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Does COVID-19 hit hard in Diabetic Patient: A Cross-sectional study at Tertiary Care Hospital

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ABSTRACT

Background and Objective

Coronaviruses are a family of viruses that can cause respiratory illness in humans. They are called "corona" because of crown-like spikes on the surface of the virus. Severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS) and the common cold are examples of coronaviruses that cause illness in humans.

The primary mode of transmission of SARS-CoV-2 is via exposure to respiratory droplets carrying the infectious virus from close contact or droplet transmission from pre-symptomatic, asymptomatic, or symptomatic individuals harbouring the virus

This study is conducted to analyse the extent of association between COVID-19 & Diabetes Mellitus and its correlation with the inflammatory markers as it is still unclear if diabetes interferes in the prognosis of COVID-19

Material & Methods

A Cross-sectional study was conducted over a period of 6 months from April 2021–September 2021.Among 149 RT-PCR positive COVID-19 patients the random blood sugar levels, CT chest severity score & C-Reactive Protein was compared among the diabetic & non-diabetic population in ACS Medical college & hospital Chennai.

Results

The study shows that out of 149 COVID-19 positive patients, 88 (59.1%) were diabetic & 61 (40.9%) were non-diabetic. Patients with diabetes had significantly higher CT chest severity score and elevated C-reactive protein than non-diabetic patients.

Conclusion

The interaction between covid-19 & diabetes could be bi-directional, with SARS-CoV-2 potentially worsening pre-existing diabetes.

Keywords

Covid-19, Diabetes mellitus, CT Chest severity, CRP

INTRODUCTION:

The new strain of coronavirus — SARS-CoV-2 — was first reported in Wuhan, China in December 2019, an outbreak of a mysterious pneumonia characterized by fever, dry cough, and fatigue, and occasional gastrointestinal symptoms happened in a seafood wholesale wet market, the Huanan Seafood Wholesale Market, in Wuhan, Hubei, China.[1]

In March 2020, the World Health Organization (WHO) declared the COVID-19 outbreak a pandemic.[2]

Coronaviruses are a family of viruses that can cause respiratory illness in humans. They are called "corona" because of crown-like spikes on the surface of the virus. Severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS) and the common cold are examples of coronaviruses that cause illness in humans [3]

The primary mode of transmission of SARS-CoV-2 is via exposure to respiratory droplets carrying the infectious virus from close contact or droplet transmission from pre-symptomatic, asymptomatic, or symptomatic individuals harbouring the virus.[4]
Most people infected with the virus will experience mild to moderate respiratory illness and recover without requiring special treatment. However, some will become seriously ill and require medical attention. Older people and those with underlying medical conditions like cardiovascular disease, diabetes, chronic respiratory disease, or cancer are more likely to develop serious illness.
Due to vast prevalence of Diabetes Mellitus, India is called the "Diabetic Capital of the World" [5]. Diabetes is associated with poor outcome of acute medical condition, including COVID-19[6]. Angiotensin-converting enzyme 2 (ACE2) has been identified as a surface receptor responsible for SARS coronavirus (SARS-CO-V) invasion in human cells with direct interaction with its spike glycoprotein (S protein) [7].
ACE2 has anti-inflammatory effects, and its found reduced in Diabetes mellitus patients [8]
CT chest severity finding in COVID-19 helps in revealing the features of viral pneumonia & hence helpful in early diagnosis [9].
C-reactive protein (CRP) is a non-specific acute phase reactant elevated in infection or inflammation. Higher levels indicate more severe infection and have been used as an indicator of COVID-19 disease severity [10]
This study is conducted to analyse the extent of association between COVID-19 severity & Diabetes Mellitus as it is still unknown whether diabetes is a risk factor for the prognosis of COVID-19 and the finding would help in better understanding the severity of the disease and guidance in better patient care.

METHODOLOGY:

Study design:

A cross-sectional study was conducted over a period of 6 months from April 2021 to September 2021 at ACS Medical College & Hospital, Chennai a tertiary care centre, after obtaining approval from the Institutional Ethical Committee. (Approval number: No.97/2020/IEC/ACSMCH)

Study population:

Around 149 COVID-19 positive patients with random blood sugar level, CT chest severity score & C-reactive protein levels were included in the study.

Exclusion criteria:

1)RT-PCR negative patients 2) Patients whose CT chest was not done 3) Patient with other comorbid conditions.

