IJBPAS, August, Special Issue, 2021, 10(8): 319-336

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

MANAGEMENT OF BLOOD GLUCOSE LEVEL DURING COVID – 19 TREATMENT AMONG DIABETIC PATIENTS - A REVIEW

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Received 19th March 2021; Revised 20th April. 2021; Accepted 19th May 2021; Available online 1st Aug. 2021

https://doi.org/10.31032/IJBPAS/2021/10.8.1023

ABSTRACT

Coronavirus disease 2019 (COVID-19) is due to extreme acute breathing syndrome coronavirus 2, and it has emerged as a rapidly spreading communicable disorder affecting individuals worldwide. The populace is usually liable to this coronavirus, in particular those with diabetes who are extra prone to the disorder. Several posted studies have pronounced that 12% to 22% of COVID-19 patients have comorbid diabetes. Since the preliminary COVID-19 outbreak in China, and the attention has targeted people with diabetes due to bad analysis in those with the infection. Initial reviews have been in particular on human beings with type 2 diabetes, despite the fact that recent surveys have proven that people with type 1 diabetes also are susceptible to excessive COVID-19. The reason for worse prognosis in humans with diabetes is probable to be

multifactorial, therefore reflecting the syndromic nature of diabetes. Age, intercourse, ethnicity, comorbidities which include hypertension and cardiovascular disease, weight problems, and a pro-inflammatory all probably contribute to the danger of worse outcomes. Glucose-lowering agents and anti-viral remedies can modulate the danger, however, boundaries to their use and interactions with COVID-19 treatments need to be cautiously assessed. Finally, excessive acute respiratory syndrome coronavirus 2 infection itself would possibly represent a worsening component for human beings with diabetes, as it is able to precipitate acute metabolic headaches through direct negative outcomes on β-mobile features. These outcomes on β-cell characteristic may additionally result in diabetic ketoacidosis in people with diabetes, hyperglycaemia at health centre admission in people with unknown history of diabetes, and doubtlessly new-onset diabetes.

Based on the high mortality and the high risk of COVID -19 patients with diabetes, the management of glucose is very important within the complete treatment of COVID-19. Individualized blood glucose level and remedy strategies should be maintained with COVID-19 patients suffering from diabetes. For slight sufferers, a strict glycemic target of 4-6.1 mmol/L, 2-hour postprandial plasma glucose is recommended. A target for the glycemic control of not unusual type sufferers (6.1-7.8 mmol/L, 2 h PG) and subcutaneous insulin remedy are encouraged. A target for non-fasting blood glucose ranges from 10.0 mmol or less in line with litre for extreme-type COVID-19 sufferers. For relatives and critically ill patients, intravenous insulin infusion remedy are encouraged. Due to the rapid modifications within the situation of some sufferers, the hazard of diabetic ketoacidosis (DKA) or hyperglycemic hyperosmolar fame (HHS) may arise all through the treatment. Blood glucose monitoring, dynamic evaluation, and well-time adjusted techniques must be strengthened to make sure patient safety and promote early recuperation of patients. The main aim of this study is to assess the importance of glucose level management in the treatment of COVID-19.

Keywords: COVID-19; remedy strategies; Blood glucose monitoring; Prognostic markers; Glycemic control

INTRODUCTION

Coronavirus Infectious disease (COVID-19) is because of SARS-CoV2 and represents the causative agent of a potentially deadly ailment that is of tremendous worldwide public difficulty **[1]**. Based on the variety of infected people in the moist animal

marketplace in Wuhan City, China, it has been found that it is probably the zoonotic beginning of COVID-19. Person-to-person transmission of COVID-19 contamination caused the isolation of sufferers that had been finally administered a ramification of treatments **[2]**. Extensive measures to reduce human-to-human transmission of COVID-19 had been implemented to control the present-day outbreak **[1]**. Health care workers should use personal protective equipment. These are the equipment that blocks the portal entry of microorganisms. PPE is used to create a protective barrier between workers and hazards in the workplace **[3]**. Special attention and efforts to protect or lessen transmission have to be implemented in inclined populations inclusive of kids, fitness care vendors, and elderly humans **[4]**.

The symptoms of COVID-19 contamination appear after an incubation length of about 5.2 days. The period from the onset of COVID-19 signs and symptoms to dying ranged from 6 to 41 days with a median of 14 days **[5]**. This length is depending on the age of the affected person and the affected person's immune system. The most common onset of symptoms includes fever, cough, and fatigue, and other symptoms encompass sputum manufacturing, headache, hemoptysis, diarrhoea, dyspnoea, and lymphopenia **[6]**. Recommended measures to save you from infection consist of common handwashing, retaining bodily distance from others (specifically from those with symptoms), quarantine (in particular for people with signs), protecting coughs, and maintaining unwashed fingers far from the face **[7]**. Touching mucus from the nose and then rubbing the eye is one way of moving staphylococcal bacteria to the eyelid **[8]**.

