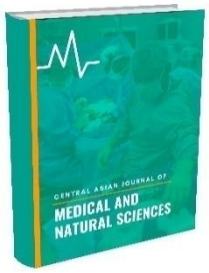
CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES



Volume: 03 Issue: 06 | Nov-Dec 2022 ISSN: 2660-4159

http://cajmns.centralasianstudies.org

New Coronavirus Infection and Diabetes Mellitus

1. **Najmutdinova D. K**
2. **Urunbaeva D. A**
3. **Sadikova N. G.**
4. **Irisova Sh. N.**

Received 22nd Sep 2022,
Accepted 23rd Oct 2022,
Online 25th Nov 2022

[1] Professor at Tashkent medical academy, Tashkent Uzbekistan

[2, 3] Associate professor at Tashkent medical academy, Tashkent Uzbekistan

[4] Master student at Tashkent medical academy, Tashkent Uzbekistan

Abstract: In this paper, a new approach and analysis of the new coronavirus infection and diabetes mellitus is given. Moreover, the authors determined the clinical course and life quality of patients with 2 type diabetes mellitus who have had a coronavirus infection.

Key words: Coronavirus, chronic diseases, diabetes mellitus, viral attack.

Actuality

New coronavirus infection 2019 (COVID-19) is a disease resulting from infection with an RNA-containing coronavirus, which is a recombinant between an unknown coronavirus and bat coronavirus. The most vulnerable in these conditions were patients with diabetes mellitus (DM) due to the peculiarities of their immune status and immune response to a viral attack, due to excessively high activity of the virus in conditions of hyperglycemia, due to comorbidity and obesity, which often accompany the course of DM [1].

According to IDF data, in 2017 were registered 425 patients with DM in the world, according to the forecast, by 2045 this figure may reach 629 million people. Since the initial outbreak of COVID-19 in China, much attention has been paid to people with diabetes due to the poor prognosis in people with the infection. Initial reports focused primarily on people with type 2 diabetes, although recent surveys have shown that people with type 1 diabetes are also at risk for severe COVID-19. The reason for the poorer prognosis in people with diabetes is likely to be multifactorial, reflecting the syndromic nature of diabetes. Age, gender, ethnicity, comorbidities such as hypertension and cardiovascular disease, obesity, and a pro-inflammatory and pro-coagulant state all likely contribute to the risk of worse outcomes. Glucose-lowering agents and antiviral drugs may modulate risk, but the limitations of their use and potential interactions with COVID-19 treatment should be carefully evaluated. Severe acute respiratory syndrome coronavirus 2 infection may itself be a aggravating factor for people with

diabetes as it can cause acute metabolic complications due to direct negative effects on β-cell function. These effects on β-cell function may also cause diabetic ketoacidosis in people with diabetes.

Objective

To determine the clinical course and life quality of patients with 2 type diabetes mellitus who have had a coronavirus infection.

Materials and methods

To study the impact of coronavirus infection on the course of diabetes mellitus, we checked laboratory data and compared the main clinical characteristics of patients. To determine the life quality of patients, we conducted a questionnaire SF36.

The most vulnerable categories of people susceptible to this disease are patients with severe chronic diseases such as heart and vascular diseases (ischemic heart disease (IHD), heart failure, arterial hypertension, cerebrovascular disease), chronic obstructive pulmonary disease (COPD), chronic kidneys and, of course, diabetes mellitus (DM). If a person with diabetes is already infected with the new coronavirus SARS COV-2, then the disease is much more severe than in patients without diabetes, and the death rate in patients with diabetes is significantly higher. [2]. According to the studies cited in the review, the incidence of severe COVID-19 was 1.3–3.9 times higher, and the incidence of deaths was 1.5–4.4 times higher in people with DM compared with people without DM [3]. The tendency of diabetic patients to a more severe course of the disease with a higher incidence of deaths can be explained by the peculiarities of the interaction of the virus and its receptor under conditions of hyperglycemia, the characteristics of the immune response, and the health status of diabetic patients in general.