Materials:

COVID-19 was diagnosed using Real Time RT-PCR. RT-PCR was done by taking nasopharyngeal & oropharyngeal swab and processed using Meril RNA extraction kit & Meril COVID-19 one step RT-PCR kit. COVID-19 positive was confirmed with detection of ORF1ab gene and N gene.

According to American Diabetes Association, based on the levels of Random blood sugar, patients having ≥200 mg/dl were considered Diabetic & those who had their levels ≤200 mg/dl as non-diabetic.

All HRCT chest was assessed by senior radiologist and quantitative CT Score was done based on the degree of lung lobe involvement and calculated severity score (out of 25). The patients were categorized into: Mild (0-5/25), Moderate (5-15/25), Severe (15-25/25).

The C-Reactive protein levels were obtained by performing the test using Nephelometry and if the levels were < 6mg/L it is considered normal and >6 mg/L is considered elevated.

A comparative study was done to see if the above parameters were elevated especially among the diabetic patients than the non-diabetic population.

Statistical analysis:

Descriptive statistics like mean (SD) and frequency (percentage) was given for continuous and categorical variables respectively. Diabetes status was defined as diabetic (if RBS>200 mg/dl) and non-diabetic (if RBS≤200 mg/dl). Chest severity score was defined as normal (if score=0), mild (if score ≥1 to score≤5), moderate (if score≥6 to score≤15) and severe (if score>15). C - reactive protein (CRP) was defined as normal (if CRP≤6 mg/dl) and elevated (if CRP>6 mg/dl). Shapiro Wilk test was used to check the normality of the data. The parameters were compared among different groups using chi-square test and independent t-test. p value <0.05 was considered as statistically significant.

Result:

A total of 149 participants were included for the final analysis. The mean ± SD of the participants was 50.45 ± 14.43 years and it ranged from 13 to 93 years. Majority of them were male (n=91, 61.1%).

Participants in the diabetic group were older (mean age) compared to the non-diabetic group (55.15 vs 43.67, p <0.001). There were no significant differences in gender between the groups (p=0.668). CT severity score was moderate to severe for most of the participants in the diabetic group which is comparatively higher than the non-diabetic group (97.8% vs 39.4%, p<0.001). C-reactive protein was mostly elevated in the diabetic group compared to the non-diabetic group (98.9% vs 31.1%, p<0.001). The slope of linear fits of this data was 0.059 and intercept was -1.34, indicating a maximum change in the chest severity score when there is an increase in the random blood sugar level (Figure 3)

Table 1: Demographic and clinical factors

	n=149(%)
Age category	
≤40 years	41 (27.5)
41 – 60 years	72 (48.3)
>60 years	36 (24.2)
Gender	
Male	91 (61.1)
Female	58 (38.9)
Diabetes status	
Diabetic	88 (59.1)
Non-diabetic	61 (40.9)
Chest severity score	
Normal	15 (10.1)
Mild	24 (16.1)
Moderate	63 (42.3)
Severe	47 (31.5)
C-reactive protein	
Normal	43 (28.9)
Elevated	106 (71.1)

Table 2: Comparison of demographic and clinical parameters between diabetic and non-diabetic

	Diabetic N=88(59.1%)	**Non-diabetic N=61 (40.9%)**	**P value**
Age, mean (SD)	55.15 (11.46)	43.67 (15.62)	<0.001††
Age category			
≤40 years	10 (11.4)	31 (50.8)	
41 – 60 years	47 (53.4)	25 (41.0)	
>60 years	31 (35.2)	5 (8.2)	<0.001†
Gender			
Male	55 (62.5)	36 (59.0)	
Female	33 (37.5)	25 (41.0)	0.668†
Chest severity score			
Normal	-	15 (24.6)	
Mild	2 (2.2)	22 (36.1)	
Moderate	43 (48.9)	20 (32.8)	
Severe	43 (48.9)	4 (6.6)	<0.001†
C-reactive protein			
Normal	1 (1.1)	42 (68.9)	
Elevated	87 (98.9)	19 (31.1)	<0.001†

††Independent t-test**,** †Chi square test

Figure 1:Bar chart showing the distribution of CTSS in patients without and with DM CTSS: chest computed tomography severity score; DM: diabetes mellitus

