medications in COVID-19 patients.[30,32]Due to the potential for alogliptin and sitagliptin to increase the risk of heart failure (HF), their use is not recommended.[33,34] DPP4i are typically not advised because to the fragile nature of acutely unwell COVID-19 hospitalized patients.

Serious issues arise when different non-insulin medicines are used in hospital settings.When used by older patients, those with diminishing renal function, or those on insulin therapy, sulfonylureas and other insulin secretagogues should be taken with caution, if at all, and should be stopped due to the risk of hypoglycaemia.[35] Patients who have acidosis or who are at risk for it, such as those who have bleeding disorders, hypoxia, or serious damage to the kidneys, should not take metformin.[36]When there is no clinical evidence to support the use of metformin in critically sick patients, the current guidelines for terminating treatment in hospitalized COVID-19 patients should be followed.[29,30] Thiazolidinediones should not be provided to individuals on insulin because of its delayed onset of action, fluid retention, and elevated risk of heart failure.It is generally not recommended to begin glucagon-like peptide receptor agonist (GLP1RA) medication used for acute treatment because of some adverse effect.[37]

Now that a number of GLP1RA formulations are offered as once-weekly options, many hospitalized patients will receive this when they are admitted. Like DPP4i, continuous administration of these medications is generally not advised for COVID-19 patients who are critically unwell because of the risk of a rapid decline in clinical status.

Because SGLT2 inhibitors improve kidney and cardiovascular results in both diabetes and non-diabetics, their use in outpatient settings has increased.[38] This implies that many patients will be receiving these medications when they check into hospitals.There is currently no evidence to support the use of medications in this class in any inpatient setting due to their association with the risk of euglycemic diabetic ketoacidosis (euDKA) and volume depletion.[39,40] It is advised to think about quitting these medications in outpatient care who get COVID-19 since glucosuria can persist for a few days after stopping them, which raises the risk of euDKA.[41]

In conclusion, insulin therapy continues to be the recommended course of action for treating hyperglycaemia in COVID-19 inpatients. Following regular meals and anticipated release home, individuals with T2D may be suitable for a selective use of the DPP4i, sitagliptin and linagliptin.Individuals using sitagliptin need to have their renal function monitored and their doses changed if they have renal insufficiency.[42]

Special issues in Patients with COVID-19 Infection and Diabetes

Numerous pharmacological remedies are used to investigative methodologies in an effort to determine the most effective drug therapy for infected people.[24]Among these, systematic glucocorticoid medication and hydroxychloroquine have distinct but noteworthy impacts on glycaemic control in both diabetics and those who are not.

Glucocorticoid Therapy

Glucocorticoids can worsen hyperglycaemia in people with diabetes or induce it in people who were previously normoglycemic when given to specific individuals on mechanical ventilation who have SARS and COVID-19.Administering infected individualswith hydrocortisone at a dose of 50 mg IV every 6 hours is one suggested investigational approach. This dosage is associated with hyperglycaemia in both normal and high BGL people.Managing patients with hyperglycaemia that is produced or exacerbated by glucocorticoids presents unique issues that vary based on the drug, dosage, and frequency of treatment.[43]

Some strategies for lowering BGL glucocorticoid therapy include to increasing pre-existing NPH insulin either alone or with other insulins.[44,45] NPH insulin is a desirable substitute for treating hyperglycaemia in people on prednisone and methylprednisolone since its pharmacokinetics match those of these medications.NPH have shown benefits for patients on longer-acting glucocorticoids like dexamethasone.[46]For those with severe glucocorticoid-induced hyperglycaemia, a concomitant continuous IV insulin infusion may be required if glycaemic control with SC insulin is not

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achieved.[47]In order to eliminate insulin demand changes during glucocorticoid medication, certain hospitals offer hydrocortisone as a continuous infusion for 24 hours to patients undergoing IV insulin therapy.This is done for patients in critical care settings.[48]

Hydroxy chloroquine

One medication being studied for COVID-19 that is related to glycaemic control is hydroxychloroquine. In one short research, hydroxychloroquine medication enhanced insulin sensitivity and beta cell activity in obese adults who were insulin resistant but did not have diabetes.[49] Significant decreases in HbA1c, fasting, and postprandial plasma glucose levels were noted in a comprehensive evaluation of 18 studies involving 55,776 patients. For certain patients on hydroxychloroquine, a 30% reduction in insulin dosage may be necessary to prevent hypoglycaemia.[50,51]

Other medications

Additional medications administered to diabetic patients with infection in both hospital and outpatient settings may have an effect on blood glucose levels. Using antitussive syrups that contain sugar, which can cause hyperglycaemia, is one example.[24]

Diabetes Inpatient Services

The large number of COVID-19 patients who stay in hospitals and also have diabetes or hyperglycaemia may quickly overwhelm any hospitalized diabetes care with demands for glycaemic control consultations. In general, a specialized assessment is not necessary for non-critically sick patients with sustained BG < 180 mg/dl. Patients with persistent BG > 180 mg/dl may start both IV and SC insulin treatment, according published or clinic guidelines.

