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Correlation of HBA1C values and CT severity scores in patients with RT-PCR proven Covid-19 Pneumonia

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Abstract
AIM: Our study aims to identify the role of glycemic control in predicting the CT severity in patients with COVID-19 pneumonia.
Materials and Methods: Our study is a single-centre, retrospective, observational study of 60 patients with RT-PCR proven COVID-19 Pneumonia admitted to Kamineni Institute of Medical Sciences, Narketpally from June 2020 to September 2020. 30 patients with diabetes were taken as cases and 30 patients who were non-diabetic were taken as controls. Patient's age, sex, baseline HbA1c levels and CT severity scores were analysed using Statistical Package for the Social Sciences (SPSS) software version 22.0. The Chi-square test was used to analyse qualitative data and p-value significant at level <0.05.
Results and Discussion: In the study among diabetics, 23.3% had mild, 43.3% had moderate and 33.3% had severe CT score and among non-diabetics, 33.3% had mild, 46.7% had moderate and 20% had severe CT score. There was no significant difference in CT severity score between two groups.
Conclusion: In this study among diabetics there was significant positive correlation between HbA1c and CT severity score i.e. increasing HbA1c, there was increase in CT severity score and vice versa.

Keywords: HbA1c, CT severity score, RT-PCR Positive, COVID-19 Pneumonia, SARS-CoV 2

Introduction
COVID-19 disease caused by (SARS-CoV-2) virus that damages lung and immune system [1] has resulted in large number of deaths worldwide. WHO declared COVID-19 outbreak a pandemic on March 11, 2020 [2, 3].
RT-PCR is currently considered a gold standard for diagnosis having a sensitivity of 60-70% [4]; pooled sensitivity of 89% [5]. It has been reported that diabetics who get COVID-19 develop more severe inflammation and have a higher mortality rate [6]. The prognosis of COVID-19 patients is linked to systemic inflammation, hypercoagulability, and glycated hemoglobin [7].
Type 2 diabetes has been linked to a higher severity and fatality rate in COVID-19 infections. In terms of insulin administration and non-invasive ventilation, COVID-19 patients with uncontrolled diabetes required more intense treatment than those with controlled diabetes [8]. HbA1c is the gold standard for determining blood glucose levels since it offers an average value over the previous three months, and a high HbA1c level (greater than 8%) is linked to a higher risk for COVID-19 infection and it's severity in terms of clinical presentation, inflammatory storm, fast lung invasion, need for more intensive therapy, and poor outcome in diabetes patients [8, 9].
Severe COVID-19 Pneumonia can cause lethal consequences such pneumonia, acute respiratory distress syndrome (ARDS), multi-organ failure, septic shock, and disseminated intravascular coagulation, all of which can lead to death [10, 11].

Materials and Methods
Our study is a single-centre, retrospective, observational study. 60 patients who are diagnosed with COVID 19 pneumonia by RT-PCR and admitted to Kamineni Institute of Medical Sciences, Narketpally from June 2020 to September 2020 have been enrolled into the study. This retrospective study is approved by institutional review board and Informed consent was waived.

30 patients with diabetes were taken as cases and 30 patients who were non-diabetic were taken as controls Demographic data including patient's age sex etc, baseline HbA1c levels have been obtained from medical records. HbA1C levels were categorized as normal(less than 5.7%), pre-diabetic (5.7 to 6.5%) and diabetic range (greater than 6.5%) [12].
HRCT Chest was performed on all the patients using Toshiba Alexion 16 slice CT imager and was reported by two different radiologist with 5 years and 12 years' experience respectively. Chest CT severity scores were categorized as mild (7 or less) and moderate (8 to 17) and severe (18 or more) [13]. HbA1C levels of both cases and controls were correlated with HRCT Chest CT severity scores. All the information was recorded onto a proforma and Hb1Ac levels of cases and controls were correlated with their respective HRCT Chest CT severity scores.

Statistical analysis
Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square test was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation. Independent t test or Mann Whitney U test was used as test of significance to identify the mean difference between two quantitative variables and qualitative variables respectively.
Pearson correlation or Spearman's correlation was done to find the correlation between two quantitative variables and qualitative variables respectively.

