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Case Report

Effects of the Sinopharm Vaccine on the Incidence of Type 2 Diabetes Mellitus and its Complications: A Post-COVID Case Report

Running Title: Sinopharm and Type 2 Diabetes Mellitus

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Abstract

Background: SARS-CoV-2, by inducing inflammatory conditions, contributes to the development of Coronavirus disease 2019 (COVID-19) and complications associated with Type 2 diabetes mellitus (T2DM). The Sinopharm COVID-19 vaccine primed the body to respond to subsequent infections by stimulating the immune system. However, this case report investigated the effects of the Sinopharm vaccine on the incidence and complications of T2DM.

Case Presentation: A 57-year-old man with a history of prediabetes visited the Amol Health Center (April 18, 2023). Initial and laboratory evaluations showed weight gain, hypertension, hypertriglyceridemia, abnormal glucose profile, and the occurrence of T2DM. The patient reported no prior COVID-19. However, they had been administered a third booster dose of the Sinopharm COVID-19 vaccine around one year earlier. About three years ago, the patient underwent angiography under the supervision of a cardiologist. Prior to the diagnosis of T2DM, the patient was not on any hypoglycemic medication. After approximately three years of quarterly follow-up and drug therapy, significant improvements were observed in the patient's hyperglycemia, hypertriglyceridemia, and hypertension.

Discussion and Conclusion: No significant evidence links the Sinopharm vaccine to the pathogenic mechanisms of T2DM. The Sinopharm vaccine might serve as a metabolic stressor that triggers the development of T2DM and its complications in predisposed individuals with prediabetes. Although the risk of T2DM after COVID-19 infection is notably higher than after vaccination, vaccination remains an important protective measure. However, more frequent follow-up could have allowed earlier identification of T2DM in this individual.

Keywords: T2DM, COVID-19, Sinopharm, Hypertriglyceridemia, Hypertension

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Introduction

Type 2 diabetes mellitus (T2DM) is a metabolic disease characterized by mitigated insulin secretion and sensitivity, and commonly accompanied by lipid abnormalities and elevated blood pressure (1, 2). Coronavirus disease 2019 (COVID-19) was a global pandemic in the early 2020s caused by SARS-CoV-2, which claimed millions of lives worldwide. The BBIBP-CorV vaccine, also known as the Sinopharm COVID-19 vaccine, was developed by a state-owned pharmaceutical company in China. It is an inactivated vaccine containing killed SARS-CoV-2 virus particles. When administered intramuscularly, inactivated-virus antigens stimulate antibody production, thereby priming the immune system to respond to future infection with the live virus (3, 4). The association of COVID-19 and diabetes has been shown in various studies (5). However, the association between COVID-19 vaccination and diabetes has not been established. This study aims to investigate the effects of the Sinopharm vaccine on the incidence of T2DM and its complications in individuals with no prior history of these conditions.

Case Report

A 57-year-old man presented to the Amol Health Center (2023/4/18) with a four-month history of excessive thirst. Preliminary evaluation revealed hypertension and overweight (BMI = 26.2). Laboratory investigations showed markedly elevated blood glucose indicators:fasting blood sugar (FBS), 2-hour postprandial (2hpp), and glycosylated hemoglobin (HbA1c) were 235 mg/dl, 438 mg/dl, and 7%, respectively, indicating T2DM. Furthermore, this patient had hypertriglyceridemia (Triglyceride = 506). Liver enzyme levels were normal, and given the atherogenic factor and cardiac risk score, the cardiovascular risk was low (The second set of tests shown in **Table 1**).

Table.1. Laboratory results before angiography and approximately one year after Sinopharm vaccination

Laboratory tests	Results (2020/5/18)	Results (2023/4/22)	Normal Range
FBS (mg/dl)	100	235	70-99
2hpp (mg/dl)	141	438	< 140
HbA1c (%)	5.8	7	4-5.6
T-Chol (mg/dl)	165	154	< 200
Triglyceride (mg/dl)	147	506	< 150
LDL (mg/dl)	70	68	< 100
HDL (mg/dl)	33	35	> 50
Atherogenic Factor	2.1	2	0.5-3
Cardiac Risk	5	4.4	3.3-4.4
ALT (U/L)	32	40	8-41
AST (U/L)	21	25	< 37
ALP (Iu/L)	97	141	80-306
Blood Urea Nitrogen (mg/dl)	12	16	8-24
Creatinine (mg/dl)	0.9	1	0.7-1.4
Hemoglobin (g/dl)	13.7	13.5	13.5-17.5
Hematocrit (%)	41	40.5	40.3-50.5

The patient had no history of COVID-19 infection but had received the third dose of the Sinopharm vaccine approximately one year prior. Approximately three years ago, despite no history of hypertension, hypercholesterolemia, hypertriglyceridemia, elevated hemoglobin and hematocrit, or a high atherogenic factor and cardiac risk score, angiography was performed under the care of a cardiologist. Before angiography, the laboratory results showed an FBS of

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100 mg/dL, 2hpp of 141 mg/dL, and an HbA1c of 5.7%, which were diagnostic of prediabetes (the first set of tests shown in **Table 1**). The individual did not receive any hypoglycemic drugs until the onset of T2DM. Following about three years of quarterly monitoring and pharmacotherapy, the patient's hyperglycemia, hypertriglyceridemia, and hypertension notably improved. Throughout recent years, the patient's BMI has shown little variation and has consistently stayed within the overweight category (25.5-26.3). Furthermore, the patient had no family history of diabetes, neither from parents nor from other first-degree relatives.

Discussion

Substantial evidence indicates the significant impact of COVID-19 on the development and progression of T2DM. SARS-CoV-2 binds to the angiotensin-converting enzyme 2 (ACE2), leading to damage in pancreatic islets. Furthermore, SARS-CoV-2 induces a pro-inflammatory state that leads to upregulation of interleukin-1β (IL-1β) and tumor necrosis factor-α (TNF-α). These cytokines impair both insulin secretion and insulin sensitivity. ACE converts angiotensin I (AngI) to angiotensin II (AngII). Activation of the Angiotensin II type 1 receptor (AT1R) stimulates nuclear factor kappa-light-chain-enhancer of activated B cells (NF-κB), NADPH oxidase (NOX), and toll-like receptor 4 (TLR4) activity (6). TLR4 signaling activates NF-κB, resulting in increased expression of inflammatory factors, reduced insulin secretion and sensitivity, and the development of diabetic complications (6-8). Furthermore, the production of superoxide anions by NOX drives oxidative stress (2). ACE2, a homolog of ACE, enzymatically converts Ang II into Ang (1–7), a peptide with anti-inflammatory properties. Interaction between SARS CoV-2 and ACE2 leads to decreased ACE2 expression and inhibition of its anti-inflammatory effects (6).

While no significant evidence demonstrates the Sinopharm vaccine to T2DM mechanisms, Sinopharm could act as a metabolic stressor, pushing individuals with prediabetes toward overt T2DM and its complications such as hypertension and hypertriglyceridemia.

Conclusion

While the metabolic and T2DM risks from COVID-19 infection substantially outweigh those from vaccination due to infection-related inflammatory damage, vaccination remains a crucial protective strategy. In this specific case, however, the patient's prediabetes, advanced age, and the year-long gap between the third vaccine dose and T2DM diagnosis suggest that low-interval monitoring could have enabled earlier detection. Therefore, considering the patient's clinical circumstances described earlier, vaccination exerted a synergistic influence on the factors related to T2DM.

Declarations

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