http:// doi.org/10.3658/j.kunu.2021.03.0 4
Al-Kunooze University College
Journal homepage: http://journals.kunoozu.edu.iq/1/archive

Incidence of COVID-19 in patients with diabetes mellitus: A review

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Abstract

COVID-19 disease that caused by the SARS-CoV-2 virus, appeared in 2019, is considered one of the most deadly modern diseases for humanity that effects on different aspects of life, the present study aims to review studies and evidence on the severity of injury with Covid-19 in patients with diabetes mellitus and the increase in death rates among these patients, as many research confirmed the existence of a relationship between the two diseases and revealed some of the physiological and immunological mechanisms that may be responsible for this overlap between the two diseases and the most plausible explanation for this relationship is the role of glucose in facilitating the entry of the virus into the cells of the body and the rise of proinflammatory factors such as cytokines and weakness Immunity in diabetics, which makes them more likely to catch the virus, and worsens the severity of infection.

Keywords

SARS-CoV-2, Cytokines, ACE2, islet β-cell

1. Introduction

Various studies conducted in the China, United States, and Italy showed that the prevalence of COVID-19 disease is not very high among diabetics, but there are many evidence that show that diabetes is an important risk factor in the progression of HIV infection, but the mechanism that explains this overlap between the two diseases is not yet clear[1]. Diabetes is one of the risk factors that contribute to the high death rates among Corona patients because diabetes lowers blood sugar

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and weakens the immune response and also contributes to the emergence of other vascular diseases such as high blood pressure, cardiovascular disease and obesity. Therefore, the use of anti-diabetic drugs must be It is prescribed depending on the severity of the virus infection and blood sugar levels[2].

The factors that explain this link between diabetes and mortality rates or disease complications in Covid-19 patients are unclear, and perhaps high BMI and HbA1c play a role in this issue, as Covid-19 indirectly affects diabetic patients by increasing psychological pressure and affecting the daily routine of treatment for Diabetes mellitus patients is like exercise and diet[3]. The relationship between these two diseases is a two-way relationship, as the virus increases the severity of old diabetes and increases the tendency of people without diabetes to develop diabetes[4]. It was noted that the period that a diabetic patient with Covid-19 needs to recover is much longer than a person infected with this virus and who does not already suffer from diabetes, and the death rates due this virus are higher in diabetic mellitus patients compared to diabetic mellitus patients without covid-19[5].

2. The prevalence of covid-19 in diabetics patients :

The prevalence of Covid-19 infection among diabetic patients is 10% of diabetic patients with severe injury and death due to the Corona virus by two-folds compared to diabetic patients without covid-19[6]. The incidence rates of diabetic patients with Covid-19 recorded in Chinese hospitals are 9.9%, and the factors that stimulate infection with this virus among diabetic patients must be subject to further research and studies to understand such a link[7]. It has been noted that people who have a long history with diabetes are at twice the risk of contracting covid-19 and dying from this virus compared with non-infected diabetics people, so intensive care must be given to this category of infected people[8].

In a study conducted in China, it was noticed that diabetics patients of middle ages are more susceptible to infection with Covid-19 and that there is a close relationship between sugar level and the severity of infection with this virus, even with the exclusion of the influence of sex, smoking and other chronic metabolic diseases[9]. The symptoms of acute respiratory distress syndrome increase in diabetic patients with Covid-19, as they have increased mortality rates and the severity of infection with this virus, but evidence has shown that the severity of infection in the air of the category is less at young ages or those who do

not suffer from hypertension and pulmonary and cardiovascular diseases[10]. Based on a lot of evidence and studies that show a clear overlap between diabetes and Covid-19, a clear scientific plan must be developed in order to understand the mechanisms that explain this interference and its consequences[11].