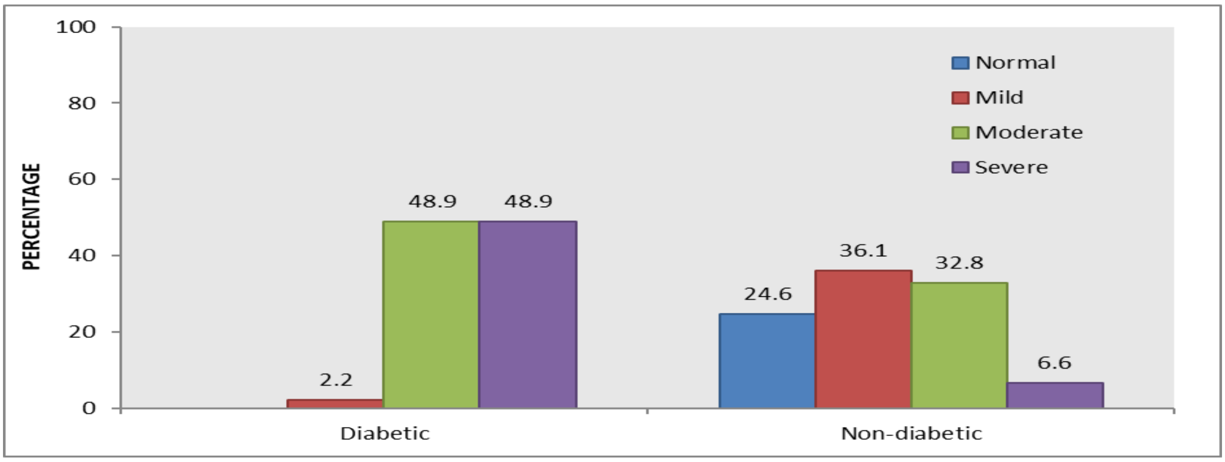


Figure 2 showing the comparison of C-reactive protein between the diabetic and non-diabetic group

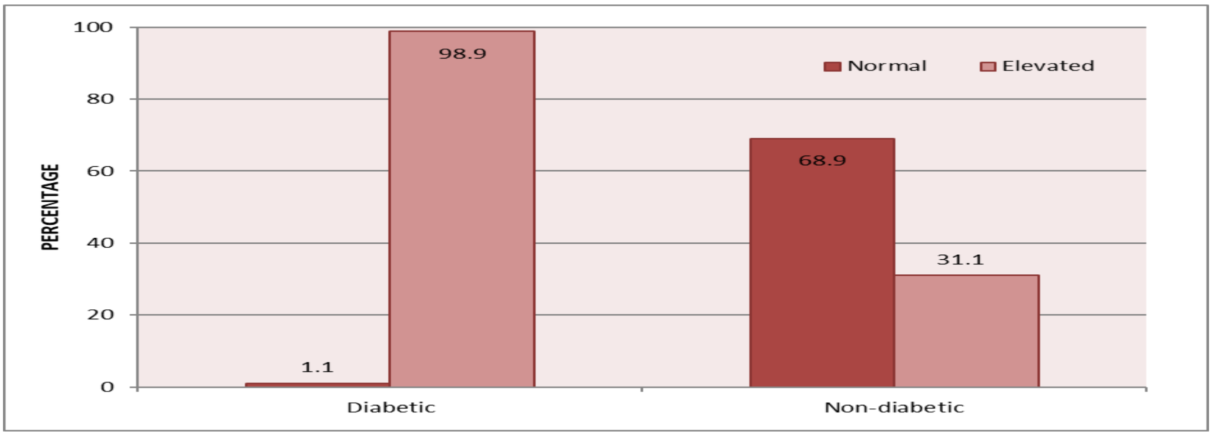
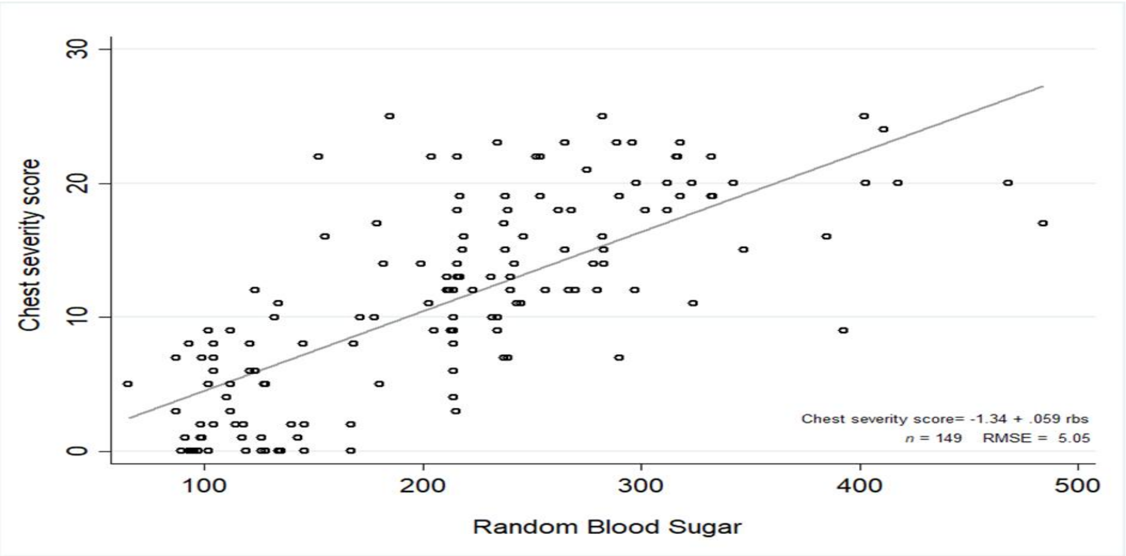