Correlation coefficient (r)	Interpretation
0 - 0.3	Positive Weak correlation
0.3-0.6	Positive Moderate correlation
0.6-1.0	Positive Strong correlation
0 to (-0.3)	Negative Weak correlation
(-0.3) to (-0.6)	Negative Moderate Correlation
(-0.6) to – (1)	Negative Strong Correlation

Graphical representation of data: MS Excel and MS word was used to obtain various types of graphs such as bar diagram, and Scatter plots.
p value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Statistical software: MS Excel**,** SPSS version 22 **(**IBM SPSS Statistics, Somers NY, USA) was used to analyze data [14, 15, 16].

Results

Table 1: Age and Sex distribution comparison between two groups

		Group				P value
		Diabetic		Non Diabetic		
		Count	%	Count	%	
Age	<40 years	8	26.7%	8	26.7%	0.780
	41 to 50 years	8	26.7%	11	36.7%	
	51 to 60 years	7	23.3%	7	23.3%	
	61 to 70 years	5	16.7%	2	6.7%	
	>70 years	2	6.7%	2	6.7%	
	Mean & SD	49.3	12.5	49.0	11.9	0.916
Gender	Female	7	23.3%	9	30.0%	0.559
	Male	23	76.7%	21	70.0%	

Mean age of diabetic group was 49.3 ± 12.5 years and in Non-diabetics was 49.0 ± 11.9 years. There was no significant difference in mean age between two groups.

In both groups, majority of subjects were males. There was no significant difference in gender distribution between two groups.

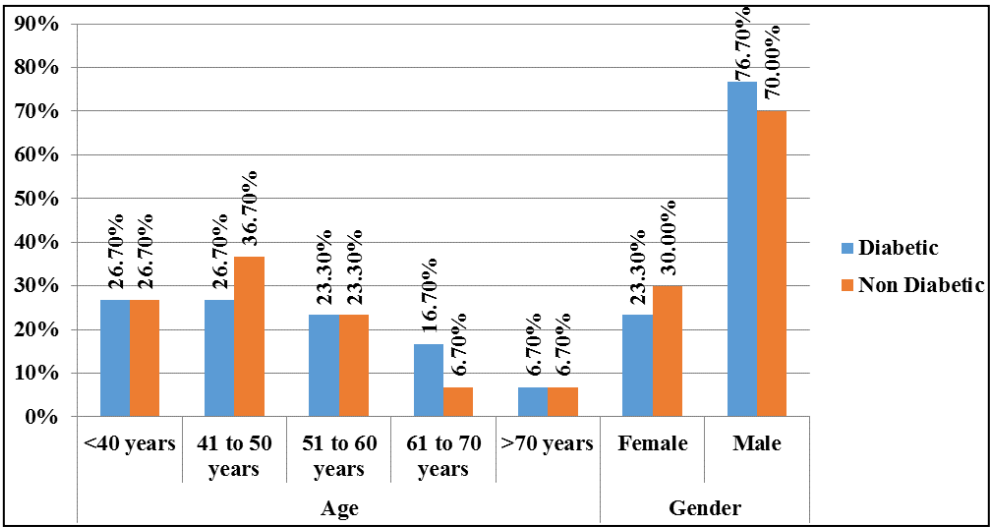

Fig 1: Bar diagram showing Age and Sex distribution comparison between two groups
Table 2: Severity of glycemic control comparison between two groups

		Group			
		Diabetic		Non Diabetic	
		Count	%	Count	%
Severity of glycemic control	Normal range	2	6.7%	30	100.0%
	Pre-diabetic range	7	23.3%	0	0.0%
	Diabetic range	21	70.0%	0	0.0%

$\chi 2 = 52.5$, df =2, p <0.001*

In Diabetic group, 6.7% had normal range, 23.3% had pre diabetic range and 70% had diabetic range HbA1c and in Non-diabetic group, 100% had normal range of HbA1c.