Diabetes is an ailment that influences the body's capability to provide or use insulin. Insulin is a hormone **[9]**. When the body turns the food we eat into strength (also referred to as sugar or glucose), insulin is released to help transport this electricity to the cells. Insulin acts as a “key.” It is a chemical message that tells our body to obtain glucose **[10]**. If little or no insulin is produced or are insulin resistant, an excessive amount of sugar stays in the blood. Blood glucose tiers are higher than regular for individuals with diabetes. There are principal types of diabetes: Type 1 and Type 2 **[11]**.

Diabetes is a continual, metabolic ailment characterized through elevated degrees of blood glucose (or blood sugar), which leads over the years to severe damage to the heart, blood vessels, eyes, kidneys, and nerves **[10]**. The risk of heart attack and respiratory

diseases increases with age **[12]**. Diabetes Mellitus is a major health issue in India **[13]**. For human beings dwelling with diabetes, there is a need for an inexpensive remedy, such as insulin, and is important to their survival. Nocturia is common in people with heart failure and poorly controlled Diabetes Mellitus, or Diabetes Insipidus **[14]**. There is a globally agreed goal to halt the upward thrust in diabetes and obesity with the aid of 2025 **[15]**. With increasing age, people tend to have more systemic diseases and health problems **[16]**. About 422 million human beings worldwide have diabetes, specifically in low-and middle-income countries, and 1.6 million deaths are directly attributed to diabetes every year **[17]**. Diabetes Mellitus is more common in men than women but dental anomalies are more common in women **[18]**. The number of cases in diabetes has been increased over the past few years **[9]**. A buccal smear is used for diagnosing Malignancy and other infections **[19]**. Breast cancer is the most common and frequent malignancy affecting one million women worldwide **[20]**. Hysterectomy is also very common among women which involve surgical removal of the uterus **[21]**. Immunity levels should be high to protect the body from these infections.

RELATION BETWEEN GLUCOSE LEVEL AND COVID -19:

According to the evidence, human beings with diabetes do not have a better susceptibility to SARS-CoV-2 infection **[22]**. However, observations within the recent COVID-19 pandemic are similar to those from other epidemics, with headaches and mortality among patients with diabetes **[23]**. Hypertension, diabetes, coronary artery disorder, and cerebrovascular ailment have been the primary associations with the extreme disorder and mortality rates. Immunocompromised patients, obesity, and tobacco smoking are different hazard elements for severe ailment and demise **[24]**. It has been said that among 314 sufferers with COVID-19 in China, indicated that sufferers with diabetes had a higher mortality rate compared with the COVID-19 standard sufferers **[25]**. In Italy, where the general case fatality charge is better among a collection of 355 COVID-19 fatalities, 35% had diabetes and 30% had ischaemic heart disorder **[26]**. Older age, the presence of two or greater comorbidities and obesity additionally are expecting bad analysis among COVID-19 sufferers **[6]**. These are commonplace associations of diabetes and may make contributions, at the least in component, to the determined multiplied

chance **[27]**. Nevertheless, in a nationwide observation of 1590 COVID-19 patients in China, after adjusting for age, smoking, and comorbidities, diabetes became an unbiased hazard aspect for the final results of expanded ICU admission, for ventilation and death **[22]**. For instance, there is no information to be had on disease severity amongst younger sufferers with type 1 diabetes, although professionals inside the area have determined it to be similar to the ones without **[27]**.

Older age and male sex are epidemiological functions related to a better prevalence of COVID-19 and a greater excessive medical route. In the early segment of the outbreak, the highest incidence of COVID-19 came about in older human beings in most of the areas. The occurrence of diabetes increases with age in both the overall population and in sufferers with COVID-19. Accordingly, the common age of sufferers with COVID-19 with diabetes is older than the ones without diabetes. In summary, available records endorse that age is related to worse consequences in COVID-19, and it may be hypothesised that this courting is stronger in people with diabetes for at least three reasons. First, the prevalence of diabetes increases with age to reach a peak in people older than sixty-five years. Second, people older than sixty-five years are more likely to have a longer period of diabetes and an extra incidence of diabetic complications. Third, diabetes and older age regularly correlate with comorbidities together with cardiovascular disorder, hypertension, and obesity.

