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Newly Emerging Type 2 Diabetes in Covid-19 Patients: *A Study in tertiary care hospital in North India.*

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ABSTRACT

The COVID-19 pandemic has led to an increased risk of developing Type 2 Diabetes in patients with no prior history of the disease. In this systematic review, we aim to investigate the association between COVID-19 and newly diagnosed Type 2 Diabetes and identify the potential risk factors and underlying mechanisms of diabetes development in COVID-19 patients.

Investigating the occurrence of diabetes following coronavirus infection was the study's goal. Out of the total 2700 cases, the mildly symptomatic (1628, 60.30%) and moderately symptomatic (815, 30.18%) patients received OPD treatment and experienced alleviation in 3–7 days; none of them required hospitalisation. Out of 2700 cases, 257 (or 9.52%) required hospitalisation due to serious illness.

Our analysis shows that COVID-19 is associated with a higher risk of newly diagnosed Type 2 Diabetes, and that factors such as inflammation, insulin resistance, and genetic predisposition may contribute to the development of diabetes in COVID-19 patients. This study confirms the necessity of active glucose monitoring in hospitalised, critically unwell SARS-CoV-19-infected patients.

Keywords: COVID-19, Diabetes type 2, Risk factors, Emerging cases.

INTRODUCTION

Highly infectious respiratory disease, COVID-19, is caused by novel corona virus SARS-CoV-2. The outbreak of COVID-19 was first identified in December 2019 in Wuhan, China, and quickly spread to become a global pandemic. [1] The virus spreads primarily through respiratory droplets and close contact with infected individuals, and symptoms range from mild to severe, including fever, cough, and difficulty breathing. [2] Apart from pulmonary infection and complications, there are numerous extra-pulmonary complications of coronavirus disease 2019 (COVID-19).

The immune system of people with Type 2 Diabetes may not function as efficiently, making them more susceptible to infections such as COVID-19. the virus may exacerbate underlying metabolic dysfunction in individuals with Type 2 Diabetes, leading to more severe illness and poor outcomes. [3] According to some data, those who have the severe COVID-19 conditions endure post-acute sequelae, sometimes known as protracted COVID, which can include symptoms of the pulmonary and extra-pulmonary organ systems, including diabetes. [4]

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A significant extra-pulmonary organ that is impacted by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the pancreas. It has been noted that beta cells are damaged, which results in fewer insulin secretory granules in beta cells and decreased insulin production in response to glucose. [5]

AIMS

To investigate the association between COVID-19 and newly diagnosed Type 2 Diabetes.

OBJECTIVES

1. To conduct a systematic review of the existing literature on the association between COVID-19 and newly diagnosed Type 2 Diabetes.
2. To analyze the potential risk factors and underlying mechanisms of diabetes development in COVID-19 patients.

METHODS

The prospective cross-sectional study was carried out in the institution after obtaining ethical clearance from the institutional ethical committee. The study was carried out over a period of 05 months. A total of 2700 patients were taken into consideration.

Inclusion criteria: All the patients coming to the COVID clinic.

Exclusion criteria: Patients with a history of diabetes or on corticosteroid prescriptions.

Both informed written, and audio-visual consent was taken age appropriately. Detailed history and examination were performed for the COVID-positive patients.

Acute and sudden onset of chest symptoms that can range in severity including mostly dry cough, fever, respiratory problems, chest wheezing, excessive sweating, nausea, vomiting, epigastric discomfort with a feeling of fullness, diffuse abdominal distension and tenderness, loss of appetite was noted. All patients were classified according to the severity of the COVID disease and also all of them underwent random sugar blood level checks. In every instance, a focus on concomitant conditions such as obesity, hypertension, diabetes, hyperlipidemia, heart disorders, and stroke was put in great detail. It was taken into account whether a person had a history of using drugs, notably corticosteroids like dexamethasone, hydrocortisone, and methylprednisone. In all cases, a physical examination and an SPO_2 level are performed.

In addition to all other routine laboratory tests such as complete blood counts, liver function tests, kidney function tests, blood sugar and C-reactive protein, X-ray chest, and investigations for acute febrile illnesses like malaria, dengue fever, and typhoid fever were also performed.