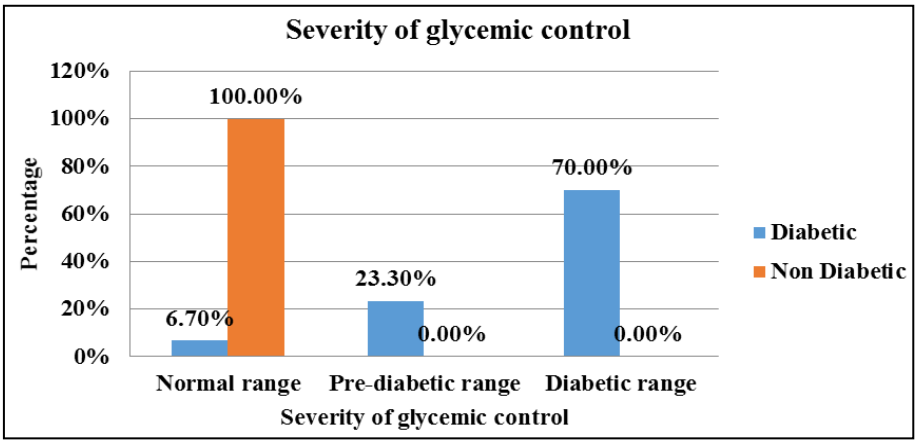

Fig 2: Bar diagram showing Severity of glycemic control comparison between two groups

Table 3: HbA1c level comparison between two groups

		HbA1c level			P value
		Mean	SD	Median	
Group	Diabetic	8.1	2.1	7.8	<0.001*
	Non Diabetic	5.0	0.3	4.9	

Mean HbA1c in diabetic group was 8.1 ± 2.1 gm% and in Non-diabetic group was 5.0 ± 0.3 gm%. There was significant difference in mean HbA1c between two groups.

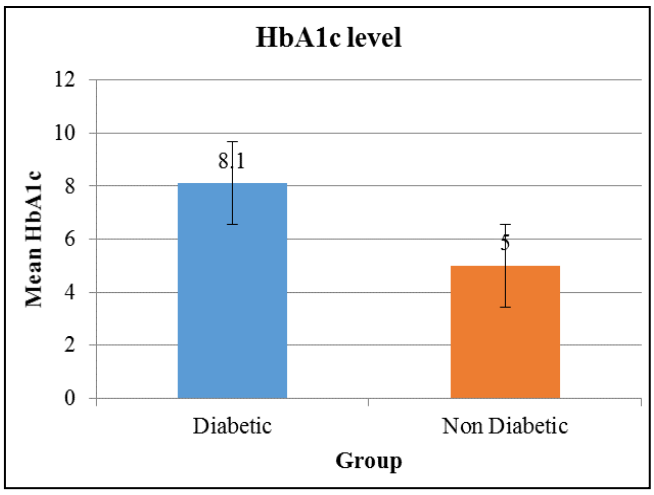

Fig 3: Bar diagram showing HbA1c level comparison between two groups

Table 4: CT severity score comparison between two groups

		CT severity score (out of 25)			P value
		Mean	SD	Median	
Group	Diabetic	14.3	6.6	15.5	0.051
	Non Diabetic	10.9	6.7	10.0	

Mean CT severity score in Diabetics was 14.3 ± 6.6 and in Non-Diabetic group was 10.9 ± 6.7. There was no significant difference in mean CT severity score between two groups

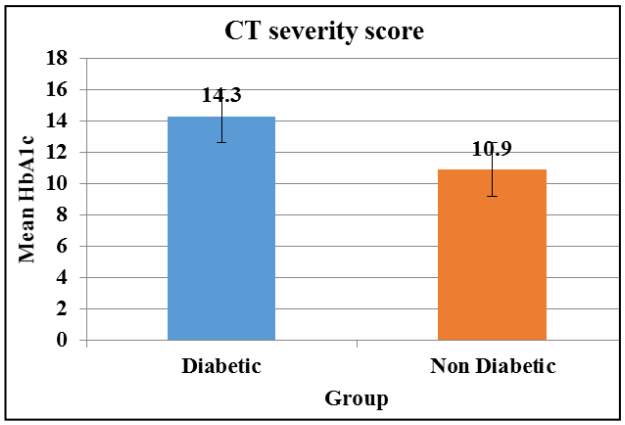

Fig 5: Bar diagram showing CT severity score comparison between two groups

Table 5: CT severity score comparison between two groups

		Group			
		Diabetic		Non Diabetic	
		Count	%	Count	%
CT severity	Mild	7	23.3%	10	33.3%
	Moderate	13	43.3%	14	46.7%
	Severe	10	33.3%	6	20.0%

$\chi 2 = 1.566$, df =2, p = 0.457

In the study among diabetics, 23.3% had mild, 43.3% had moderate and 33.3% had severe CT score and among non-diabetics, 33.3% had mild, 46.7% had moderate and 20% had severe CT score. There was no significant difference in CT severity score between two groups.