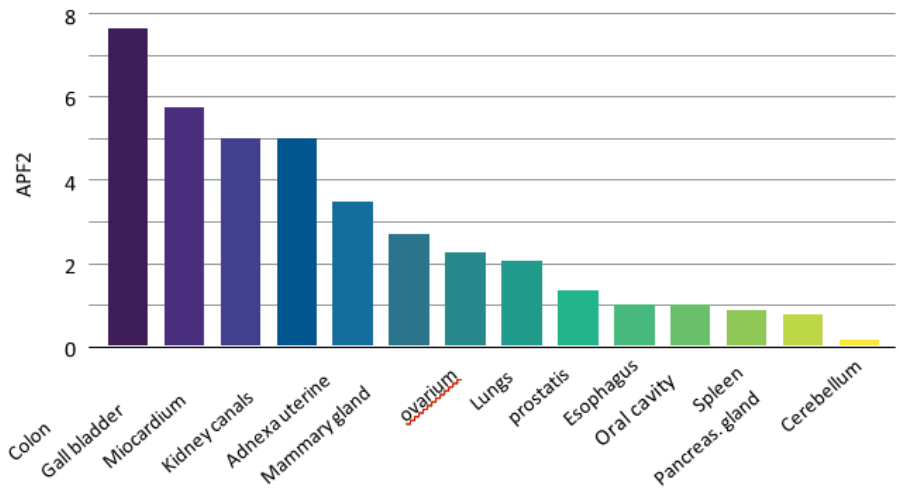


Figure 1. Expression of ACE2 (SARS COV-2 virus receptor) in DM

The SARS COV-2 virus, in order to invade human target cells (primarily the alveolar cells of the lungs), must come into contact with its receptor. It has been established that such a receptor for the new coronavirus is angiotensin-converting enzyme type 2 (ACE2) [4] Figure-1. The expression of this enzyme is quite high in the oral mucosa, nasopharynx, and in lung tissue (in type 2 alveolar cells) [5]. That is why the "entrance gate" for the virus is the upper respiratory tract, after which the virus easily penetrates the lungs and infects the alveoli, causing the rapid development of pneumonia and respiratory failure. Hyperglycemia in diabetics in the lung tissue activates the process of glycosylation of the ACE2 receptor (i.e. protein binding to glucose), which increases its affinity for the SARS COV-2 virus. Therefore, in diabetes, not only the expression of the receptor (in many tissues), but also its

association with the coronavirus. Both processes lead to greater sensitivity of diabetic patients to viral attack.

Another link that worsens the course of COVID-19 is the violation of coagulation processes. According to Tang N, et al, deceased patients who were diagnosed with COVID-19 had higher levels of D-dimer, activated partial thromboplastin time, and fibrin breakdown products compared with surviving patients, confirming the bleeding disorder in COVID. -19 [6]. Patients with DM2 also tend to hypercoagulation due to increased expression of fibrinogen receptors and von Willebrand factor on the platelet membrane, as well as due to higher levels of sP-selectin, IL-1, IL-6, IL-8, which contribute to platelet hyperactivation and accelerate time thrombus formation due to faster conversion of fibrinogen to fibrin [7]. Thus, in patients with COVID-19 and type 2 diabetes, the risk of developing thrombotic complications that affect the clinical outcomes of the disease increases dramatically.

