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ORIGINAL ARTICLE

A Study on Postcovid-19 Patients Assessing the correlation between Covid-19 Infection and an Increased Risk of New-onset Diabetes (NOD)

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SARS-CoV-2, diabetes mellitus, new onset diabetes mellitus, HbA1C, Post COVID-19 condition

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ABSTRACT

Background: *The SARS-CoV-2 pandemic is characterized by multiple cases and high rates of morbidity and mortality in individuals with predisposing risk factors. 1- to 50 people who have been infected with SARS-CoV-2 are thought to have developed post-COVID-19 symptoms. Several studies have recently indicated new-onset diabetes associated with COVID-19. Preliminary observations suggest that new-onset diabetes (NOD) after COVID-19 infection is a miracle. Objectives: This study focuses on the chain of events that follow infection with COVID-19. It investigates the effects of infection-related onset diabetes known as newly diagnosed diabetes (NDD).* ***Methodology:*** *This Study included 100 cases of females and males. It was confirmed that all patients were actually infected with Covid-19, which were part of the current prospective experimental study they were divided in three groups, after testing positively by a rapid antigen test or rapid antibody test. During the three-months follow-up, the cases that developed NOPD and NODM as well as the threat factors related to them were evaluated.* ***Results:*** *The first group whose HbA1c levels were examined actually developed diabetes (NOD) as a result of their infection with COVID-19 disease, the second group were in the early stage of diabetes (NOPD); Cases diagnosed with NODM had an HbA1c > 6.4. The HbA1c range of 5.7 to 6.4 was utilized to describe NOPD, whereas the third group that was infected with Covid-19 and after that did not develop any form of diabetes.* ***Conclusion:*** *A considerable proportion of initial non-diabetic cases experienced new-onset hyperglycemia following COVID-19 infection.*

INTRODUCTION

Due to the potential for fatal infections caused by coronaviruses, the introduction of the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) and the Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) changed perceptions throughout the world. Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) is a novel strain of coronavirus causing an ongoing pandemic and posing risks to global public health and economy[1]. It appears that the coronavirus will alter the International Diabetes Federation's (IDF) predictions given the increase in cases of hyperglycemia and new-onset diabetes (NOD) identified during SARS-CoV-2 infection and following COVID-19 [2,3]. As a result, a two-way relationship has been found between SARS-CoV-2 infection and diabetes mellitus (DM): the infection may raise the risk of NOD, while diabetes itself raises the risk of a severe form of the disease [4].

The pathophysiologic pathways leading to increased inflammation and hyperglycemia are depicted in Fig. 1.

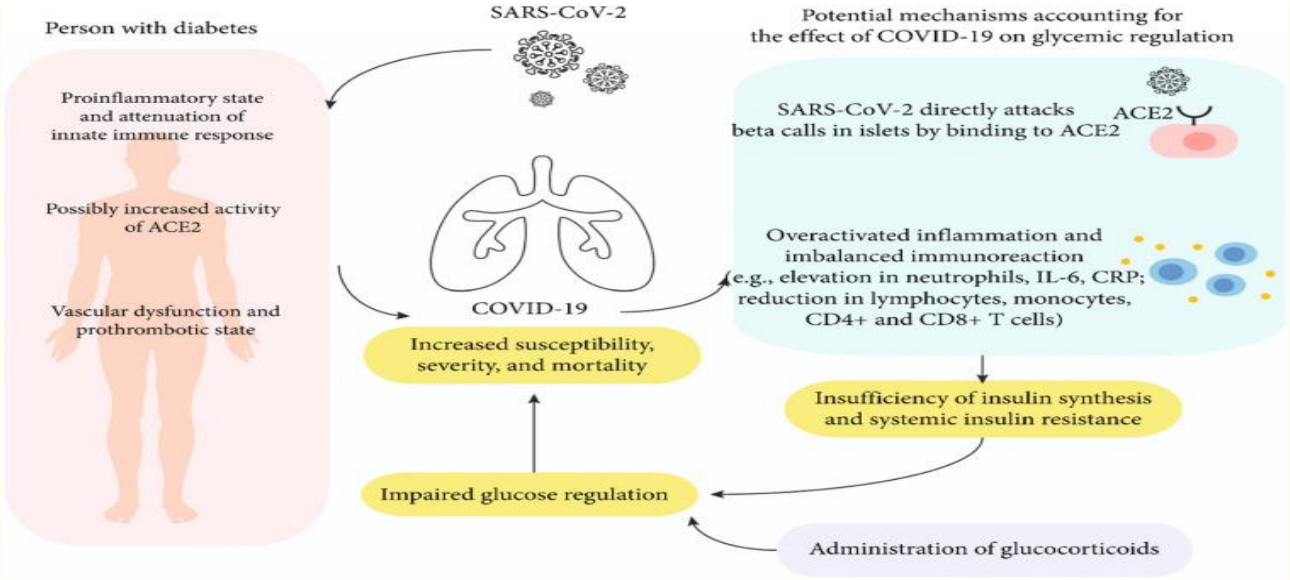

Fig. 1: Mechanisms leading to increased risk of hyperglycemia and diabetes in SARS CoV2 Infection [5].