Many COVID-19 patients might still need the involvement of glucose management teams in their care.In order to reduce the number of professionals who have direct interactions with any one patient, this can occasionally be done as part of an e-consult or virtual consult.[52,53]

Virtual Glucose Monitoring Services (vGMS) have been adopted in certain institutes. These services gather data on diet, insulin, glucose, and medications and save it in the electronic medical record (EMR) so that a diabetes care team can evaluate it remotely.The team then remotely recommends changes to the primary team's therapy.[52,53]For COVID-19 patients with glycaemic control problems, a vGMS could serve as an active patient dashboard that enables remote monitoring and provides action recommendations when necessary.[54]

Discharging Patients with Diabetes and COVID-19 from the Hospital to Home

While not all hospitalized diabetics with COVID-19 will be able to manage their disease at home, many will. It is possible for patients who were previously at ease with self-care to be released from the hospital on a different schedule than they had before. A crucial component of comprehensive diabetes care is diabetes awareness and instruction, which should continue to be included in discharge planning during the COVID-19 pandemic.[55] Using telemedicine and a HIPPA-compliant system, patient education can be delivered through tablets, PCs, or cell phones while leveraging technology.[56,57]Patients at risk for uncontrolled diabetes can be identified via Bluetoothpen devices, which also provide remote monitoring of insulin administration and schedule adherence.[58] Self-management instruction should start long in advance of the discharge date. Individuals who are new to administering insulin ought to be given the chance to get comfortable with the pens, vials, and syringes can utilize at home.Patients should have emergency consultant to call, track POC blood glucose levels, adjust their treatment plan in reaction to low or high blood glucose, and know when and how to take their diabetic medications.The symptoms and protocols for hypoglycaemic episodes should be understood by all patients who are discharged on insulin or an insulin secretagogue. A prescription for nasal or injectable glucagon assures patients on basal bolus insulin therapy that they will have the necessary resources in case of a severe hypoglycaemia episode.[24]

II. CONCLUSION

Diabetes mellitus significantly increases the risk of complications, extended hospital stays, and death in patients with COVID-19. Therefore, insulin is preferred over oral hypoglycaemic medications for the management of diabetic patients with COVID-19 who are hospitalized.

Diabetes in COVID-19 patients has been linked to more severe cases, more admissions to the intensive care unit, and a higher death rate. Patients' prognoses can be improved by early therapeutic therapy, which includes hospitalization, respiratory

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support, and immunosuppressive medication treatment.

Guidelines given by thedoctorsshould strictly followed by the COVID-19 virus infected individuals because it might cause blood glucose levels to rise, patients with diabetes mellitus. If a patient's blood glucose levels are frequently more, they should meet doctor.For individuals with diabetes mellitus, maintaining a healthy diet and engaging in physical activity is especially crucial.

It is advised that patients who confront symptoms like dry cough, increased production of sputum, fever, or surge in blood sugar levels to consult their physician immediately.Most importantly, both healthcare providers and their patients should strictly follow general precautions including social distancing, mask wearing, hand washing, and disinfectant use for decreasing the DM risk.

Telehealth or virtual consultations may help to lower the danger, even while direct physical interaction between patients and medical professionals may still carry some risk. These could be further measures to reduce the danger of SARS-CoV-2 transmission while also offering the public ongoing, secure medical care.

Coronavirus infections have been shown to have a major effect on the treatment of diabetes mellitus by escalating inflammation and altering immune system reactions, which makes glycaemic control difficult.

T2DM was not linked to any improvement in COVID-19 patients. T2D patients were more likely to have severe and critical COVID-19 sickness and having a lower lymphocyte count are two important risk factors that influence the healing process of people with T2DM and COVID-19.

The most common COVID-19 presentations among patients with type 1 diabetes were fever, dry cough, nausea, vomiting, elevated blood sugar, and diabetic ketoacidosis. A variety of COVID-19-related outcomes, including as length of hospital stay, hospitalization, ICU admission, DKA rate, and severe hypoglycaemia, were found in the included trials.

Uncontrolled hyperglycaemia and diabetes were common among COVID-19 patients in hospitals. Compared to individuals without diabetes or uncontrolled hyperglycaemia, the mortality rate was greater for these COVID-19 patients who had both conditions.The mortality rate for patients with uncontrolled hyperglycaemia was very high.Healthcare practitioners must ensure that inpatient hyperglycaemia is managed safely and effectively.

Diabetes mellitus dramatically raises the risk of complications, longer hospital admissions, and increased death rates in patients infected with COVID-19. Insulin should be the primary strategy used to control acute glycemia at this time. Therefore, it is advised to treat diabetic individuals who are hospitalized for COVID-19 infections with insulin and other oral hypoglycaemic medicines.

Dipeptidyl peptidase 4 (DPP4) inhibitors are safe to take continuously in COVID-19 patients and are well tolerated.It is not recommended to utilize SGLT2inhibitors in COVID-19 patients due to their potentially harmful pharmacological characteristics.

Glucocorticoids can worsen hyperglycaemia in people with diabetes or induce it in people who were previously normoglycemic when given to specific individuals on mechanical ventilation who have SARS and COVID infection.

When comparing hydroxychloroquine group to the usual care group, the incidence of death did not reduce. Metformin may help reduce adverse composite outcomes, including as intubation, ventilation, intensive care unit hospitalization, illness progression, and other unfavorable composite outcomes.In individuals with diabetes, particularly those with COVID-19, long-term treatment of oral anti-diabetics would not raise the risk of death or adverse composite outcomes.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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