Patients with severe symptoms were hospitalized and treated, while patients with mild to moderate symptoms received outpatient care and were encouraged to remain in isolation at home.

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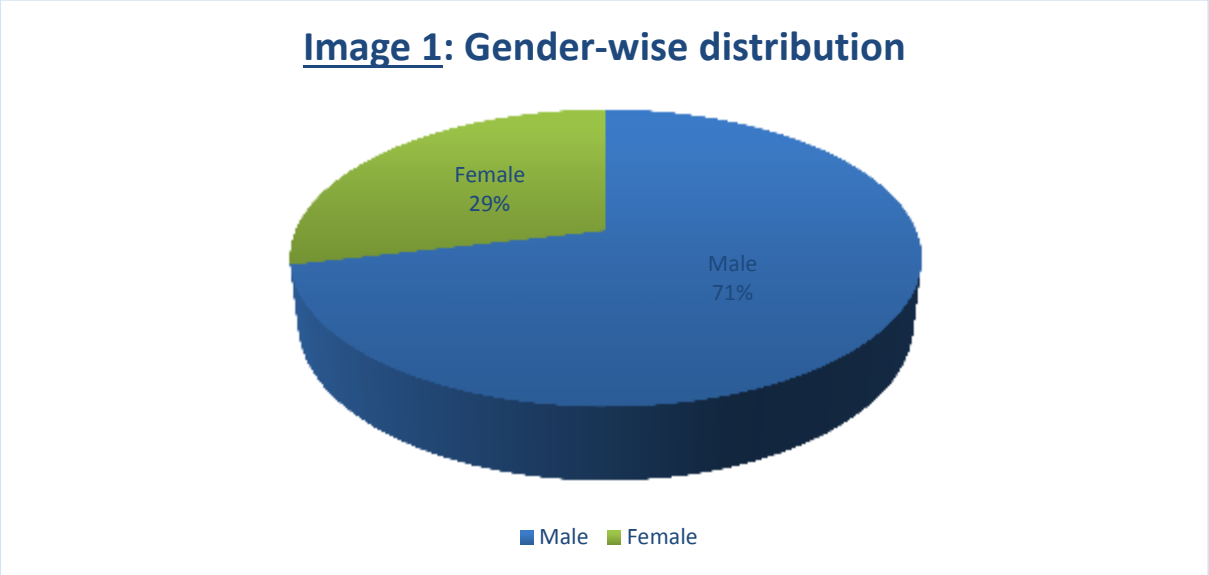
OBSERVATIONS

The cases studied were all between the age group of 25 to 70 years. Both sexes were taken into consideration. Image 1 shows the gender-wise distribution of cases. A total of 2700 cases is reported.



We observed that the maximum number of cases seen between the age group of 56-65 years in both genders is shown in Table 1. The total number of cases in this age group is 1105 (40.93%) out of which 815 were males and 290 were females.

Table 1: Age and Gender-wise distribution of patients

S. No.	Age groups (Years)	Males	Females	Total
1.	25-35	136	62	198 (07.33%)
2.	36-45	220	119	339 (12.56%)
3.	46-55	323	93	416 (15.40%)
4.	56-65	815	290	1105 (40.93%)
5.	66-75	432	210	642 (23.78%)
Total		**1926 (71.33%)**	**774 (28.67%)**	**2700 (100%)**

The patients were analysed as per their clinical symptoms and signs and categorized according to their symptoms as mildly symptomatic patients, moderately symptomatic patients, and patients with severely symptomatic patients as shown in Table 2.