Figure 3: Scatter plot with regression line showing the effect of random blood sugar in the chest severity score



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Discussion:

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a highly transmissible and pathogenic virus that emerged in late 2019 causing acute respiratory disease, which is a threaten to human health and public safety [11]

Recently COVID-19 is on focus and several investigations have highlighted on diabetes as a predictor of clinical course and prognosis of COVID-19[12]

Diabetes is one of the most common disease that leads to multiple complications. In addition to this, COVID-19 the novel viral respiratory illness worsens the condition [13]. Certain studies found that diabetes negatively affected medical complication, including mortality in COVID-19 cases [14]. Hyperglycaemia is correlated with high levels of inflammation & massive release of cytokines which may lead to increased insulin resistance. The over production of pro-inflammatory cytokines (TNFα, IL-6, IL- 1ß) results in 'cytokine storm' which leads to high risk of vascular hyperpermeability, multiorgan failure, and death [15]

In this study we analysed various parameters which includes percentage of COVID-19 positive patients with pre-existing diabetes, the CT chest severity pattern, inflammatory marker C-Reactive Protein and its comparison with those patients who are non-diabetic.

In our study it shows that out of 149 COVID-19 positive patients, 88 patients (59.1%) were diabetic whereas 61 patients (40.9%) were non-diabetic. Patients in the diabetic group were older (mean age-55.15) when compared to the non-diabetic group (mean age-43.67). In another study Zeming Liu et al also found that COVID-19 patients with DM were older than COVID-19 patients without DM.

It also shows that with increasing random blood sugar level the lung involvement is high. A high CT severity score indicates extensive lung involvement in uncontrolled diabetic patient. In a study conducted by Sudhir et al the CT severity score was significantly higher in uncontrolled diabetes group.

The patient's CT chest severity and C-Reactive proteins were checked & compared between the diabetic & non -diabetic group. It showed the CT chest severity was moderate [n-43 (48.9%)] to severe [n-43 (48.9%)] among the diabetic patients which is much higher when compared to non-diabetic group. In a study of Weina Guo et al the diabetes group was presented with higher CT imaging score compared with non-diabetes group. And, the biochemical results showed that the indicative enzymes were abnormally elevated in the blood of patients with SARS-CoV-2 pneumonia. Similarly, the C-Reactive Protein levels were elevated among the diabetic group [n-87 (98.9%)] compared to the non-diabetic ones.

In Weina Guo et al, it has shown that the serum levels of some inflammation-related biomarker were much higher compared to those without diabetes, such as IL-6, serum ferritin, ESR & CRP. In Varsha Rangankar et al the proportion of patients with severe form of COVID-19 lung involvement was higher in patients with DM compared to patients without DM.

The relationship between COVID-19 and diabetes might be bidirectional, with SARS-CoV-2 exacerbating underlying diabetes or perhaps predisposing non-diabetic individual to diabetes.

Conclusion:

The study indicates that patients with diabetes are prone to inflammatory storm, which eventually lead to rapid deterioration of COVID-19. Our study has shown that the diabetic patients are at a higher risk in developing severe form of COVID-19 with increased CT chest severity score and elevated CRP levels than the non-diabetic patients. This gives a guidance for the clinicians in managing COVID-19 patients with diabetes.

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Conflict Of Interest:

The authors declare that there is no conflict of interest.