Over 650 million people worldwide have contracted SARS-CoV-2 [6]. Early in the COVID-19 pandemic, a considerable proportion of individuals reported continuing to experience symptoms and after effects months after contracting SARS-CoV-2. The World Health Organization (WHO) later referred to this illness as a "post-COVID-19 condition," although patient groups still called it "long COVID"[7].

METHODOLOGY

Study design

- The first group (8 cases), after being infected with Covid-19, was noticed to have actually begun to suffer from chronic diabetes (NOD).
- The second group (11 cases), after being infected with Covid-19, was observed to be in the first or advanced stage of diabetes (NOPD).
- The third group (81 cases) that was infected with Covid-19 and after that did not develop any form of diabetes.

Patients selection

Patients were randomly selected in the city of Najaf, which included more than 100 cases of females and males, taking into account the necessity of all patients from whom samples were taken, firstly, all of them were actually infected with Covid-19 through testing, and secondly, not everyone has a family history of diabetes, so that this is not genetically linked, and to avoid the appearance of diabetes, because of genetics and just to investigate the link between COVID-19 and the emergence of diabetes.

Data collection

Data for this study were collected over a period of five months, from September, 2023 to February, 2024. The process was carried out by conducting a random survey in the city of Najaf as described above, which included 100 cases of females and males. It was confirmed that all patients were actually infected with Covid-19, after that they were tested for the level of HbA1C, the repercussions and effects of which may appear during the infection or after days or months. The Hb1ac level was retested after three months, specifically at the end of January 2024, to confirm and interpret the results.

Clarifications

Non-diabetic cases were defined as having an HbA1C<5.7[8]. Pre-diabetes and NOPD were defined by an HbA1c of 5.7 to 6.4. An opinion of NODM was made in cases with HbA1c>6.4.We also considered applicable ICD canons for diabetes mellitus in the reviewed studies where further information about new diabetes mellitus was unapproachable. We defined post-COVID-19 conditions as new, returning, or ongoing health problems being ≥4weeks after being infected with COVID- 19[9].

Statistical analysis

The data of this study were statistically analyzed using a graphic pad prism 5, and we obtained a clear significant difference using the ANOVA test between the three groups (NOD group 1, NOPD group 2, Hb1Ac group 3) and using the t-test to compare between the first and second groups and between the second and third and the first and third groups. All tests indicated that there was a clear and significant difference between the groups. $P \leq 0.05$ indicates statistical significance. P value < 0.0001.

RESULTS

Data Demographics

This research was done to examine one hundred cases of females and males as the process was carried out by conducting a random survey from Najaf Governorate, all of them were actually infected with Covid-19 through testing, and secondly, not everyone has a family history of diabetes .The age of the cases ranged from 18 to 60 years. The ages of cases were expressed as mean ± standard deviation. They were found to be 48.4 ± 10.9 year, with a minimum to maximum of 18-60 years.

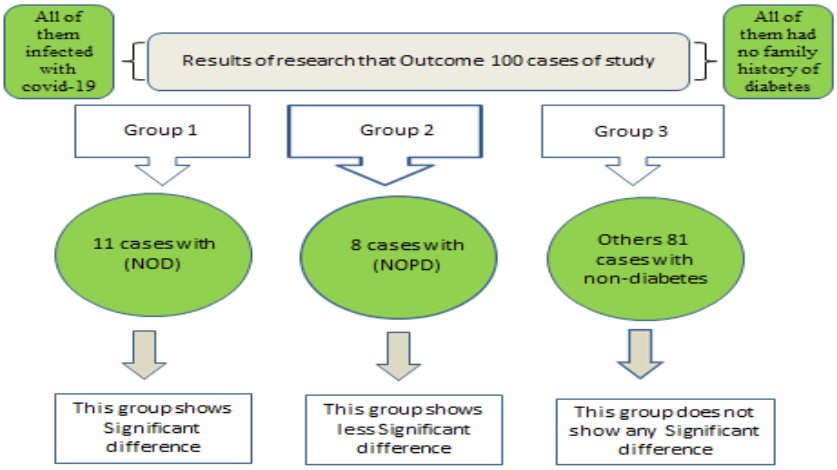

Fig. 2: Describe the Outcome of 100 cases examination.

Outcomes of (New-Onest-Diabetes)

Table 1: New-Onest-Diabetes

NO	Age	gender	Case	Hb1Ac
1	51	Female	(NOD)	9.37
2	43	Female	(NOD)	7.19
3	40	Male	(NOD)	8.47
4	44	Female	(NOD)	8.62
5	37	Female	(NOD)	7.68
6	55	Male	(NOD)	9.56
7	33	Female	(NOD)	8.58
8	43	Female	(NOD)	8.7
9	44	Male	(NOD)	6.7
10	53	Female	(NOD)	6.77
11	47	Male	(NOD)	7.26

Described the results of the first group, which showed that members of this group actually developed diabetes as a result of their infection with Covid-19.So this called (NOD).The correlation between HB1AC level group 3 and Hb1Ac (NOD) group 3 of COVID 19 patient's medians significant Difference ($P < 0.05$).