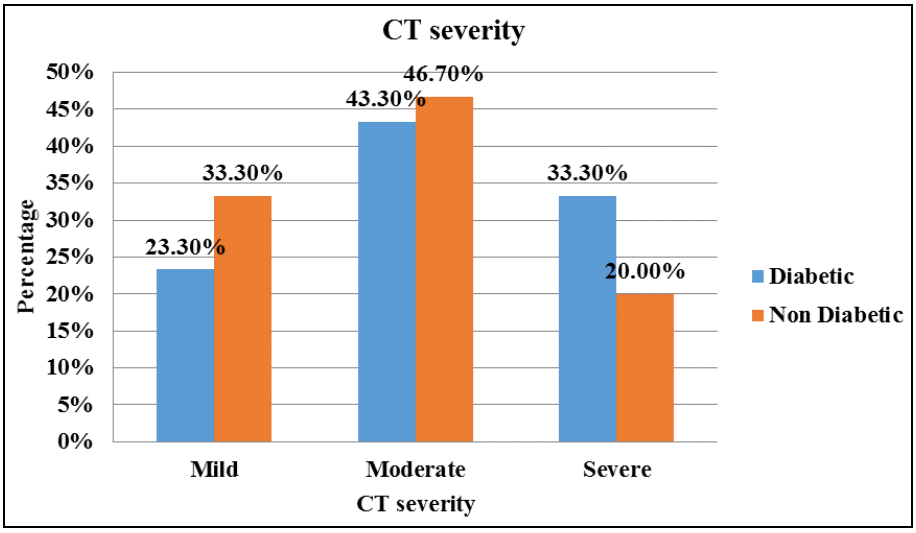

Fig 5: Bar diagram showing CT severity score comparison between two groups

Table 6: Correlation between HbA1c and CT Severity Score in all the patients

		HbA1c level	CT severity score (Out of 25)
HbA1c level	Pearson Correlation (r)	1	0.337**
	P value		0.009*
	N	60	60

**. Correlation is significant at the 0.01 level (2-tailed).

In our study, there was significant positive correlation between HbA1c and CT severity score i.e. with increase in HbA1c, there was increase in CT severity score and vice versa.

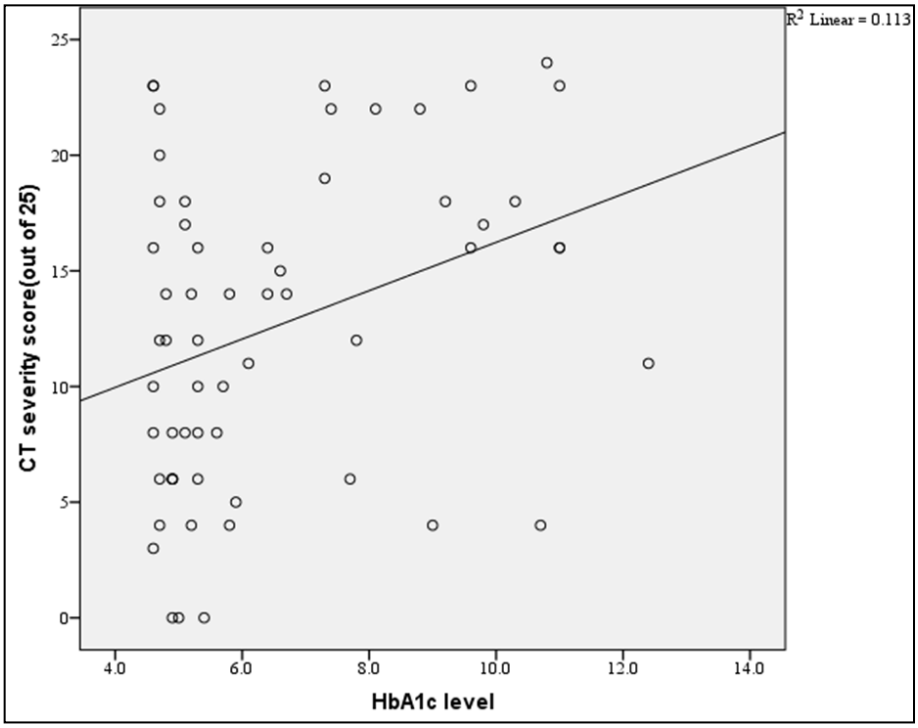

Fig 6: Scatter plot showing Positive Correlation between HbA1c and CT Severity Score in all the patients