Author's Contribution:

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Reference:

1. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China - PubMed. PubMed 2020. https://pubmed.ncbi.nlm.nih.gov/31986264/ (accessed August 19, 2022).

2. World Health Organization Novel Coronavirus (2019-nCoV)Available at https://www.who.int/emergencies/diseases/novel-coronavirus-2019. Accessed February 7, 2020

3. https://www.cdc.gov/coronavirus/2019-ncov/your-health/about-covid-19/basics-covid-19.html

4. https://www.ncbi.nlm.nih.gov/books/NBK554776/

5. Rangankar V, Koganti DV, Lamghare P, Prabhu A, Dhulipala S, Patil P, et al. Cureus | Correlation Between CT Severity Scoring and Diabetes Mellitus in Patients With COVID-19 Infection. Correlation Between CT Severity Scoring and Diabetes Mellitus in Patients With COVID-19 Infection 2021. https://www.cureus.com/articles/79634-correlation-between-ct-severity-scoring-and-diabetes-mellitus-in-patients-with-covid-19-infection (accessed August 18, 2022).

6. [12]Vij A, Choudhary S, Mittal C, Gupta A, Moolrajani K. Journal of Mahatma Gandhi University of Medical Sciences and Technology. Journal of Mahatma Gandhi University of Medical Sciences and Technology n.d. https://www.jmgumst.com/abstractArticleContentBrowse/JMGUMST/47/6/2/24921/abstractArticle/Article (accessed August 19, 2022).

7. Impact of glycemic control in diabetes mellitus on management of COVID-19 infection - PubMed. PubMed 2020. https://pubmed.ncbi.nlm.nih.gov/32905072/ (accessed August 19, 2022).

8.Li G, Chen Z, Lv Z, Li H, Chang D, Lu J, et al. Diabetes Mellitus and COVID-19: Associations and Possible Mechanisms. Diabetes Mellitus and COVID-19: Associations and

ISSN 2515-8260 Volume 09, Issue 06, 2022

Possible Mechanisms 2021. https://www.hindawi.com/journals/ije/2021/7394378/ (accessed August 18, 2022).

9. Rangankar V, Koganti DV, Lamghare P, Prabhu A, Dhulipala S, Patil P, et al. Cureus | Correlation Between CT Severity Scoring and Diabetes Mellitus in Patients With COVID-19 Infection. Correlation Between CT Severity Scoring and Diabetes Mellitus in Patients With COVID-19 Infection 2021. https://www.cureus.com/articles/79634-correlation-between-ct-severity-scoring-and-diabetes-mellitus-in-patients-with-covid-19-infection (accessed August 19, 2022).

10.The role of C-reactive protein as a prognostic marker in COVID-19 - PubMed. PubMed 2021. https://pubmed.ncbi.nlm.nih.gov/33683344/ (accessed August 19, 2022).

11.Das S, Sen KK, Menon SM, Bhuyan D, G MK, Kuniyil J. Evaluation of HRCT chest features in COVID 19 patients with pre-existing comorbidity and clinical correlation | International Journal of Health and Clinical Research. Evaluation of HRCT Chest Features in COVID 19 Patients with Pre-Existing Comorbidity and Clinical Correlation | International Journal of Health and Clinical Research 2021. https://ijhcr.com/index.php/ijhcr/article/view/1568 (accessed August 19, 2022).

12.Hyperglycemia and Correlated High Levels of Inflammation Have a Positive Relationship with the Severity of Coronavirus Disease 2019 - PubMed. PubMed 2021. https://pubmed.ncbi.nlm.nih.gov/33814982/ (accessed August 19, 2022)..

13.Liu Z, Li J, Huang J, Guo L, Gao R, Luo K, et al. Frontiers | Association Between Diabetes and COVID-19: A Retrospective Observational Study With a Large Sample of 1,880 Cases in Leishenshan Hospital, Wuhan. Frontiers 2001. https://www.frontiersin.org/articles/10.3389/fendo.2020.00478/full (accessed August 19, 2022).

14. Adverse outcomes in COVID-19 and diabetes: a retrospective cohort study from three London teaching hospitals - PubMed. PubMed 2021. https://pubmed.ncbi.nlm.nih.gov/33408084/ (accessed August 19, 2022).

15.Diabetes is a risk factor for the progression and prognosis of COVID-19 - PubMed. PubMed 2020. https://pubmed.ncbi.nlm.nih.gov/32233013/ (accessed August 19, 2022).