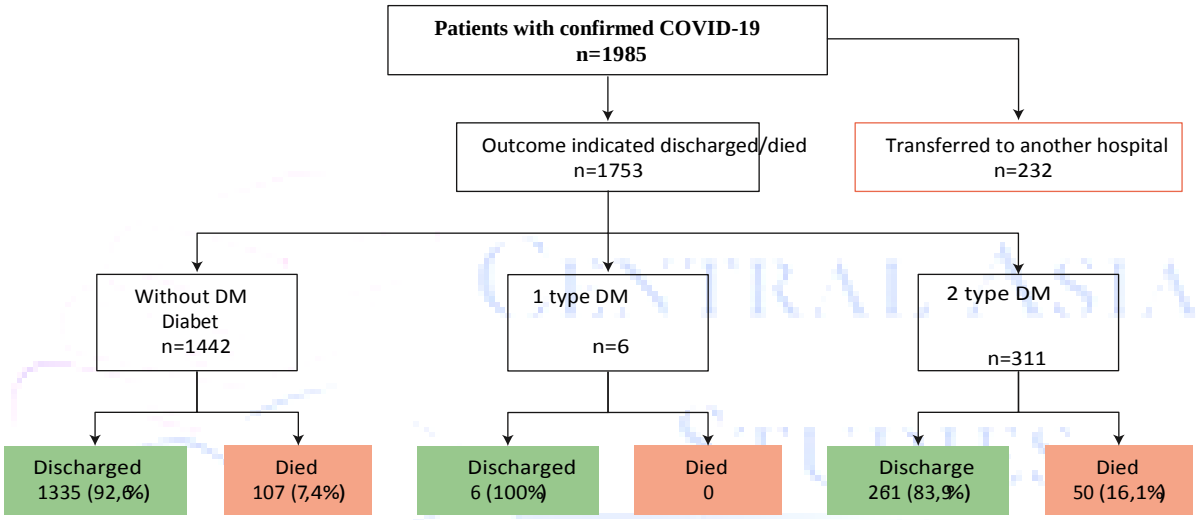


Figure 2. Design for including patients in a retrospective analysis

A retrospective analysis of data from 1985 patients with a confirmed diagnosis of COVID-19 was performed by detecting SARS-CoV-2 nucleic acids in sputum and throat swabs using the polymerase chain reaction method. The patients were hospitalized in the city clinical hospital named after. V.P. Demikhov in the period from 03/23/2020 to 06/01/2020 the final analysis included 1753 patients, of which 311 (17.7%) patients had DM2. All patients underwent clinical and laboratory monitoring until the onset of the outcome of the disease: recovery or death. A total of 1335 patients without DM2 and 261 patients with DM2 were discharged. 157 patients died: 107 patients without DM2 and 50 patients with DM2. The design for including patients in the retrospective analysis is shown in Figure 2.

Statistical analysis was performed using STATISTICA 10.0 software. Checking the normality of the distribution of quantitative traits was carried out using the Kolmogorov-Smirnov test (with the number of subjects >50) or the Shapiro-Wilk test (with the number of subjects <50). To describe signs with a normal distribution, the mean value was used with an indication of the 95% confidence interval. When describing features with a distribution other than normal, the median was used, indicating the interquartile range [25th and 75th percentiles]. Data from populations with a normal distribution were compared using Student's t-test. Data from non-normally distributed populations were compared using the Mann-Whitney test. Comparison of qualitative data was carried out using contingency tables by Pearson's $\chi 2$ test and Fisher's exact test. Differences were considered statistically significant at $p<0.05$.

Overall mortality was calculated as the percentage of deceased patients to the number of cases of COVID-19. [eight]

Results

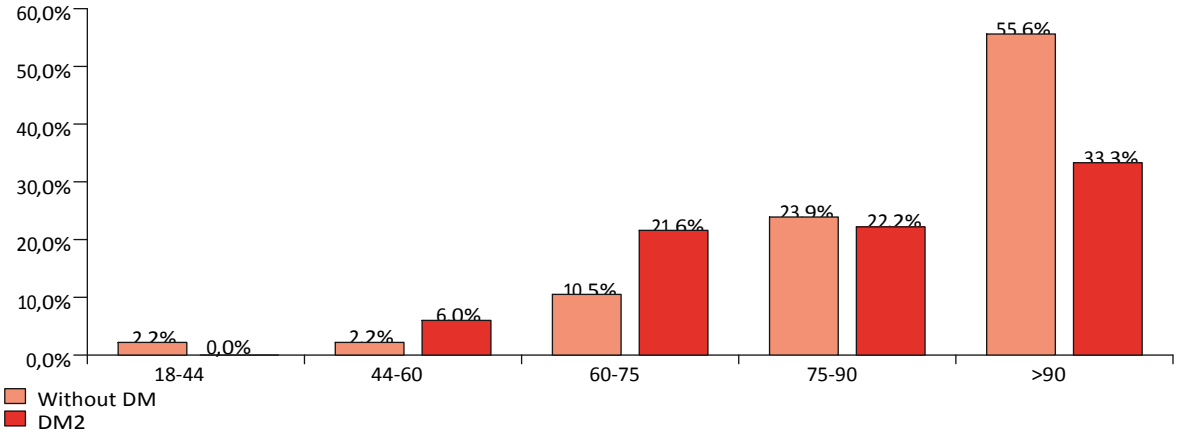


Figure 3. Lethality depending on age categories among patients without DM and with DM

