



## Study Of COVID-19 Effect In Diabetic Patients' Chest Using Computed Tomography : Case Control Study

Tagread Ahmed Abd Alla Elmahi, Ahmed Abdelrahim Mohammed Ibrahim

### Abstract:

Diabetes is a group of diseases that result in too much sugar in the blood (high blood glucose); people with it are more likely to have severe symptoms and complication when infected by any virus. COVID-19 is a contagious disease caused by severe acute respiratory syndrome corona virus 2, it's more affected in diabetic patients and there is lack of research about COVID-19 in diabetic patients in Sudan. A retrospective cohort study on 102 COVID-19 patients, {50 diabetic patients (cases group), and 52 non diabetic (controls group)}, aimed to detect the significant correlation between diabetes mellitus (DM) chest and COVID-19 effect by using CT (Computed Tomography) in Sudanese population in light of available published information, to demonstrate accuracy of it.

The data was presented in percentage between patients' age, gender, type of diabetic and CT chest findings analysis and its correlate to complications of COVID-19 in diabetic patients were discussed, and then statistically the results were analyzed. We concluded that CT is good modality for detection and follows up the complication of COVID – 19 in diabetic patients' chest so we can reduce mortality and morbidity by apply good management.

**Keywords:** COVID-19 - Computed Tomography – Diabetes.

### Introduction:

COVID-19 (corona virus disease-2019) is an infectious respiratory disease caused by the corona virus SARS-CoV-2 and has emerged as a fast spreading contagious disease affecting most countries across the globe<sup>(1)</sup>.

The key feature of SARS CoV-2 that differentiates it from other viruses is its transmissibility combined with a great risk of mortality due to the acute respiratory distress (ARDS). Signs and symptoms of it range from mild asymptomatic infections, restricted to upper respiratory tract (20-86% of all infections), to sever respiratory distress characterized by the spread of infection to the lower airways leading to regional inflammation and pneumonia. This manifested particularly in patients with co morbidities such as chronic obstructive pulmonary disease (COPD) and diabetes<sup>(2,3)</sup>. Madaaloni et.al suggested an increased prevalence of COPD and of chronic kidney diseases in Covid-19 patients with diabetes.<sup>(4)</sup> Several studies reported that people with diabetes are at high risk of poor out come from Covid-19<sup>(2,5-8)</sup>.

Among patients infected with SARS virus it has been shown that histories of diabetes and hyperglycemia are independent predictors of mortalities and morbidity and that metabolic control might improve their prognosis<sup>(9)</sup>.

MD refers to a group of diseases that affect how your body uses blood glucose, is characterized by spectrum of metabolic disorders and has become one of the most significant global public health concerns in the 21<sup>st</sup> century. The prevalence of DM is increasing rapidly worldwide among all groups of people without any barrier and is also responsible for the burden on socio-economic development. The most common types of diabetes are: type 1 is a chronic condition in which the pancreas produces little or no insulin

and type 2 which is a chronic condition that affects the way the body processes blood sugar (10, 11).

**Objective:** To evaluate covid-19 effect in diabetic patients' chest using computed tomography.

**Materials and methods:** This was descriptive case control study conducted in Al amal National hospital - Khartoum state- Sudan in the period from 1st of January to 31 of March 2022 to evaluate COVID-19 effect in patients' chest using CT scan. 50 diabetic patients were enrolled as cases group, and 52 non diabetic Patients as controls group, all were aged between 20 to 70 years, and had confirmed by laboratory test (PCR) as COVID-19 patients. COVID-19 patients with other pathology than diabetes were excluded.

All Patients were equipped with CT machine, Hitachi spedia 64 slice, with Tube voltage ≤120 kvp, Field of view (FOV) 300 mm, Slice thickness: ≤0.625 mm, interval: ≤0.5 mm with laser printer.

They were scanned in supine position, thorax centered within the gantry and both arms elevated up, Scout to mid-abdomen to below the lesser trochanter, Scan extent from the lung apices to the bottom might vary depending on the indication, scan direction craniocaudal.

Patient characteristics that were recorded include patients' age, gender, type of DM and then CT chest findings monitored, statistically analyzed and their correlates to complications of COVID-19 in diabetic patients were discussed.