The present-day pandemic of SARS-CoV-2 coronavirus disorder 2019 (COVID-19) is a particular task for diabetes sufferers. Diabetes mellitus predisposes to an especially extreme course of the ailment and doubles the COVID-19 mortality threat due to pulmonary and cardiac involvement. In addition, diabetes patients often are afflicted by comorbidities which in addition worsen medical results. Glycemic manipulate during infectious illnesses is often suboptimal, and antidiabetic pills and insulin remedy ought to be adapted accordingly. Hence, the possibility of the COVID 19 needs to be taken to make a sizeable step forward in the care of diabetes sufferers.

DIABETES - TYPES AND NORMAL VALUES

There are generally three main types of diabetes. Type 1, Type 2 and Gestational diabetes **[28]**. Type 1 which is also known as juvenile diabetes, occurs when the body fails to produce insulin and these sufferers are insulin-dependent which means they must

take artificial insulin daily to survive **[9]**. Type 2 diabetes affects the way the body uses insulin. This is the most common type of diabetes and it has a strong link with obesity **[29]**. Gestational diabetes occurs in women during pregnancy when the body becomes less sensitive to insulin **[30]**. For the majority of healthy individuals, normal blood sugar, 4.0 to 5.6 mmol/L [72 to 99 mg/dl] when fasting and 7.8 mmol/ L [140 mg/dl], 2 hours after eating **[11]**. For people with diabetes, blood glucose targets are as follows - before meals, it is 4 to 7 mmol/L for people with type 1 or type 2 diabetes, and after meals, it is 9mmol/L for people with type 1 diabetes and under 8.5 mmol/L for people with type 2 diabetes **[10]**.

IMPORTANCE OF BLOOD GLUCOSE MANAGEMENT

Researchers have discovered that hyperglycemia in sufferers with novel coronavirus disease 2019 (COVID-19) is related to noticeably worse consequences, indicating a want for an early normalization of glucose tiers **[31]**. Rapid inflammatory response and improved glycosylation of angiotensin changing enzyme receptors may boost COVID - 19 disease severity and give better prosperity for the intrusion of extreme acute breathing syndrome, coronavirus the ACE2 receptor **[29]**. These elements also explain why hyperglycemia influences COVID - 19 diagnosis **[22]**. It is already known that hyperglycemia in humans within the in-depth care unit (ICU) worsens the prognosis **[28]**. In the case of COVID-19, there are at least 2 reasons why hyperglycemia can be dangerous: it produces a big cytokine release and favours the nonenzymatic glycosylation of the ACE2 receptor **[27]**. The glycosylation of ACE2, a response that can be prompted by hyperglycemia, is needed for the linkage of the virus to this cell receptor. This mechanism, at the very early stage, is reversible. Otherwise, it is irreversible **[32]**. So it is important to manage blood glucose levels.

PROGNOSTIC MARKERS

Among 174 COVID-19 patients in Wuhan, China, humans with diabetes had a more inflammatory response (higher CRP, ESR and IL-6, and relative neutrophilia and lymphopenia), the better incidence of coagulopathy, metabolic derangements (hyperglycemia, transaminitis), excessive pneumonia and higher mortality charge, in comparison with the ones without **[22]**. However, people with diabetes in this study are older and had a better occurrence of cardiovascular disorder. It is noteworthy that diabetes itself is proinflammatory and

prothrombotic **[33]**. The data suggest that COVID-19, at the least in its extreme condition, is a state of extreme inflammation and thrombotic tendency, so people with diabetes can be predisposed to such severe immune dysfunction ensuing in the extreme past due to sickness **[34]**. An elevated level of N-terminal pro-brain natriuretic peptide and cardiac troponin I is related to various extreme diseases and it also indicates that COVID-19 might also result in myocardial injury and impair cardiac failure. In people with diabetes and recurrent ischaemic coronary heart disorder, the limited cardiac reserve may also have morbidity and mortality chances **[35]**.