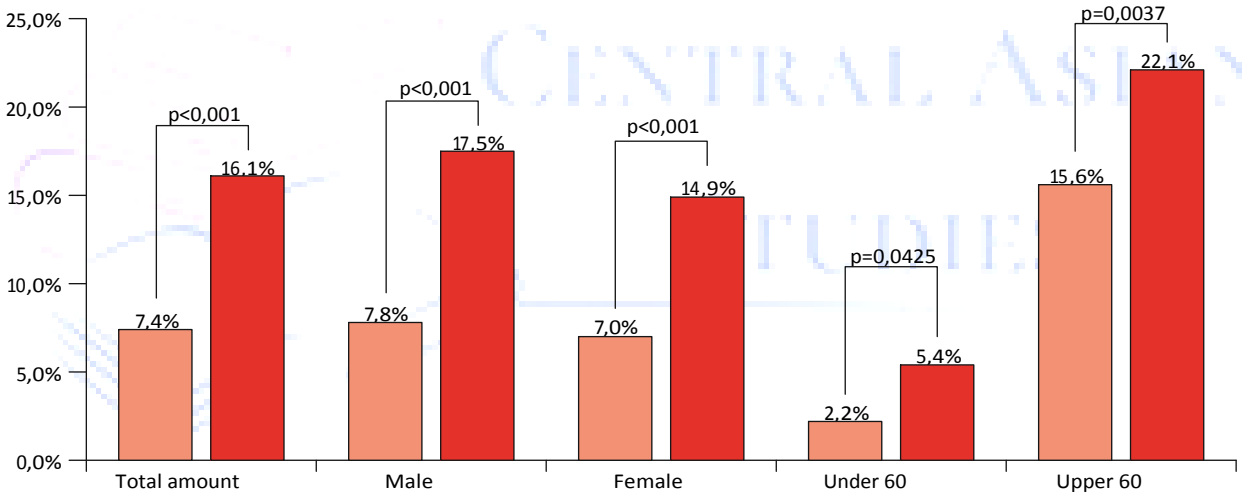


Figure 4. Mortality of patients depending on gender and age

Most studies evaluating the impact of carbohydrate metabolism disorders on the course and prognosis of patients with COVID-19 have shown that hyperglycemia has been associated with adverse outcomes in patients with COVID-19. Thus, in the CORONADO (Coronavirus SARS-CoV-2 and Diabetes Outcomes) study, hyperglycemia on the day of admission was associated with an unfavorable course of COVID-19, as well as with death on day 7. [9]. According to Zhu L, et al. If patients with COVID-19 and DM2 had glycemic values in the range of 3.9-10.0 mmol/l, then recovery was noted in 98.9% of cases. If glycemia exceeded 10.0 mmol/l, mortality reached 11.0%.[10] Similarly, in the English study, the mortality of patients with COVID-19 and T2DM increased as the level of glycated hemoglobin increased, while the worst prognosis was observed with the level of glycated hemoglobin >7.6% [11]. In the present study, there was a direct relationship between the level of glycemia and mortality among patients with COVID-19 and type 2 diabetes. At the same time, among patients without DM2, the curve of dependence of mortality on glycemic indices was U-shaped: mortality increased with glycemia <6.1 mmol/l and >7.0 mmol/l. It is possible that the increase in mortality against the background of low-normal and low glycemic values among patients with COVID-19 is due

to an increase in the synthesis of contra-insular hormones, activation of the sympathoadrenal system, increased platelet reactivity in conditions of hypoglycemia. All of these together contribute to the development of endothelial dysfunction and thrombotic complications, and also predisposes to progression cardiovascular disease (CVD) [12].

According to the study, it was found that coronavirus infection gives complications that are more complex in type 2 diabetes mellitus. This retrospective and prospective study included 40 randomly selected patients with type 2 diabetes mellitus who had Covid 19, were hospitalized in the second therapy with endocrinology department of the multidisciplinary clinic of the Tashkent Medical Academy No. 3 and RSNPMC of endocrinology. To study the impact of coronavirus infection on the course of diabetes mellitus, we checked laboratory data and compared the main clinical characteristics of patients. To determine the quality of life of patients, we conducted a questionnaire SF36.

Results of the 40 patients who underwent COVID-19, women accounted for 15 (37.5%), men - 25 (62.5%). The age of the patients ranged from 42 to 65 years. During the examination, it was proved that after a caronavirus infection, the general condition of patients and the complications of diabetes worsened several times. The study compared the clinical course of the disease before and after coronavirus infection. It was found that glycated hemoglobin before Covid-19 was ±8.5 in 62.5% of patients, after Covid-19 in 80% of patients the Hb A1c value was ±16.5. Diabetic distal symmetrical sensory polyneuropathy before Covid-19 in 30 % was detected in stage II, after Covid-19, 45% were in stage III. Hypertensive crisis was not observed before Covid-19, after Covid-19 it was detected in 7.5% of patients with type 2 diabetes, SDS mixed form before Covid-19 was in 42.5% of patients, after Covid-19 in 2.5% of patients the Charcot joint was attached, bilateral hydrothorax developed in 7.5% of patients after Covid19, therefore.