**Results:**

**Table 1: shows frequency distributions of gender for controls and cases groups:**

Gender	Control		Case	
	Frequency	Percent	Frequency	Percent
Males	25	48.1 %	36	72.0 %
Females	27	51.9 %	14	28.0 %
Total	52	100%	50	100%

**Table 2: shows distribution of age group for controls and cases group:**

Age/years	Control		Cases	
	Frequency	Percent	Frequency	Percent
20-30	7	13.5%	3	6%
31-40	16	30.8%	3	6%
41-50	20	38.5%	5	10%
51-60	9	17.3%	5	10%
More than 60	0	0	34	68.0%
Total	52	100%	50	100%

**Table3: shows The effected chest side:**

Effected chest	Controls	Cases group
----------------	----------	-------------

side				
	Frequency	Percent	Frequency	Percent
bilateral	52	100%	42	84%
unilateral	0	0.0%	8	16%
Total	52	100%	50	100%

**CT Findings:**

**Table 4: shows Severity of infection in controls and cases groups:**

Severity of infection	Cases		Controls	
	Frequency	Percent	Frequency	Percent
Mild	9	18%	36	69.2%
Moderate	11	22%	11	21.2%
Sever (pneumonia)	30	60%	5	9.6%
Total	50	100%	52	100%

**Table 5: shows the type of diabetes mellitus:**

Type of diabetes mellitus	Frequency	Percent
I	7	14%
II	43	86%
Total	50	100%

**Table 6: shows correlation between dependant variables considered from controls and Cases:**

		CT Finding
Diabetics (cases)	Pearson Correlation	0.479**
	Sig. (2-tailed)	0.000
	N	50
Controls	Pearson Correlation	0.270
	Sig. (2-tailed)	0.058
	N	52

**Discussion:**

This was descriptive cross sectional Study deal with CT Chest scan for COVID - 19 patients. Table (1) summarized that from 50 diabetic patients ( cases group) 36 (72%) were male while 14 (28%) were female, this is agree with Abdullah M. Alguwaihes et. al who found that from A total of 439 patients (median age 55 years; 68.3% were men).<sup>(12)</sup> Naomi Holman et al. also reported that Male sex, older age, renal impairment, non-white ethnicity, socioeconomic deprivation, previous stroke and heart failure were associated with increased COVID-19-related mortality in both type 1 and type 2 diabetes <sup>(13)</sup>. Regarding the variable age the result found that in cases group(6% vs 13%) were in aged group 20 to 30, (6% vs 30.8%) were in group 31 to 40, (10% vs 38.5%) were in group 41 to

50, (10% vs 17.3%) were in group 51 to 60 and (68% vs none ) were more than 60 years old, as compared to non diabetics (Table 2). This result agrees with Naomi Holman, et.al <sup>(13)</sup> who reported that older age associated with increased COVID-19-related mortality in both type 1 and type 2 diabetes.

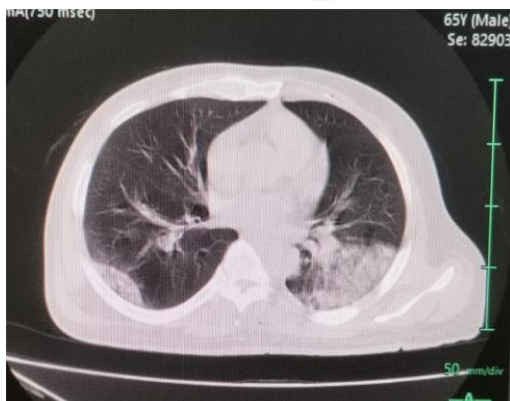
In concern distribution of the effected chest side, CT finding showed that: 52 controls patients were bilateral (100%), where in 50 patients (cases group) 42 patients (84%) found bilateral and 8 patients (16%) unilateral Table (3).

Regarding the severity of infection we found that: diabetics with COVID-19 had more severe infection, presented as pneumonia in CT image (60% vs 9.6%), while moderate infection (22% vs 21.2%) and mild infection (18% vs 69,2%) as compared to non diabetics. Table 4, this result matching the study reported that increased blood glucose level is considered an independent factor that can increase the severity of Covid – 19 and mortality <sup>(14)</sup>.

Table 5 Showed that type I diabetes were 7 patients (14%), where type 2 diabetes were 43 patients (86%). This result agrees with Emma Barron Result <sup>(15)</sup> who found that from 23 698 in-hospital COVID-19-related deaths occurred during the study period, (31.4%) in people with type 2 diabetes, (1.5%) in those with type 1 diabetes, and (0.3%) in people with other types of diabetes. Unadjusted mortality rates per 100 000 people over the 72-day period were 27 (95% CI 27–28) for those without diabetes, 138 (124–153) for those with type 1 diabetes, and 260 (254–265) for those with type 2 diabetes.

When we study correlation of CT Findings between controls and cases group we found that there were positive significant relation between CT findings between diabetic diseases and affection of covid-19, P. Values (0.000), table (6) this is also agree with Naomi Holman et al. who said that diabetic disease is risk factor and lead to death in covid-19 patients <sup>(13)</sup>.

**Conclusion:** We concluded that people with DM are more prone to COVID-19 infection , and the risk of severity in diabetics is greater than that in non diabetics so applying of CT chest exam can help in treatment, follow up and management complication of COVID – 19 in diabetic patients.