Table 2: Classification of signs and symptoms

Classification	Clinical symptoms	Clinical signs
Mildly Symptomatic Patients (N = 1628, 60.30 %)	Running nose, mild sore throat, myalgia, mild occasional coughing, no fever or low-grade fever without	None Normal RR, HR & SPO_2. Treated on OPD bases and

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	chills.	symptoms subsided within 3-4 days
Moderately Symptomatic Patients (N = 815, 30.18 %)	Moderate fever (temperature 99.8-101 ^{0}F) with or without chills, frequent dry cough with or without tightness in the chest, myalgia, sore throat, decreased appetite with or without GIT symptoms.	Always febrile. With or without wheezing. Normal RR, HR & SPO_2. Treated on OPD bases and got relief within 6-7 days
Severely Symptomatic Patients (N = 257, 09.52%)	High-grade fever mostly temperature >101 ^{0}F, with chills, severe coughing mostly dry cough, Respiratory distress, severe myalgia, vomiting, GIT symptoms such as pain and heaviness in the upper abdomen, distension of abdomen, dehydration, sweating,	Extensive wheezing with or without crepitations in the chest, tachypnea, tachycardia, Low SPO2, abdominal distension, and tenderness, mostly hypotension. Admitted to hospital ward/ICU.

Out of 257 patients who were critically sick, we transferred 11 patients to a higher center either on the same day (when they came for the first time) or a few days later. Depending on the severity of their conditions, the remaining 246 patients were hospitalized for durations of time ranging from 4 days to 25 days over the period of two months.

Vital signs, SPO2, blood sugar, LFT, KFT, CRP, and CBC were continuously monitored. As required chest X-ray and USG of the abdomen were performed.

During the first two months, fatalities of 3 (1.22 %) of 246 hospitalized patients and 9 (0.33 %) of 2700 patients occurred. In addition, 6 deaths occurred before the patients were admitted and worked up.

Our examination of the patients showed that only 1276 (47.26%) of the 2700 patients had RT-PCR results done for the Covid-19 test as shown in Table 3. RT-PCR was only done on 407 (25.00%) of the 1628 patients with moderate symptoms, and of those, 91 (22.36%) instances were found to be positive whereas 316 (77.64%) were found to be negative. There were 815 people in total who had minor symptoms. In 623 (76.44%) of these cases, RT-PCR was carried out; 227 (36.44%) of the outcomes were positive, whereas 396 (63.56%) were negative. RT-PCR was carried out on 246 (95.72%) of the sickest patients; 231 (93.90%) of the outcomes were positive, whereas 15 instances (6.10%) had negative findings.

Table 3: Distribution of RT-PCR results

Clinical symptoms	No. of Patients	RT-PCR Report available	RT-PCR Positive	RT-PCR Negative
Mildly symptomatic patients	1628	407 (25.00%)	91 (22.36%)	316 (77.64%)
Moderately symptomatic Patients	815	623 (76.44%)	227 (36.44%)	396 (63.56%)
Severely Symptomatic	257	246 (95.72%)	231 (93.90%)	15 (06.10%)

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Patients				
Total	**2700**	**1276 (47.26%)**	**547 (42.87%)**	**727 (57.13%)**

All hospitalised patients have their blood sugar levels continuously monitored, while non-hospitalized patients had their blood sugar levels checked when they first arrived at the emergency department. Of the 1628 patients with mild symptoms, 85 had diabetes and were receiving treatment, while 33 of the 815 patients with moderate symptoms had the condition and were receiving treatment, and 14 of the 257 patients with severe illnesses had the condition.

The patients with mild to moderate symptoms were able to get over their acute respiratory symptoms in 3 to 7 days, and they did not return for additional care. In the instance of 257 critically sick patients, 11 patients were referred, and 246 were hospitalised and stayed in the hospital for a range of times, ranging from four to twenty-five days, depending on the circumstances. During this time, their blood glucose levels were continuously monitored. Table 4 displays the diabetic status of patients who are hospitalised.