MANAGEMENT OF HYPERGLYCAEMIA AND ASSOCIATED METABOLIC CONDITION

Hypertension and dyslipidemia were the major metabolic syndromes in most of Type 2 diabetic groups. An appropriate antihypertensive and lipid-lowering regimen in all these patients is of crucial importance. The expression of ACE2, which could accelerate the entry of the virus into the cells were increased by the treatment of COVID patients with ACE Receptors and angiotensin receptor blockers. However, as SARS-CoV-2 might impair the protective ACE2/Mas receptor pathway and increase deleterious angiotensin-2 activity, the utilization of ACE inhibitors and angiotensin 2 receptor blockers could protect against severe lung injury following infection. On the idea of the currently available evidence, we recommend that patients should continue with their antihypertensive regimens including ACE inhibitors and angiotensin 2 receptors. Statins are shown to revive the reduction of ACE2 induced by high lipids like LDL or lipoprotein. The pleiotropic anti-inflammatory effects of statins are attributed to the upregulation of ACE2. However, although we believe that modulation of ACE2 expression is related to both infection and mortality rates in COVID-19, statins shouldn't be discontinued due to the long-term benefits and therefore the potential for tipping the balance towards a cytokine storm by rebound rises in interleukin (IL)-6 and IL-1ß if they were to be discontinued. The close links between diabetes and disorder, recommend control of lipid concentrations altogether to patients with COVID-19.

The majority of sufferers with type 2 diabetes are residing with situations of overweight or obesity. Body mass index is a vital determinant of lung quantity, respiratory mechanics, and oxygenation in the course of mechanical air flow, mainly within the

supine role. Therefore, sufferers with obesity and diabetes will be at precise threat of ventilatory failure and complications all through mechanical ventilation.. Furthermore, people with obesity or with diabetes have an altered innate and adaptive immune response, characterised via a country of continual and low-grade irritation with higher concentrations of the pro-inflammatory leptin and lower anti inflammatory adiponectin. Additionally, weight problems is regularly associated with bodily inactivity leading to aggravated insulin resistance. Furthermore, SARS-CoV-2 can set off lengthy-time period metabolic changes in sufferers who've been infected with the virus, as has been mentioned formerly with the SARS virus. Therefore, careful cardiometabolic tracking of sufferers who've survived intense COVID-19 disease might be necessary.

SPECIAL MANAGEMENT OF DIABETES WITH COVID -19

General Setting:

The majority of people with COVID - 19 will develop a mild disease that can be managed according to local guidelines **[36]**. For those managed at home, regular telephone contact with healthcare services and follow - up is crucial to recognize deterioration in glycaemic control **[37]**. Frequent glucose monitoring, a healthy diet, adequate hydration, dose titration of glucose-lowering medication with healthcare providers should be prioritized **[38]**.

Glycemic control:

Glycemic management is crucial in any patient who has COVID -19. Though there are restricted statistics about the affiliation of blood glucose ranges with disease course in COVID -19, data from other infections like SARS has proven that suffers from negative glycemic control have increased hazard of headache and dying **[39]**. Most hospitalized patients with COVID -19 in particularly people with respiratory misery, would require insulin. Ideally, patients with very poor oral intake or ones in mechanical ventilation require intravenous insulin infusion. There is a need to discover exchange insulin techniques. It includes subcutaneous quick-acting insulin analogues, a single dose of basal insulin, and insulin pump **[35]**. Fully computerized closed-loop glucose manipulation has been attempted in important infection and if possible, maybe beneficial in treating patients with COVID - 19 **[38]**.

Blood glucose monitoring:

Blood glucose tracking possesses a unique challenge because it necessitates a common visit to the patient's bedside, especially if the

patient is seriously ill and receiving IV insulin **[23]**. If an affected person is not severely unwell, they may be given a glucose testing device and monitoring can be taught. Blood glucose monitoring can be communicated and necessary steps can be taken **[5]**. Continuous glucose monitoring may be crucial. Relaxation strategies consisting of medication can assist humans with strain and tension **[17]**.

PATIENT WITH DIABETES ARE AT HIGH RISK FOR COVID - 19:

The COVID-19 pandemic is a way of being solely a scientific phenomenon **[1]**. It disrupts non-public and professional lives critically and influences human beings and societies on numerous tiers. The key strategies promoted for containment of a virus together with isolation, social distancing, and lockdown of towns may have a widespread impact on the health and lifestyle of an individual **[7]**. Management of a persistent disease which includes diabetes requires dietary modification, regular workout, and excellent adherence to medicinal drugs, and poses many complex challenges **[4]**. Maintaining healthful food may be tough because of restraints to suitable meals. Careful element selection and adjusting mealtime insulin in line with carbohydrate intake continues to be the strategy, particularly for sufferers on multiple-dose insulin **[40]**. Adopting a normal exercise plan won't be viably attributable to social distancing, restrictions on outside sports, and issues over the high chance of disorder spread in gyms and sports centres **[17]**. Activities including indoor walking, gardening, and excessive activities may be appropriate options to hold an energetic lifestyle **[39]**.

