

COVID-19 infection-induced type one Diabetes Mellitus and Diabetic Ketoacidosis

Amir Hayat¹, Sohail Siddique², Syed Rehan Shamim³

^{1,2} Specialist Registrar, Department of Medicine,
Darrent Valley Hospital, United Kingdom.

² Consultant, Department of Acute Medicine,
Darrent Valley Hospital, United Kingdom.

Author's Contribution

¹ Conception of study

^{1,2} Experimentation/Study conduction

^{1,2} Analysis/Interpretation/Discussion

² Manuscript Writing

³ Critical Review

Corresponding Author

Dr. Sohail Siddique

Specialist Registrar,

Department of Medicine,

Darrent Valley Hospital,

United Kingdom

Email: ssm_262@hotmail.com

Article Processing

Received: 14/11/2020

Accepted: 23/08/2021

Cite this Article: Khan, H., Bari, F., Mohammad, T., Jan, R. COVID-19 infection-induced type one Diabetes Mellitus and Diabetic Ketoacidosis. *Journal of Rawalpindi Medical College*. 31 Aug. 2021; 25 COVID-19 Supplement-1, 154-156.
DOI: <https://doi.org/10.37939/jrmc.v25i1.1516>

Conflict of Interest: Nil

Funding Source: Nil

Access Online:



Abstract

A 63-year-old female patient presented with a one-week history of reduced appetite, weakness, nausea, polyuria, and occasional vomiting on a background of recurrent urinary tract infection and hypothyroidism. She appeared lethargic and dehydrated. The arterial blood gas showed a picture of diabetic ketoacidosis (DKA) which was treated according to the protocol. Viral polymerase chain reaction (PCR) for COVID-19 was positive. The diagnosis of new-onset type one diabetes is made based on specific antibodies test. Computerized Tomography (CT) of the abdomen excluded pancreatic cancer as a cause of new-onset diabetes. Hence, the patient was labelled as type one diabetes mellitus induced by the COVID-19 virus. She was treated accordingly and sent home on insulin.

Keywords: COVID-19, Diabetes Mellitus, Diabetic Ketoacidosis.

Introduction

The data obtained so far after the onset of the COVID-19 pandemic showed that the risk of contracting the virus by patients with diabetes is the same as the patients with non-diabetes.¹ However, the patients with diabetes are at risk of increased complications especially diabetic ketoacidosis thus increasing the mortality rate.² Certain cases of new-onset diabetes in patients have been published.^{3,4} It is still unclear how the COVID-19 virus causes new-onset diabetes and its complications. It is believed that the likely cause is increased expression of angiotensin-converting enzyme 2 (ACE-2) receptor which acts as an entry point of COVID-19 virus into the pancreatic cells leading to the destruction and causing new-onset diabetes.⁵ However, this theory still needs further research.

Materials and Methods

A 63 years old female patient presented to the accident and emergency department with complaints of reduced appetite, weakness, nausea, polyuria, and occasional vomiting for a week. The background history included recurrent urinary tract infections and hypothyroidism. She was taking Levothyroxine 50 microgram once a day at the time of presentation; was self-employed, non-smoker, and consumed alcohol socially (4-6 units per week). There was no significant family history of note.

Vitals measurement showed blood pressure of 103/76 mmHg, a pulse of 92 beats per minute, respiratory rate of 17 per minute, oxygen saturation on room air 98%, and temperature of 37.9 C.

On general examination, the patient appeared dehydrated and lethargic, and mildly agitated. Systemic examination showed normal air entry in both lungs, normal heart sounds, and audible bowel sounds.

Arterial blood gas (ABG) was done upon arrival which showed pH 7.08, pO₂ 14.2, pCO₂ 3.9, HCO₃ 6.3, glucose 37.5, and lactate 2.7; blood ketones of 6.7 were recorded. Noticing diabetic ketoacidosis picture, the patient was immediately commenced on DKA protocol. Serial ABGs were done and electrolytes were checked as per protocol. She recovered out of DKA within sixteen hours.

Results

Investigations: Laboratory investigations showed C-reactive protein 15, White cell count 15, Sodium 133, Potassium 4.4, Hemoglobin 126 g/dl, Creatinine 151, Urea 10.4, and AKI stage 2. Urine dip showed negative blood, nitrites, and leukocytes. HbA1c was 10.5%. The screening test for SARS-CoV-2 (COVID-19) returned positive.

Chest x-ray report revealed no abnormal findings. An electrocardiogram showed sinus rhythm. There was a suspicion of pancreatic cancer as a likely cause of new-onset diabetes. So CT scan of the abdomen was arranged which did not show any pancreatic and peri-pancreatic lesions.

Antibodies tests for type 1 diabetes mellitus showed Glutamic Acid Decarboxylase antibody level of 57 U/mL (0-10.9U/mL), Insulinoma associated-2 antibody level of 3461U/mL (0-7.99U/mL) and Zinc transporter 8 antibody level of 1443U/mL (0-9.99U/mL). The antibodies results were consistent with type 1 diabetes mellitus and COVID-19 infection was considered as the likely cause given normal CT pancreas.

Differential diagnosis: New-onset type one diabetes mellitus in middle age patients can be due to pancreatic cancer, recent pancreatic trauma or surgery, and infection. Our patient has no recent abdominal trauma or surgery. The risk of alcoholic-induced pancreatic damage was low due to non-heavy intake. Pancreatic cancer was ruled out due to normal CT scan findings. In the absence of other causes, COVID-19 infection was considered a likely cause.