Table 4: Hyperglycemia trend in hospitalised patients

Total hospitalised patients	**Known diabetes cases**	**Additional patients with elevated blood glucose levels at admission**	**Elevated blood glucose level after 3rd month follow up**	**Patients whose blood glucose level reduce to Normal after 3 months**	**Patients who have never shown elevated blood glucose levels**
246	14	103 Showed FBS >130 mg/dl PPBS >200 mg/dl most of the time during regular monitoring	13 These patients are labelled as newly diagnosed post-COVID-19 diabetes.	90	126

Out of 246 severely ill patients, 14 were already diabetic, 106 displayed hyperglycemia, 3 passed away, and 103 were monitored for 3-6 months. Of these 103 patients, 90 continued to have normal blood glucose levels after stopping anti-hyperglycemic medication for another 3 months, and the remaining 13 are classified as newly diagnosed post-COVID-19 diabetes. 126 individuals out of 232 never displayed hyperglycemia while being treated in the hospital. As a result, we discovered that 13 (5.60%) out of 232 critically sick hospitalised patients had post-COVID-19 diabetes.

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DISCUSSION

A new virus from the coronaviridae family causes the contagious airborne viral pneumonia known as coronavirus disease (COVID-19). [6] The fact that COVID-19 continues to pose a threat despite all measures to counteract it highlights the necessity for continuous monitoring and study. [7] Studies have shown that COVID-19 infection can also trigger the onset of newly diagnosed Type 2 Diabetes in some individuals, particularly those with pre-existing risk factors such as obesity and insulin resistance.

Out of a total of 2700 patients, 1926 (71.33%) were male and 774 (28.67%) were female. This is a significant difference that may be explained by the fact that males tend to spend more time outdoors for personal, social, and professional reasons, which increases their chances of coming into contact with other people and contracting infections, whereas females tend to stay at home more, which reduces their chances of contracting infections. [8,9]

Clinically, COVID-19, RT-PCR-positive individuals might exhibit a variety of clinical symptoms, from minor ones similar to the common cold to life-threatening ones. The fact that in our observation we found 1628 cases with mild symptoms and out of that 407 cases of RT-PCR was done and only 91 (22.36%) patients were found positive, thus the rate of RT-PCR positivity is quite low in the mildly symptomatic group, also implies that such mildly symptomatic patients are a source of infection in society and their social contact should be restricted even if they are not documented to be COVID-19 positive. [19,10,11]

Such mildly symptomatic patients in the COVID-19 scenario should be handled as suspect COVID, and the requirement for social isolation should be overemphasized in order to stop the transmission of infection. Contrarily, it has also been noted that the RT-PCR for COVID-19 was found to be negative even in patients with severe illnesses and in patients with mild symptoms. Out of 246 severely ill patients, 15 patients (06.10%) were RT-PCR negative, while out of 623 patients with mild symptoms, 396 (63.56%) were negative the scenario is similar to other studies. [12,13]

There are 13 new cases of diabetes or 56 new cases for every 1000 persons. We found that the COVID-19 severity correlates with the risk of diabetes. Additionally, it has been shown that independent of age, gender, type of diabetes, or length of follow-up, the risk of acquiring diabetes rose. Patients with previous viral infections have reported similar outcomes. [14,15]

In our study, people with significant Covid-19 following recovery had a higher risk of type 2 diabetes. In our analysis, we found that the average age of all 2700 Covid-19 patients is around 40 years old, with men making up a greater number of 1926 (71.33%).

Our research's findings are consistent with a retrospective cohort analysis of Covid-19 patients who were hospitalised in other studies, which included those with more severe illness, higher viral loads, and higher immune activation. [16]

The findings of our study suggest that diabetes screening be advised for people who have recovered from even moderate Covid-19.

CONCLUSION

Early detection and management of diabetes in COVID-19 patients is crucial to prevent complications and improve outcomes. Additionally, individuals with Type 2 Diabetes should take extra precautions to minimize their risk of COVID-19 infection, such as maintaining good glycemic control and adhering to public health guidelines. it is clear from a number of

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clinical datasets that both acute and chronic infections promote insulin resistance, which acts as a risk factor for type II diabetes mellitus in those with pre-diabetes.

Limitations

We only included severely ill hospitalised patients who were under regular follow-up after discharge from the hospital, which is a major limitation of the study because patients with mild and moderate symptoms did not come after recovering from acute respiratory illness. Future research should look at how SARS-CoV-2 infections affect continuous monitoring of glucose and HbA1c.

Conflict of Interest: Authors don't have any known conflict of interest.

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