Table 7: Correlation between HbA1c and CT Severity Score among diabetics

		HbA1c level	CT severity score (out of 25)
HbA1c level	Pearson Correlation (r)	1	0.381*
	P value		0.038*
	N	30	30

In our study among diabetics, there was significant positive correlation between HbA1c and CT severity score i.e. with increase in HbA1c, there was increase in CT severity score and vice versa.

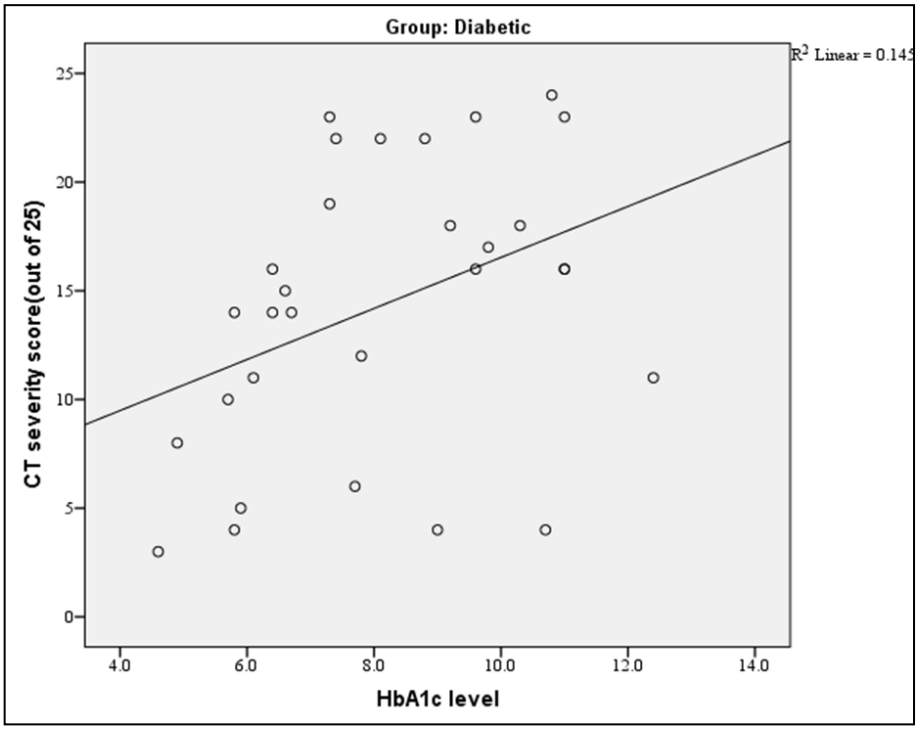

Fig 8: Scatter plot showing Positive Correlation between HbA1c and CT Severity Score among diabetics

Table 8: Correlation between HbA1c and CT Severity Score among Non-diabetics

		HbA1c level	CT severity score (out of 25)
HbA1c level	Pearson Correlation (r)	1	-0.351
	P value		0.057
	N	30	30

In our study among non-diabetics, there was negative correlation between HbA1c and CT severity score i.e. with increase in HbA1c, there was decrease in CT severity score and vice versa. However the correlation was not statistically significant.

