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Predictive value of HbA1c for in-hospital adverse prognosis in COVID-19

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Abstract---HbA1c is considered the gold standard for evaluating blood glucose level and provides an average value of the past 3 months, and high HbA1c level is related to the risk of complications in diabetic patients. However, whether the increase in HbA1c level is related to high inflammation, hypercoagulability, and mortality in COVID-19 patients has not been reported. We performed a retrospective study to evaluate the effect of high HbA1c level on mortality and inflammation in COVID-19 patients with abnormal glucose metabolism. Prognosis may be more sinister in patients with higher HbA1c than in patients with lower HbA1c. More research data and knowledge are currently being collected to improve our insights into this constellation and to guide therapies in clinical reality. It's believed that the virus damages certain kinds of cells — known as beta cells — that are found in the pancreas. They are found within another kind of cell known as an islet cell (more on islet cells below). The destruction of these beta cells prevent the body from making insulin — triggering hyperglycemia (or high blood sugar). Because, in this case, the body needs glucose as energy (but can't use it), it turns to ketones, chemicals the liver makes when you don't have enough insulin, for energy. The use of ketones signals the production of acids, which can also lead to a condition called diabetic ketoacidosis (DKA), a potentially-fatal condition. **Materials and Methods:** This is a single hospital based retrospective observational type of study. **Results:** All the patients were asked detailed history about preexisting comorbidities, which decreases the chance of false positive result of study. It was found that higher HbA1c was significantly related to increased hospital mortality compared with groups with lower HbA1c. **Conclusion:** Prolonged uncontrolled hyperglycemia increases the risk of adverse prognosis in COVID-19. Patients with higher HbA1c should be

monitored strictly to minimize the risk of adverse prognosis in COVID-19.

Keywords---COVID-19, blood glucose, HbA1c, predictive value.

Introduction

The epidemic of COVID-19 has spread rapidly worldwide. The manifestations of severe cases with COVID-19 can develop into acute respiratory distress syndrome (ARDS) and multiple organ dysfunction syndrome (MODS). Identifying the risk factors associated with the progress of COVID-19 is essential to guide clinicians to carry out targeted therapy. Data has showed that patients with poor glucose control have a higher mortality of other viral epidemics such as H1N1 flu and SARS. Currently, the inclusion of diabetes status estimation is strongly supported by the evidence on the risk management of COVID-19 patients. Glycosylated hemoglobin (HbA1c) is a stable index of long-term glucose control and provides an average value of the past 3 months. It can be used to assess diabetes status to identify high-risk individuals of COVID-19 with low awareness of diabetes. Compared with several risk elements identified for COVID-19-related mortality such as advanced age, HbA1c can be improved through health-care interventions and easily available in daily practice. Thus, HbA1c may be used for efficient risk assessment of COVID-19. So far, some studies have found that HbA1c is independently associated with hospital mortality, while others got opposite results. In conclusion, the relationship between HbA1c and severe COVID-19 in diabetic and non-diabetic individuals is still unclear. The predictive value of HbA1c for adverse prognosis in patients with COVID-19 needs to be examined. This study therefore carried out the meta-analysis of retrospective and prospective cohort studies to estimate if higher HbA1c levels are associated with adverse prognosis of COVID-19 patients.

Table1: Distribution of Cases according to Hba1c levels

	N	%
Hba1c > 7.0	118	28.7%
Hba1c < 7.0	293	71.3%
Total	411	100.0%

In the present study total 411 cases were included .Out of which 28.7% were found to have Hba1c > 7.0, which is very significant. Remaining 71.3% had Hba1c level <7.0.

Distribution of parameters according to DM

Table 2: Distribution of HRCT according to DM

Parameters	Hba1c > 7.0		Hba1c < 7.0		p value
	Mean	SD	Mean	SD	

D-dimer	4.2	39.5	3.1	26.1	0.735
Ferritin	182.2	192.0	171.3	217.6	0.635

The following data shows the HRCT score of patients having HbA1c >7.0 and patients having HbA1c < 7.0. Among patients having HbA1c >7.0, most of the patients have been found to have higher HRCT score compared to patients having HbA1c < 7.0. This indicates that patients having HbA1c >7.0 in association with COVID 19 infection leads to significant lung damage.

Table 3: Distribution of PFT according to DM

HRCT	HbA1c > 7.0		HbA1c < 7.0		p value
	N	%	N	%	
<5%	1	0.8%	16	5.5%	<0.001(sig)
5-10%	1	0.8%	64	21.8%	
10-15%	10	8.5%	19	6.5%	
15-20%	17	14.4%	34	11.6%	
20-25%	19	16.1%	49	16.7%	
25-30%	14	11.9%	58	19.8%	
30-40%	21	17.8%	27	9.2%	
40-50%	29	24.6%	22	7.5%	
50-60%	1	0.8%	3	1.0%	
60-70%	3	2.5%	0	0.0%	
70-80%	2	1.7%	1	0.3%	
Total	118	100.0%	293	100.0%	

The following data shows the result of pulmonary function test and HbA1c level comparison. Results of patients having HbA1c >7.0 and patients having HbA1c < 7.0. Among patients having HbA1c >7.0, most of the patients have been found to have more severe lung obstruction compared to patients having HbA1c < 7.0. This indicates that patients having HbA1c >7.0 in association with COVID 19 infection leads to significant lung obstruction.

PFT	HbA1c > 7.0		HbA1c < 7.0		p value
	N	%	N	%	
Mild obstructive	8	6.8%	19	6.5%	0.092
Mild Restrictive	6	5.1%	12	4.1%	
Mild Restrictive & obstructive	1	0.8%	32	10.9%	
Moderate obstructive	1	0.8%	7	2.4%	
Moderate Restrictive	1	0.8%	1	0.3%	
Moderate Restrictive & obstructive	10	8.5%	5	1.7%	
Severe Restrictive & obstructive	19	16.1%	2	0.7%	
Mixed Disorder	1	0.8%	0	0.0%	
Within normal limits	71	60.2%	215	73.4%	
Total	118	100.0%	293	100.0%	

Discussion

In this context, there is accumulating evidence that HbA1c >7.0, indicates a poor prognosis. Importantly, patients having HbA1c >7.0 is linked to increased mortality, as compared patients having HbA1c < 7.0 and normal glucose levels in patients with COVID-19. In the light of these findings, several leading diabetologists have established a global registry of patients with COVID-19-related DM to further investigate the intricacies and implications of these associations.

Our data suggests that HbA1c > 7.0 is important in deciding prognosis of patients infected with COVID 19. According to ,New England journal of medicine it is plausible that SARS-CoV-2 may cause pleiotropic alterations of glucose metabolism that could complicate the pathophysiology of preexisting diabetes or lead to new mechanisms of disease.

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