Image(1):

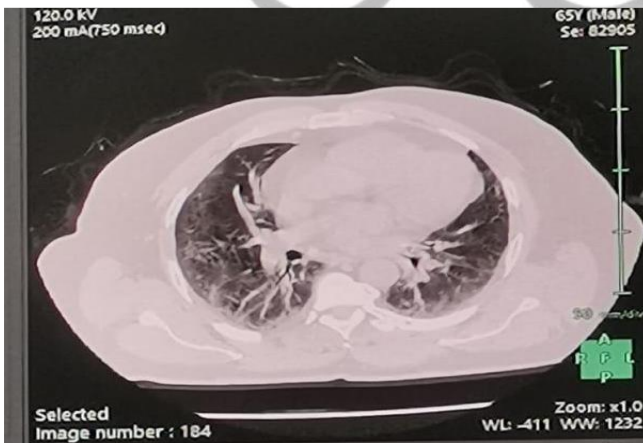
Axial CT lung Window for 65 years old male Patient.



Image(2): Axial CT lung Window for a 38 years old male Patient.



Image(3): Axial CT lung Window for a 70 years old male Patient.



Image(4): Axial CT lung Window for 65 years old male Patient.

### References:

1. Walls AC, Park YJ, Tortorici MA, Wall A, McGuire AT, Veesler D. Structure, Function and Antigenicity of the SARS-CoV-2 Spike Glycoprotein. Cell (2020) 181 (2):281-292.e6. 10.1016/j. cell. 2020.02.058 [PMC free article] [PubMed] [CrossRef] [Google Scholar].
2. Muniyappa R, Gubbi S. COVID-19 pandemic, coronavirus, and diabetes mellitus. Am J Physiol Endocrinol Metab (2020) 318 (5):E736-e741. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

3. Li B, Yang J, Zhao F, Zhi L, Wang X, Liu L, et al. Prevalence and impact of cardiovascular metabolic diseases on COVID-19 in China. *Clin Res Cardiol* (2020) 109(5):531-8. 10.1007/s00392-020-01626-9 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
4. Maddaloni E, Donofrio L, Alessandri F, Mignogna C, Leto G, Pascarella, et al. Clinical features of patients with type 2 diabetes with and without COVID-19: a case control study (CoViDiab 1). *Diabetes Res Clin Pract* (2020)p:108454. 10.1016/j.diabres.2020.108454.
5. Onder G, Rezza G, Brusaferro S. Case-Fatality Rate and Characteristics of Patients Dying in Relation to COVID-19 in Italy. *JAMA*(2020) 323(18):1775-6. 10.1001/jama.2020.4683 [PubMed] [CrossRef] [Google Scholar]
6. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factor for mortality of adult inpatients with COVID-19 in Wuhan, china: a retrospective cohort study . *Lancet*(2020) 395(10229):1054-62. 10.1016/S0140-6736(20)30566-3 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
7. Wu C, Chen X, Cai Y, Xia J, Zhou X, Xu S, et al. Risk Factors Associated With Acute Respiratory Distress Syndrome and Death in Patients with Coronavirus Disease 2019 Pneumonia in Wuhan, China. *JAMA Intern Med* (2020) 180(7):934-43.
8. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou Clinical Characteristics of Coronavirus Disease 2019 in China. *N Engl J Med*(2020)382(18):1708-20. 10.1056/NEJMoa2002032 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
9. Yang JK, Zheng Y, Gou X, Pu K, Chen Z, Gou Q, et al. Plasma glucose Levels and diabetes are independent predictors for mortality and morbidity in patients with SARS Diabetes *Med*(2006)23(6):623-8.
10. Sen S, Chakraborty R, De, B, Devanna N. Trends in diabetes epidemiology in Indian population in spite of regional disparities: a systemic review. *Int J Diabetes Dev Ctries*. 2015;35:264-279. [Google Scholar]
11. <https://www.merckmanuals.com/home/hormonal-and-metabolic-disorders/diabetes-mellitus-dm-and-disorders-of-blood-sugar-metabolism/diabetes-mellitus-dm.20/12/2021>
12. <https://en.m.wikipedia.org/wiki/COVID-19/s12933-020-01184-4.25/1/2022>.
13. <https://www.sciencedirect.com/science/article/pii/S2213858720302710.19/30/2022>
14. Lim S, Bae JH, Kwon HS, Nauck MA. COVID-19 and diabetes mellitus: from pathophysiology to clinical management. *Nat Rev Endocrinol*. 2021;17:11-30 [PMC free article] [PubMed] [Google Scholar]
15. <https://dmsjournal.biomedcentral.com/articles/10.1186/s13098-021-00705.30/1/2022>