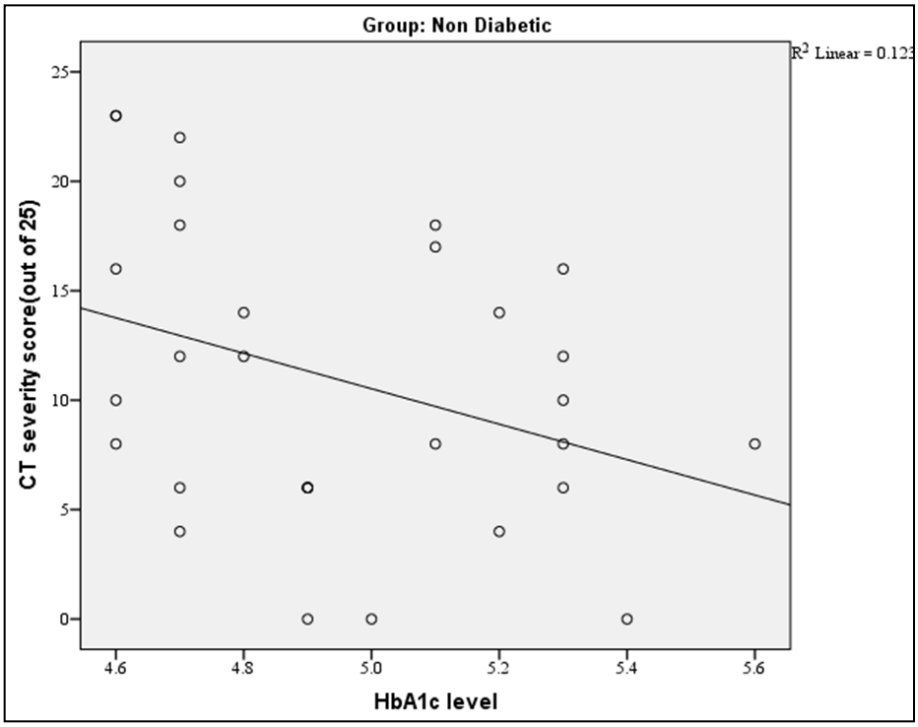

Fig 8: Scatter plot showing negative Correlation between HbA1c and CT Severity Score among Non-diabetics

Discussion

Diabetes mellitus is already a main cause of morbidity in the world, with the ability to affect practically every system of the body [17]. As a result, diabetics may develop a dysregulated immune system, exposing them to a variety of infections [18].

In uncontrolled diabetes, radiological abnormalities revealed by chest radiograph and computed tomography chest suggested life- threatening involvement. The study's baseline CXR findings revealed that uncontrolled diabetic patients had a larger proportional lung involvement than those with controlled diabetes. Furthermore, in uncontrolled diabetic individuals, a high CT severity score indicated significant lung involvement [8].

Our study is a retrospective study aimed to predict prognosis in Covid 19 patients if glycated hemoglobin, in addition to identifcation of hyperglycemia, can help assess severity of disease (comparing radiological involvement) and predict prognosis in COVID -19 patients.

Based on strong association between uncontrolled HbA1c levels and severe lung involvement, higher oxygen requirement and hypercoagulability, this commonly available test can be used in covid-19 patients for early triage, proper resource allocation and optimal monitoring at the time of admission so as to guide patient management according to the risk assessment [19].

Mean age of diabetic group in our study was 49.3 ± 12.5 years and in Non-diabetics was 49.0 ± 11.9 years. There was no significant difference in mean age between two groups.

In both groups, majority of subjects were males. There was no significant difference in gender distribution between two groups.

In Diabetic group, 6.7% had normal range, 23.3% had pre diabetic range and 70% had diabetic range HbA1c and in Non diabetic group, 100% had normal range of HbA1c.

Mean HbA1c in diabetic group was 8.1 ± 2.1 gm% and in Non diabetic group was 5.0 ± 0.3 gm%. There was significant difference in mean HbA1c between two groups.

Mean CT severity score in Diabetics was 14.3 ± 6.6 and in Non-Diabetic group was 10.9 ± 6.7. There was no significant difference in mean CT severity score between two groups.

In our study among diabetics, 23.3% had mild, 43.3% had moderate and 33.3% had severe CT score and among non-diabetics, 33.3% had mild, 46.7% had moderate and 20% had severe CT score. There was no significant difference in CT severity score between two groups.

There was significant positive correlation between HbA1c and CT severity score i.e. with increase in HbA1c, there was increase in CT severity score and vice versa.

Conclusion

Among diabetics there was significant positive correlation between HbA1c and CT severity score i.e. with increase in HbA1c, there was increase in CT severity score and vice versa. Among non-diabetics, there was negative correlation between HbA1c and CT severity score i.e. with increase in HbA1c, there was decrease in CT severity score and vice versa. However the correlation was not statistically significant.