Conclusion

Consequently, our data largely coincide with the results of other authors. Thus, the global COVID-19 pandemic poses a significant health risk, especially for patients with diabetes, as it exacerbates the course of the disease and puts it at high risk of adverse outcomes. Hyperglycemia leads to a worsening of the clinical course in DM after a caronavirus infection. Infection of beta cells via ACE 2 receptors results in high hyperglycemia in diabetic patients. The manifestations of a cytokine storm in the body leads to the progression of acute and chronic complications, as well as the emergence of new complications of diabetes mellitus.

References

1. М.В. Шестакова*, Н.Г. Мокрышева, И.И. Дедов https://cyberleninka.ru/article/n/saharnyy-diabet-v-usloviyah-virusnoy-pandemii-covid-19-osobennosti-techeniya-i-lecheniya.
2. International Diabetes Federation. IDF Diabetes Atlas, 9th dn. Brussels, Belgium; 2019, doi: https://doi.org/10.1001/jama.2020.4683.
3. Epidemiology Working Group for Ncip Epidemic Response. Avalable from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports.
4. Глыбочко П.В., Фомин В.В., Авдеев С.В., и др. Клиническая характеристика 1007 больных тяжелой SARS-COV-2 пневмонией, нуждавшихся в респираторной поддержке // Клиническая фармакология и терапия.2020.Т.29.№2.С.21−29. 18.
5. Андреева А.В., Маркова Т.Н., Анциферов М.Б. Особенности ведения пациентов с сахарным диабетом и COVID-19 // Доктор.Ру. 2021; 20(2): 11– 20. DOI: 10.31550/1727-2378-2021-20-2-11-20

6. Huang C., Wang Y., Li X. et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan. China // Lancet.2020.395.(10223).497–506. DOI:10.1016/S0140-6736(20)30183-5
7. Sardu C., D'Onofrio N., Balestrieri M.L. et al. Outcomes in patients with hyperglycemia affected by COVID-19: can we do more on glycemic control? // Diabetes Care. 2020.43.(7). 1408–1415.DOI:10.2337/dc20-0723
8. Hoffmann M, Kleine-Weber H, Schroeder S, et al. SARS-CoV-2 cell entry depends on ACE2 and TMPRSS2 and is blocked by a clinically proven protease inhibitor, https://doi.org/10.1016/j.dsx.2020.04.018.
9. Glycemic characteristics and clinical outcomes of COVID-19 patients hospitalized in the United States. *J Diabetes Sci Technol.*
10. Tang N, Li D, Wang X, Sun Z. Abnormal coagulation parameters are associated with poor prognosis in patients with novel coronavirus pneumonia. J Thromb Haemost. 2020; 18 (4):844-7. doi:10.1111/jth.14768.
11. Pretorius L, Thomson GJA, Adams RCM, et al. Platelet activity and hypercoagulation in type 2 diabetes. Cardiovasc Diabetol. 2018; 17:141. Doi: 10.1186/s12933-018-0783-z.
12. Pretorius L, Thomson GJA, Adams RCM, et al. Platelet activity and hypercoagulation in type 2 diabetes. Cardiovasc Diabetol. 2018; 17: 141. doi: 10.1186/s12933-018-0783-z
13. Online map of the spread of coronavirus. (In Russ.) Онлайн карта распространения коронавируса. [Электронный ресурс]. URL: https://coronavirus-monitor.ru/.
14. Bode B, Garrett V, Messler J, et al. Glycemic Characteristics and Clinical Outcomes of COVID-19 Patients Hospitalized in the United States. J Diabetes Sci Technol. 2020; 14(4):813-21. Doi: 10.1177/1932296820924469.
15. Roca-Ho H, Riera M, Palau V, et al. Characterization of ACE and ACE2 Expression within Different Organs of the NOD Mouse. Int J Mol Sci. 2017; 18(3):563. Doi: 10.3390/ijms18030563.
16. Rao S, Lau A, So HC. Exploring diseases/traits and blood proteins causally related to expression of ACE2, the putative receptor of SARS-CoV-2: a Mendelian randomization analysis highlights tentative relevance of diabetes-related traits. Diabetes Care. 2020;43(7):1416-26. doi:10.2337/dc20-0643.
17. Глыбочко П.В., Фомин В.В., Моисеев С.В., и др. Исходы у больных с тяжелым течением COVID-19, госпитализированных для респираторной поддержки в отделения реанимации и интенсивной терапии //Клиническая фармакология и терапия.2020.Т.29.№.3.С.25-36.