3. Physiological alterations in diabetics patients with covid-19 :

In general terms, diabetes, hypertension and aging increase the risk of catching Covid-19 and multiplying its symptoms. A number of explanations have been developed for the mechanisms that clarify this interaction, including that diabetes increases the virus's attachment to the host's cells, facilitating its entry, difficulty getting rid of the virus, increasing T cell inhibition and stimulating Inflammation response, cytokines release and generation of cardiovascular disease[12]. The rapid progression of Covid-19 disease in diabetics may be due to the possibility of facilitating the invasion of the virus into the cells of the body through its binding to the angiotensin-converting enzyme 2 (ACE2) receptors in the host cells and also associated with high levels of cytokines in diabetics as a high-grade inflammatory response to virus invasion[13].

Weak autoimmunity, increased proinflammatory factors, impaired gene expression of renin-angiotensin-aldosterone system antagonists in diabetics patients are all factors that encourage Covid-19, as well as the destruction of beta cells and insulin resistance resulting from high levels of cytokines, hypokalemia, and the use of drugs in the treatment of this virus all Factors that lead to a loss of control of sugar levels in diabetic patients with Covid-19[14]. Diabetics who suffer from diabetic ketoacidosis are susceptible to infection with this virus more quickly than regular diabetic patients, as diabetic ketoacidosis occurs in diabetic patients with a long and even new history, and it is better to diagnose this condition in diabetic patients with Covid-19 to know its effect on the progress of infection with the virus[15]. It was noted that this epidemic is associated with high blood sugar and insulin resistance, and this may be due to a dysfunction and death of islet β-cell and the inability of the insulin hormone to enter glucose into the cells of the body. Human or animal research can be done to reveal the way in which Covid-19 works to accelerate the destruction of beta cells[16].

The severity of infection with Covid-19 is varied and depends on many factors such as gender, age, obesity and diabetes, which act as risk factors that increase the chances of death among people with Covid-19 ,

but the role of insulin resistance in this regard is not fully explained yet and may play a great deal[17]. Through studies, a full description of the physiological changes associated with diabetes patients with Covid must be given and there are mechanisms that can increase the emergence of diabetes in people with Covid-19 , including beta-cell injury, cytokine release and the renin-angiotensin system activation, and these factors may work to generate type 2 diabetes or a new type From diabetes[18].Natriuretic-Peptide, D-dimer, N-Terminal-pro-Brain, and hs-Troponin may be used as biomarkers in diabetics with Covid-19 because they are mainly elevated in diabetics and there is no clear evidence that stopping the use of angiotensin-renin-blockers or angiotensin-converting-enzyme inhibitors or statins may prevent the virus from entering the body through this receptor, so it is preferable to rely on Various criteria for diagnosis[19].

SARS-CoV-2 virus affects glucose metabolism and involves in the metabolism affecting pathophysiology of diabetes or it may generate new physiological pathways for the diabetes mellitus[20]. Increased glucose in monocytes increases the multiplication of the covid-19, and the glycolysis process maintains this multiplication by activating hypoxia-inducible factor 1α and producing reactive oxygen species of the mitochondrial type[21]. In general, diabetes generates an acute inflammatory response, and this creates a suitable environment for people to infect with Covid-19, controlling normal sugar levels is the best way to stop the progression of the virus's invasion of body cells[22].

There are many factors that expose diabetic patients to developing Covid-19, such as obesity, high blood pressure, cardiovascular disease, weak immunity, dysfunction in the alveolar and endothelial cells, increased coagulation processes, and an imbalance in the expression of ACE2 receptors[23]. Diabetics are exposed to a metabolic defect due to obstruction of immunity, increased levels of inflammation, and the effect on organ functions such as the lung, and this increases the virulence of the virus and increases the risk of infection with SARS-CoV-2 and Covid-19 infection may stimulate insulin resistance, obesity and diabetes, or it may generate a new infection with diabetes and the use of DPP4is, ACEis / ARBs, and anti-inflammatories Diabetes may have an important role in controlling infection in these patients[24]. People with Covid-19 who have high levels of glucose have higher levels of cytokines, such as some types of interleukins, interferon's and TNF-α[25]. High blood sugar negatively affects the immune response

and this makes diabetic patients more vulnerable to infection with covid-19, and among the most important pathways for the virus to enter the cells of the body are dipeptidyl peptidase 4 (DPP4) and Angiotensin-converting enzyme 2 (ACE2) receptors, which are the places where the virus attaches to host cells to enter it[26].