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References

1. Zhenzhou W, Zhe D, Zhu Fengxue Z. Glycosylated hemoglobin is associated Zith systemic infammation hypercoagulability, and prognosis of COVID-19 patients. Diabetes Res Clin Pract 2020;164:108214. https://doi.org/10.1016/j.diabres.2020.108214
2. WHO. Coronavirus disease (COVID-19) outbreak. 2020; https://www.who.int/emergencies/diseases/novel-coronavirus-2019 (accessed Apr 30, 2020).
3. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, *et al*. A novel coronavirus from patients with pneumonia in China. N Engl J Med 2019:382(8):727-733.
4. Fang Y, Zhang H, Xie J, *et al*. Sensitivity of Chest CT for COVID-19: Comparison to RT-PCR. Radiology. February 2020:200432. doi:10.1148/radiol.2020200432
5. Kim H, Hong H, Yoon SH. Diagnostic Performance of CT and reverse transcriptase-polymerase chain reaction for Coronavirus Disease 2019: A meta-analysis [published online ahead of print, 2020 Apr 17]. Radiology. 2020, 201343. doi:10.1148/radiol.2020201343
6. Zhonghua Liu Xing Bing Xue Za Zhi. Novel Coronavirus Pneumonia Emergency Response Epidemiology TeamThe epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China 2020;41:145-151.
7. Zhenzhou Wang, Zhe Du, Fengxue Zhu, Trauma Center. National Center for Trauma Medicine, Key Laboratory of Trauma and Neural Regeneration, Peking University People's Hospital, Beijing 100044, China Impact of glycemic control in diabetes mellitus on management of COVID-19 infection
8. Bhandari S, Rankawat G, Singh A, Gupta V, Kakkar S. Research Society for Study of Diabetes in India 24 August 2020.
9. Nalysnyk L, Hernandez-Medina M, Krishnarajah G. Glycaemic variability and complications in patients with diabetes mellitus: evidence from a systematic review of the literature. Diabetes Obes Metab 2010;12:288-298
10. Hui DS, Azhar E, Madani TA, Ntoumi F, *et al*. The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health. The latest 2019 novel coronavirus outbreak in Wuhan, China. Int J Infect Dis. 2019;91:264-6.
11. Murthy S, Gomersall CD, Fowler RA. Care for critically ill patients with COVID19. JAMA. 2020;323(15):1499.
12. Kishan JH, Kumar VS. Role of Glycaemic Control in Predicting Severity of Illness in COVID-19 Patients with Diabetes Mellitus 2021;15(5):OC25-OC27. https://www.doi.org/10.7860/JCDR/2021/48021/14934
13. Saeed GA, Gaba W, Shah A, Al Helali AA, Raidullah E, Al Ali AB, *et al*. Correlation between Chest CT Severity Scores and the Clinical Parameters of Adult Patients with COVID-19 Pneumonia. Radiol Res Pract. 2021 Jan 6;2021:6697677. doi: 10.1155/2021/6697677. PMID: 33505722; PMCID: PMC7801942.
14. Dakhale GN, Hiware SK, Shinde AT, Mahatme MS. Basic biostatistics for post-graduate students. Indian J Pharmacol 2012;44(4):435-442.
15. Sunder Rao PSS, Richard J. An Introduction to Biostatistics, A manual for students in health sciences,

New Delhi: Prentice hall of India. 4th edition 2006, 86-160.
16. Elenbaas, RM, Elenbaas, JK, Cuddy PG. Evaluating the medical literature, part II: Statistical analysis. Ann Emerg Med 1983;12:610-620.
17. Knapp S. Diabetes and infection: is there a link mini-review. Gerontology 2013;59(2):99-104.
18. Hodgson K, Morris J, Bridson T, Govan B, Rush C, Ketheesan N. Immunological mechanisms contributing to the double burden of diabetes and intracellular bacterial infections. Immunology 2015;144(2):171-85.
19. Gupta P, Halani A, Samuel T, Singh DP. Association of inflammatory biomarkers with radiological severity for COVID-19 patient risk stratification: An Indian perspective. Asian Journal of Medical Sciences 2021;12(4):1-7.
https://doi.org/10.3126/ajms.v12i4.33483