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*** Corresponding author**.

radiodiagnosis2020@gmail.com

Evaluation of Covid Severity in Diabetic vs Non-Diabetic Individuals using CT Severity Score

C R Raghavendra¹*, **G Yuvabalakumaran²**, **Reena Rajan³**, **R M Sidhesh⁴**, **S Mathavi⁵**

1 Junior Resident, Department of Radiology, Vinayaka Mission Kirupananda Variyar Salem, Tamil Nadu, India
2 Associate Professor, Department of Radiology, Vinayaka Mission Kirupananda Variyar Salem, Tamil Nadu, India
3 Assistant professor, Department of Microbiology, Vinayaka Mission Kirupananda Variyar Salem, Tamil Nadu, India
4 Assistant professor. Department of Radiology, Vinayaka Mission Kirupananda Variyar Salem, Tamil Nadu, India
5 Proffesor and Head of department, Department of Microbiology, Vinayaka Mission Kirupananda Variyar Salem, Tamil Nadu, India

Abstract

Background/Objectives: The Corona virus disease 2019 (Covid 19) pandemic has emerged as a great challenge to healthcare system with high rate of hospitalization and deaths. People with co morbidities such as diabetes are at increased risk of complications and Covid 19 associated deaths. The present study was done to evaluate Covid 19 severity among diabetic and nondiabetic patients using Chest CT severity score. **Methods:** A total of 106 Patients were subjected to standardized High Resolution Computed Tomography (HRCT) chest imaging. The analyzed images and Computed Tomography (CT) severity score was grouped into mild, moderate, severe and no lung involvement in both diabetic and nondiabetic group. **Findings:** Among the diabetic patients 39.47% showed CT severity score of 15-25 compared to 8.82% in nondiabetic patients**.** Lung involvement was observed in 89.47% diabetic compared to 88.24% nondiabetic patients. **Novelty:** Diffuse ground glass opacity involving all the lobes was observed among poorly controlled diabetic patients whereas patch ground glass opacity was observed among nondiabetic group. By chest CT severity scoring, the severity of lung involvement due to Covid 19 in Diabetes mellitus patients was found to be greater (39.47%) when compared to nondiabetic individual (8.82%).

Keywords: Computed Tomography chest imaging; Computed Tomography severity score; Diabetes mellitus; Lung involvement; Covid 19 severity

1 Introduction

Coronavirus disease 2019 (Covid 19) is an infectious respiratory illness caused by beta corona virus respiratory Corona virus syndrome corona virus 2(SARSCov-2).[1]

The invasion of SARS CoV-2 to host cells is mediated by the transmembrane spike (S) glycoproteins that form the viral surface. The entry of the SARS CotableV-2 into the host cells requires the cleavage of S protein at the junction between S1 subunit (host cell receptor) and S2 subunit (host cell membrane) by transmembrane protease serum protease 2(TMPRSS2). SARS CoV-2 enters the body through angiotensin converting enzyme 2 (ACE 2) receptors on host surface. The binding affinity between SARS CoV-2 and human ACE 2 was proposed to correlate with increased virus transmission and disease severity in humans. [1] [2] The virus then activates innate and adaptive immune response resulting in cytokine storm. Cytokine storm leads to inflammatory filtration, tissue destruction and multiorgan dysfunction. [3]

The severity of Covid 19 infection in Diabetes Mellitus patients have been attributed to impaired immunity, up regulation of ACE and potential changes in the glycation of ACE. SARS cov-2 attaches to ACE 2 in pancreatic islet cells, results in cell damage and acute hypoglycemia. People with diabetes develops deteriorating glycaemic control and those with type I diabetes may present with Ketoacidosis. [4,5] Hyperglycemia induced changes in coagulation, endothelial dysfunction and overproduction of inflammatory cytokines can lead to poor outcome and mortality. [6]

In patients with type II diabetes mellitus insulin resistance and altered glucose homeostasis leads to micro vascular damage and interstitial fibrosis through inflammation. Progression of Covid 19 pneumonia, thromboembolism events and lung function impairment was observed in patients with type II diabetes mellitus. [7] Poorly controlled diabetes may increase the severity of Covid 19 infection and is associated with increased morbidity and mortality. As a consequence of Diabetes Mellitus, increased ACE 2 glycation and TMPRSS expression in cardiomyocytes may favour the entry of virus in the host cell. This leads to worse clinical outcome and cardiovascular events in Covid 19 patients. Patients with hypertension have excessive inflammation mediated by ACE2, which alters heart structure through hypertrophy, interstitial fibrosis ,apoptosis and myocardial ischaemia. [8]

Diabetic patients are more likely to receive insulin and/or oral antidiabetic drugs for hyperglycaemia and such treatments may reduce the rise in free radicals and inflammation, and also decrease coagulability because of a reduced production of plasminogen activator inhibitor type-1 activity and proinsulin-like molecules, but higher IL-6 serum levels may blunt the effects of Tocilizumab therapy in hyperglycaemic patients. [9] The present study was undertaken to evaluate CT severity score due to Covid 19 among diabetic and non diabetic patients attending our hospital.

2 Materials and methods

This Prospective Cohort study was done at Department of Radio diagnosis, Vinayaka Mission's Kirupananda Variyar Medical College & Hospitals, Salem. A total of 106 patients(diabetic and non diabetic)who had underwent Chest CT and diagnosed for Covid 19 infection was included.

Pregnant patients and children less than 18 years old were excluded from this study. Data on demographic information such as age, gender & co morbidities such as diabetes, hypertension, lung disease etc were collected at the time of admission. Patients were subjected to standardized High Resolution Computed Tomography (HRCT) chest imaging. CT Images of all patients were reviewed independently by 2 experienced radiologists to avoid interobserver variation Figures 1 and 2 and the average CT severity score from two radiologists was used to calculate the severity of lung involvement as mild, moderate, severe and no lung involvement in both diabetic and nondiabetic group. Statistical analysis was done by entering data in Microsoft excel sheets and evaluated as frequencies and percentages.