4. Management and treatment aspects:

Patients with, hypertension cardiovascular disease and diabetes who are being treated with drugs targeting ACE2 and continuously are at risk of developing Covid-19 and must undergo drug modification like the use of ACE inhibitors, but there are no evidence that treatment with calcium channel blockers can increases the expression of ACE2, so these could be a appropriate treatment in these patients [27]. Diabetics suffer from high cytokines such as Interleukin 6 (IL 6), which increases in chronic inflammatory conditions, which may play a negative role after infection with Covid-19 , so the excessive production of IL - 6 is inhibited through the use of monoclonal antibodies to the IL 6 receptors or through the use of Janus Kinase inhibitors, which may be useful in treating Covid-19 in patients with diabetes[28].

The home medicines that are used to reduce sugar levels in diabetic patients have not shown a clear effect on reducing mortality rates among diabetic patients with Covid-19 and this aspect needs more research[29]. It was noted that there is a clear correlation between vitamin D levels in people with Covid-19 and mortality rates, so raising the levels of this vitamin in these patients may be an effective treatment option in this case[30]. As it was previously shown that diabetes facilitates the entry of this virus into the cells of the body and also works to weaken the immune system, so Telemedicine can be used as an effective medicine for diabetics with Covid-19 to treat such physiological changes[31]. There are many evidences that confirm that controlling high blood diabetes during the early stages of infection with Covid-19 may be a useful step for controlling the progress of the disease, and this procedure stops the vicious circle caused by high blood sugar, which leads as a result to make the infection with Covid-19 very bad[32].

The release of large quantities of inflammatory triggers in diabetic patients paves the way for an inflammatory rise that stimulates infection with Covid-19, and this leads to the generation of insulin resistance, high blood sugar, kidney failure and hypertension, in this case can use a pressor, steroid and dietary modification to reverse these

complications[33]. The weakening of the immune system and the high rate of inflammation and clotting factors in diabetic patients with Covid-19 may contribute to raising the death rates among these patients, the use of chloroquine for these patients usually leads to hypoglycemia. Therefore, blood sugar levels must be monitored and the anti-diabetic doses adjusted if necessary, this may contribute to reducing hospital stays and mortality [34].

Controlling the inflammatory state in people with Covid-19 and people with diabetes through therapeutic measures works to modify the process of macrophage transformation and T cell differentiation by inhibiting DPP4, TLR2 / 4 , TNF-alpha[35]. Targeting DPP4 may be a step to prevent and reduce the risk of infection with covid-19 in diabetics and also to stop the acute respiratory complications that diabetes adds to the incidence of Covid-19[36]. Anti-diabetic drugs may be used in the evaluation of diabetic patients who are at higher risk of developing Covid-19, as it was found that reducing sugar levels in diabetic patients with Covid-19 by means of blood-lowering drugs helps in relieving health complications and death in these patients[37].

5. Conclusion

Diabetes mellitus is one of the most important risk factors for the infection with COVID-19, as there is a bi-directional relationship between them, both of which exacerbate the symptoms of the other, as those with diabetes mellitus are more probable to have COVID-19, and having this virus increases the emergence of diabetes in previously healthy people. As COVID-19 works on a direct effect on the metabolism of glucose and high sugar levels in people with diabetes increases the rates of entry of the virus into the cells of the body and increases the formation of a the cytokine storm, and the person with diabetes has a weak immunity with a lack of blood antioxidants, and this in turn stimulates the invasion of the virus to the body cells. The treatments used to control the infection of corona in people with diabetes disturbs blood sugar levels, so accuracy must be taken in prescribing treatment in this case, telemedicine drug help in controlling sugar levels in the initial stages of infection with COVID-19, while controlling on the inflammation resulting from each injury COVID-19 and diabetes may reduce the risk of infection and symptoms of covid-19.

6. Acknolchment

My thanks and appreciation to the specialists who provided me with scientific instructions during the writing of the research.

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