Treatment: DKA protocol was treated according to the protocol. Electrolytes and ketones were checked regularly and the patient was rehydrated. An opinion from consultant endocrinology was taken due to new-onset diabetes mellitus and the patient was initiated on insulin. All necessary guidance about insulin and diabetes mellitus was given to the patient. No specific treatment was given for COVID-19 infection.

Outcome and follow-up: The patient was sent home after stabilization. A follow-up appointment was arranged in the diabetes center to monitor the diabetes control.

Discussion

COVID-19 infection has a wide spectrum of complications. Patients with diabetes are at the same risk of contracting the virus as patients with no

diabetes.⁹ However, if contracted COVID-19, the severity of the disease is high in patients with diabetes.^{6,7} Diabetic ketoacidosis is a serious complication of diabetes mellitus. COVID-19 infection worsens the outcome and mortality in patients with diabetes.⁷

The exact mechanism of COVID-19 infection leading to new-onset diabetes mellitus or complications in known patients with diabetes is still not fully known. However, recent studies showed that it can be due to overexpression of ACE-2 receptors on pancreatic beta cells⁸ through which the COVID-19 virus gain entry into the cells and cause destruction, leading to insulin-dependent diabetes.

Studies during the previous coronavirus epidemics showed that dipeptidyl peptidase 4 (DPP4) is the receptor of entry for Middle East respiratory syndrome coronavirus. Hence, it is believed that the DPP4 receptor can also act as an entry point. But the studies about this relationship are limited. Due to serious side effects of DPP4 inhibitor on the immune system, COVID-19 infection can worsen the outcome.¹¹ However, other studies do not support this relation of DPP4 inhibitors and weakening of immunity.¹⁰

Sodium/glucose cotransporter 2 inhibitors have been shown to worsen the outcomes in patients with COVID-19 infections. The exact etiology is unknown. However, it is found out that the SGLT2i increase the incidence of diabetic ketoacidosis in patient with diabetes.¹²

Conclusion

1. The case shows the likely association between COVID-19 infection and new-onset type 1 diabetes mellitus.
2. COVID-19 infection can precipitate diabetic ketoacidosis in a patient with diabetes.

References

1. Yang J, Zheng Y, Gou X, Pu K, Chen Z, Guo Q, et al. Prevalence of comorbidities in the novel Wuhan coronavirus (COVID-19) infection: a systematic review and meta-analysis. *Int J Infect Dis.* 2020. PII: S1201-9712(20)30136-3. <https://doi.org/10.1016/j.ijid.2020.03.017>.
2. Bode B, Garrett V, Messler J, McFarland R, Crowe J, Booth R, et al. Glycemic characteristics and clinical outcomes of COVID-19 patients hospitalized in the United States. *J Diabetes Sci Technol.* 2020. <https://doi.org/10.1177/1932296820924469>
3. Chee YJ, Ng SJH, Yeoh E. Diabetic ketoacidosis precipitated by Covid-19 in a patient with newly diagnosed diabetes mellitus. *Diabetes Res Clin Pract.* 2020;164:108166. <https://doi.org/10.1016/j.diabres.2020.108166>
4. Heaney AI, Griffin GD, Simon EL. Newly diagnosed diabetes and diabetic ketoacidosis precipitated by COVID-19 infection. *Am J Emerg Med.* 2020. DOI: <https://doi.org/10.1016/j.ajem.2020.05.114>
5. Zhang Y.Z., Holmes E.C. A genomic perspective on the origin and emergence of sars-cov-2. *Cell.* 2020;181(2):223–227. [PMC free article] [PubMed] [Google Scholar]
6. Federation ID. COVID-19 outbreak: guidance for people with diabetes. International Diabetes Federation; 2020. <https://www.idf.org/aboutdiabetes/what-is-diabetes/covid-19-and-diabetes/1-covid-19-and-diabetes.html>
7. Hu L, Chen S, Fu Y, Gao Z, Long H, Ren H-W et al. Risk factors associated with clinical outcomes in 323 COVID-19 patients in Wuhan, China. *medRxiv*; 2020. [PMC free article] [PubMed]
8. 57. Zheng Y.Y., Ma Y.T., Zhang J.Y., Xie X. COVID-19 and the cardiovascular system. *Nat Rev Cardiol.* 2020 DOI: 10.1038/s41569-020-0360-5. Epub 2020/03/07. Epub 2020/03/07. PubMed PMID: 32139904. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
9. Fadini G.P., Morieri M.L., Longato E., Avogaro A. Prevalence and impact of diabetes among people infected with SARS-CoV-2. *J Endocrinol Invest.* 2020 DOI: 10.1007/s40618-020-01236-2. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
10. Yang W, Cai X, Han X, Ji L. DPP-4 inhibitors and risk of infections: a meta-analysis of randomized controlled trials. *Diabetes Metab Res Rev.* 2016;32:391–404. DOI: <https://doi.org/10.1002/dmrr.2723>.
11. ClinicalTrials.gov. 2020. Effects of DPP4 Inhibition on COVID-19. <https://clinicaltrials.gov/ct2/show/NCT04341935> [Google Scholar]
12. Pradhan A, Vohra S, Vishwakarma P, et al. Review on sodium-glucose cotransporter 2 inhibitor (SGLT2i) in diabetes mellitus and heart failure. *J Family Med Prim Care.* 2019 June;8(6):1855- 1862.