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Oxidative Stress and Interleukin 6 (IL-6) as Predictor of COVID-19 Severity – A Case Report of First Pregnant Woman with Diabetes in Jigawa State, Northern Nigeria

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***Abstract*: Since the end of December 2019, the outbreak of coronavirus disease 2019 (COVID-19) epidemic has occurred and spread rapidly throughout the world. WHO officially announced that the COVID-19 had become a global pandemic. During the pandemic, there were dearth of information regarding pregnant women with COVID-19 pneumonia and their infants. In this paper, we report a case of a COVID-19 pregnant woman with diabetes. The pregnant woman blood specimens were collected periodically during her stay in the isolation center for blood chemistry analysis, IL-6, MDA as well blood sugar measurements while receiving treatments, these parameters coupled with respiratory indices were evaluated to predict the disease severity. It is suggested that respiratory failure, hyperglycemia, cytokinemia and oxidative stress played significant role in the disease progression and may therefore can be used in predicting the clinical outcome of the COVID-19.**

***Keywords*: COVID-19, Diabetes, Pregnant woman, Oxidative stress, Interleukin 6.**

1. Introduction

There were hundreds of thousand publications on COVID-19, in less than a year of its declaration as a global pandemic [1], which has shaken the world economy [2], killing millions of lives [1], and leaving middle income families and institutions under massive uncertainty [2]. COVID-19 is associated with exaggerated inflammatory immune response induced by T-cells activation and macrophages leading to hyper cytokinemia known as Cytokine Storm (CS) which may consequently increase risk of respiratory failure and death. Several studies revealed IL-6 to predict diseases prognosis and clinical profile of hospitalized COVID-19 patients [3]-[5]. Oxidative stress is typical of COVID-19 infection due to high oxidized molecules with the formation and consequent release of reactive oxygen species (ROS) that would have overwhelmed the antioxidant defense system thereby causing rapid progression of COVID-19 pathophysiology [6]. Uncontrolled hyperglycemia due to diabetes mellitus causes inflammation and poor blood circulation which increases the risk of complications from COVID-19 infections, with proper glucose control, the risk of infection could be significantly reduced. Herold and colleagues reported the association of elevated IL-6 with poor prognosis among COVID-19 patients [7]. IL-6 occupies the center stage in initiating and potentiating the dreaded CS. The IL-6 level was reported to be higher among ARDS patients [8].

2. Patient and Observation

A 31-year-old woman, gravida 6 para 5 at 11 weeks' gestation with history of pneumonia and fever was admitted to Jigawa State COVID-19 isolation center having tested positive for COVID-19 using polymerase chain reaction (PCR) which was in accordance with international standard. The physical examination revealed tachycardia, kussmaul breathing, disorientation and incoherent speech. On admission, plasma glucose, malondialdehyde and interleukin-6 levels were 22.1mmol/l, 7.3mmol/l and 809pg/ml respectively. Respiratory status declined rapidly the next day which led to the need for mechanical ventilation and later gradually improve through the next 7 days and consequently the patient had miscarriage. There was progressive improvement with regards to vital signs and

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some chemical parameters but did not recover fully from respiratory failure and later died on 11th day of admission with diabetic ketoacidosis (DKA) and kidney impairment diagnosed based on blood chemistry results of urea (29.5 mmol/l) and creatinine (896µmol/l).

3. Discussion

This case report demonstrated the value of interleukins, oxidative stress and vital signs in predicting poor prognosis and mortality in patients hospitalized with COVID-19. IL-6 is a pleiotropic cytokine produced in response to tissue damage by viral infections which triggers hypercytokinemia. [9] indicated that moderately elevated levels of IL- 6 above 80pg/ml were adequate to identify COVID-19. Patient shows an elevated level of IL-6 throughout her stay in the isolation center; the sustained hypercytokinemia may be due to exaggeratory inflammatory immune response against COVID-19 infections causing systemic cytokine storm. The positive correlation of IL-6, MDA and respiratory failure observed, support the evidence of their involvement in predicting poor prognosis on the patients

It has been recently reported by [6] that oxidative stress significantly assists in progression of COVID-19 pathogenesis. Patient's level of MDA (marker of oxidative stress) tends to raise above normal reference values throughout hospitalization period signifying deficient antioxidant defense system.

In a retrospective cross-sectional study by [10], it has been documented that lower oxygen saturation, elevated respiratory rate, lower diastolic blood pressure and elevated glucose were found to be significantly associated with COVID-19 hospitalized patients. Similarly, in this study, vital signs improve but did not recover fully from respiratory failure. Uncontrolled hyperglycemia due to insulin deficiency is the hallmark for diabetic complication. In this case report, patients had a history of diabetes and plasma glucose was higher from the day of admission. Several studies suggest link between diabetes and COVID-19 infection via ACE2 receptors thereby causing damage to pancreatic beta cells leading to insulin insufficiency that may subsequently aggravate the diabetic complications among COVID-19 patients.

4. Conclusion

COVID-19 infection thrives especially in co-infection with diabetes, malaria, hypertension and factors such as smoking, alcohol consumption, age and in weakened immune system. In this case report, respiratory failure, hyperglycemia, cytokinemia and oxidative stress were at the center of the disease progression and therefore can be used in predicting the clinical outcome of the COVID-19 patients.

Ethical Approval

Ethical approval was waived by the HREC of the Jigawa state ministry of health, Rasheed Shekoni Teaching Hospital Dutse, as part of the isolation center policy (Waiver No. RSSH/GEN/226. V.1/12)

Informed Consent

Informed consent was sought for and obtained from the patient.

Authors Contributions

All authors equally contributed to the manuscript. Yamuna Aminu Kani (YAM), Sani Iliya (SI), Yahaya Muhammad (YM), Mahmud Inusa Yandutse (MIY), Tajuddeen Akande (TA), Badamasi Musa BM Rehinatu Nasir Adejumo (RNA). YAM, YM and SI build the idea framework, MIY, BMA and MAI analysed the data, RNA, BM and TA discuss and drafted the manuscript. Furthermore, all authors reviewed and make their inputs as well as agreed to the final draft prior to submission.

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