Outcomes of (New-Onest-Pre-Diabetes)

Table 2: New-Onest-Pre-Diabetes

NO	Age	Gender	Case	Hb1Ac
1	50	Male	(NOPD)	5.74
2	41	Male	(NOPD)	5.68
3	52	Female	(NOPD)	6.34
4	38	Female	(NOPD)	5.65
5	37	Female	(NOPD)	5.62
6	40	Male	(NOPD)	6.30
7	60	Female	(NOPD)	6.4
8	55	Female	(NOPD)	5.7

Described the results of the second group, which showed that members of this group actually are in the initial stage of diabetes as a result of their infection with Covid-19.So this called (NOPD).The correlation between Hb1Ac level group 3 and Hb1Ac (NOPD) group 2 of COVID 19 patient's medians significant. Difference ($P < 0.05$).

Outcomes of non-diabetes

The results of this group are considered normal because they did not gain or lose anything of what we are looking for, although not conclusively because we did not look for other internal variations, but only if the person acquired diabetes as a result of infection with Covid-19, or he may be in the primary stage of diabetes, so The members of this group can be considered the control group, which was not affected or changed.

The correlation between Hb1Ac (NOPD) group 2 and

Hb1Ac level group 3 of COVID 19 patients medians significance. Different ($P < 0.05$) and P value < 0.0001.

DISCUSSION

In our study, we obtained the results confirming the bilateral correlation between infection with Covid-19 and the emergence of new diabetes (NOD) in people who were infected with Covid-19 and what are the traces and mechanisms that led to this relationship being parallel. The results after the survey showed that there is a group of people who actually acquired diabetes after infection (NOD). With Covid-19, shortly or recently, and another group that they are in the early stage of diabetes (NOPD). This connection has many mechanisms that explain the changes that occurs. There are numerous trigging events that include several proposed mechanisms like bus-aggressive CD8 T cells, together with other seditious cells and labels, infiltration of the pancreas leading to insulitis and hence destruction of the insulin- producing beta cells through autoimmune processes. Contagions play a vital part in induction of autoimmunity. Donation of viral antigens by Antigen- Presenting Cells (APCs) activates the auto reactive T- cells and antiviral T-cells. In this way, may occur autoimmune responses with the help of pro-inflammatory and seditious intercessors [10]. Also, lysis of the pancreas' beta cells leads to major insulin insufficiency, destroying around 90 pancreatic reserve diabetes cells. Still this is considered to be one of the mechanisms rather than the only key factor producing type 1 diabetes [11]. SARS-CoV-2 shaft proteins can interact with the RAS hormonal system and enter the host cell by binding to ACE2 receptors set up on the face of several organs and tissue, specifically pancreatic b- cells. Upon entrance, increased viral cargo, vulnerable dysregulation, alveolar and endothelial dysfunction, and increased systemic coagulation may place diabetes cases at threat for severe COVID- 19 complications. Also, from limited exploration, both the viral entrance of SARS- CoV-2 and performing up regulation of angiotensin II can lead to new onset diabetes. As broad exploration sweats are being made to understand the complications of new- onset diabetes post – COVID 19 opinion, effective operation of both conditions is veritably important. A high incidence of NOD in patients with SARS-CoV-2 infection was also previously reported. In a retrospective study reporting data from 453 patients admitted between January and March 2020 in Wuhan, China by Li et al.[12] who reported that 21.0% of COVID-19 patients without a previous diagnosis of DM had an FPG of 7.0 mmol/L or more and/or HbA1c of 6.5% or more. Another study by Smith et al[8]. Included 184 patients who were hospitalized in Livingstone, New Jersey between March and May 2020 due to COVID-19 infection [8].They reported that during the course of the illness, type2 diabetes struck 15.8% of patients. Furthermore, Shrestha and colleagues[14] conducted a meta-analysis [4], in which pooled data from six studies were analyzed, showing that 19.7% of patients admitted for SARS-CoV-2 infection were diagnosed with NOD[13,14].

CONCLUSION

In our study, a considerable proportion of initial non-diabetic cases experienced new-onset hyperglycemia following COVID-19 infection.

Recommendations

We recommend that a more extensive and comprehensive study be conducted, whether international or regional, to create a comprehensive survey picture of this phenomenon.

Ethical approval

Permission and approval were taken for all procedures used in this study by relevant clinical regulations of the Research Ethics Committee and those of the Code of Ethics of the World Medical Association (Declaration Helsinki). In addition, each participant presented written consent.

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Conflicts of interest

There are no conflicts of interest.

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