During this time of uncertainty, worry, helplessness, emotions may outgrow pressure in some sufferers **[41]**. It is vital to make certain mental well being, as stress might also adversely affect glycaemic manipulation **[15]**. Excessive stress results in neurological disorders. Dental pulp cells could be used to treat neurological disorders **[42]**. Regular sleep routines are crucial. Relaxation strategies consisting of meditation can assist humans with strain and tension **[9]**. Employers have to recollect work-at-home techniques, for employees with poorly managed diabetes or people with cardiac or renal complications, specifically for those in excessive danger occupations which include frontline healthcare work or comparable excessive risk jobs, and in particular in regions with high COVID-19 prevalence **[32]**.

TREATMENT OF DIABETES IN INSTANCE OF COVID -19 PANDEMIC

Treatment of diabetes poses a project in the present-day times. There are 'lockdowns' in maximum places with people confined to domestic **[4]**. Opportunities for exercising are restricted and normal walks and visits to gyms or swimming pools are not feasible. There is likewise widespread mental stress due to the unpredictability of the disease in addition to social immobility **[41]**. Alterations inside each day ordinary affect the nutritional intake. Access to fresh fruits and vegetables may be constrained and there can be a bent to devour packaged foods excessive in energy, saturated fats, and trans-fats **[27]**. Patients may additionally locate it difficult to get medicines, insulin, needles and glucose strips, and so forth. Due to partial or whole lockdowns **[40]**. The trouble becomes more stated with the aged who are residing alone. All those elements could be the reason for glucose dysregulation and could predispose the patients to complications like infections, hyperosmolar coma, ketoacidosis, or even acute cardiac occasions **[40]**.

Measures for appropriate fitness in patients with diabetes include maintaining a routine diet plan. Care has to be taken not to differ the calorie consumption markedly **[15]**. Exercise has to be done. Home-based totally exercising like cycling, treadmill, going for walks, and resistance exercising with small weights are beneficial **[38]**. Exercising is beneficial in many ways. Polycystic Ovarian Disease which is very common in women is mainly due to lack of exercise **[43]**. Regular intake of antidiabetic tablets and insulin is important and needs to be emphasized. Telemedicine may be very beneficial in those instances **[44]**. Patients can seek advice from their doctor through telemedicine and suitable advice approximately treatment can be given **[38]**. Patients should be educated about the want to go to the sanatorium urgently in emergencies like vomiting, drowsiness, shortness of breath, chest pain, weakness of limbs, altered sensorium, and so forth. Understanding the histology of a disease is important because it helps to understand the progression and regression of disease under treatment **[45]**. Further game-based learning can be used which would be fun, creative, and involves more attention **[46]**. For simple understanding, popplet notes can be used which simplifies the content and the app can be installed free of cost **[47]**. A safe and potent vaccine would be very useful for high-risk individuals, those with diabetes or cardiovascular disease **[44]**.

FUTURE SCOPE

COVID-19 has emerged as one of the great challenges for humankind after the Second World War **[4]**. Identification of powerful preventive and remedy strategies is essential. People with diabetes and related comorbidities had been worse, although the pathophysiological and molecular mechanisms behind this condition are not yet absolutely understood **[24]**. Palliative treatments are not intended to cure **[48]**. Researchers and governments worldwide must take important steps to answer important questions inside the prevention and management of COVID-19 and the protection of human beings with diabetes **[23]**.

Standardization of studies protocols and identification of research priorities is essential to utilize time and resources productively **[49]**. Further records are required, particularly searching at the effects of ACEI/ARBs and SGLT2 inhibitors in the ones infected, in addition to within the severely ill **[33]**. Healthcare systems need to adopt strategies for case detection and remedy even as maintaining care and delivery of crucial drug treatments for humans with continual illnesses including diabetes, to reduce morbidity and mortality risk because of such illnesses during this period **[23, 39]**. The strategic utilization of human sources in healthcare offerings and safeguarding their fitness is necessary. The modern-day project for healthcare systems ought to be an opportunity to enhance provider provision, research from regional and global techniques, and put together for destiny challenges of extra magnitude **[44]**. The pandemic additionally highlights the want for joined-up public health measures and care-for-all guidelines.

CONCLUSION

Diabetes is associated with increased incidence and severity of COVID -19. There is experimental evidence of the effect of diabetes on viral entry into cells and inflammatory response to infections. It is important to control blood glucose in patients who are affected by COVID -19. Treating diabetes at present with restriction in movement is challenging, innovations like telemedicine can be helpful at these times.

CONFLICT OF INTEREST

Authors declared that there is no conflict of interest.

ACKNOWLEDGMENT

We thank Saveetha Dental College to provide this opportunity to write this review about COVID -19.

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