3 Results

Out of 106 patients studied, 38(35.85%) were diabetic and 68(64.15%) were non diabetic. Lung involvement was observed in 89.47% diabetic compared to 88.24% non diabetic patients. Figure 1 In 38 diabetic patients 15(39.47%) showed severe lung involvement compared to 6 out of 68(8.82%) among non-diabetic patients.

Among the diabetic 10 out of 38 patients showed CT severity score of 9-14(Moderate) and 15 patients showed CT severity score of 15-25(Severe). Out of 68 non diabetic patients 26 showed CT severity score of 9-14(Moderate) and 6 showed CT severity score of 15-25(Severe). Figure 2

4 Discussion

Type I and Type II diabetes mellitus increases susceptibility to Covid 19 infection. [10] Obese patients and those with glucose intolerance reported to be particularly vulnerable to Covid 19 disease. Diabetes mellitus predispose to intense immune dysfunction and may result in severe late Covid 19 disease. [11] The higher case fatality rate among diabetic patients when compared with overall mortality rate among non diabetic Covid patients have been reported. [12] Diabetes is significantly
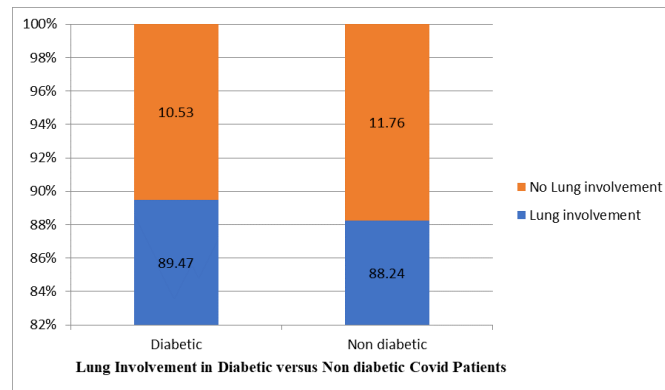
Fig 1. Percentage distribution of patients with lung involvement versus no lung involvement
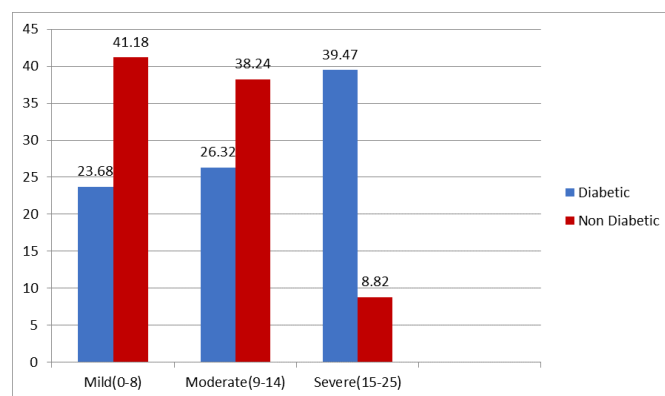
Fig 2. Chest CT severity score in diabetic and non diabetic patients

associated with development of acute respiratory distress syndrome and diabetic patients are at higher risk of need of intensive care.[13] The higher inflammatory serum markers, mainly D dimers in diabetic patients predispose to hypercoagulable state and are strongly linked to high mortality in Covid 19.[14] In type II diabetes mellitus CRP levels is a strong biomarker for disease progression and management.[8]

In the present study among diabetic, 39.47% patients showed severe lung involvement in comparison with 8.82 % of non diabetic patients. A diffuse ground glass opacity involving all the lobes was observed among Diabetic patients in our study. In Covid 19 patients, down regulation of ACE2 after SARS CoV -2 virus entry can lead to unopposed angiotensin II, which may impede insulin secretion. Angiotensin II increases pulmonary vascular permeability and worsens damage to lung parenchyma.[15] Pulmonary fibrosis seen in Covid 19 infection are more common in patients with poorly controlled diabetes.[16]

Guan et al. have reported the severity rates of Covid 19 disease significantly higher among diabetic patients when compared with non-diabetes.[17] High prevalence of diabetes among Covid patients with severe lung involvement was observed in various studies.[18–20] Well-controlled blood glucose was associated with markedly lower mortality among Covid patients when compared to those with poorly controlled blood glucose. Up regulation of the renin angiotensin-aldosterone system, oxidative stress, inflammation, and activation of the immune system likely contribute to the close relationship between diabetes and hypertension and severity in Covid 19 patients.[21]

Regular monitoring of blood glucose is important for management of patients with diabetes and COVID-19. In type 1 diabetes patients, monitoring of ketone levels are important to prevent the development of severe Covid 19 infection.

5 Limitation of the study

The vaccination status of the control group and study group was not assessed in the present study. Our study also limits in its failure to assess the role of inflammatory biomarkers in disease progression .

Table 1. Studies on severity of Lung involvement among diabetic and non diabetic patients

Various studies	Findings	
Chest CT severity score (15-25)	Diabetic patients (%)	Non diabetic patients (%)
Rangankar V et al [22]	29.3	11.7
Al Argan et al [23]	21.8	19.3
Wang G et al [24]	10.8	5.4
Present study	39.47	8.82

6 Conclusion

Diabetic patients are more prone to severe clinical course of Covid 19. Diffuse ground glass opacity involving all the lobes was observed among diabetic patients. Severity of lung involvement (CT score:15-25) was observed among diabetic patients when compared to non diabetic patients in our study. P

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