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Case Report

Acute Transient Hyperglycaemia after COVID-19 Vaccination in Patients with Stable Diabetes

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Abstract

Background: Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is responsible for causing the COVID-19 pandemic. Since effective COVID-19 vaccinations have become available worldwide, patients with diabetes are considered to be in the highest priority group to be vaccinated. To date, 3 vaccines are available in the UAE. These are the Pfizer-BioNTech, Sinopharm and Sputnik vaccines.

Objective: We describe 2 cases of patients who had diabetes with stable glycaemic control, who however, developed hyperglycaemia post COVID-19 vaccination.

Methods: Case presentation from a private hospital in Dubai of 2 patients with diabetes who were seen in ambulatory care setting regarding their glycaemic control.

Results:

Case 1: A 51-year-old Asian male, known to have type 2 diabetes, was reviewed in the ambulatory care setting following COVID-19 vaccination. His recent glycaemic control was stable with glycosylated haemoglobin (HbA1c) 3 months before presentation of 7.5%. His medications for diabetes included: xultophy injection (fixed-ratio combination of insulin degludec and liraglutide) 14 units at night, in addition to oral metformin 1000 mg twice daily. His history included ischaemic heart disease stable on medication. He took his first dose of Pfizer-BioNTech vaccine on 30th December 2020 followed by second dose 3 weeks later. All blood glucose levels (BG) pre-vaccination were within normal range. In contrast, post-COVID-19 2nd dose) fasting BG levels was elevated on Day 2 only. Similarly, evening pre-meal BG levels were elevated on Days 1, 4 and 6; with 2-hour post meal BG level also increased on Day 2. He was also asymptomatic during this period.

Case 2: A 30-year-old female, known type 1 diabetes, was reviewed in the ambulatory care setting following COVID-19 vaccination. She was on continuous subcutaneous insulin infusion (CSII) for her glycaemic control. Her HbA1c 3 months prior to presentation was 8.3%. She took her Sinopharm vaccination on 18th January 2021. Her continuous glucose monitoring (CGM) data shows time in range TIR of 68% one week before 1st dose of vaccination and it dropped to 66% one week after 1st dose of vaccination. Her TIR was 62% one week before 2nd dose and it dropped down to 40% week after 2nd dose. She was asymptomatic during this period.

Conclusion: The purpose of this case series is to make healthcare professionals aware of potential transient hyperglycaemia post-COVID-19 vaccination in patients with diabetes. We strongly recommend vaccination for people with diabetes as benefits far outweighs the risk. However, patients should be educated by their healthcare professional in advance for close blood glucose monitoring post vaccination and regarding sick-day rules. As ADA 2021 recommendations were developed before COVID-19 vaccines were available worldwide, no detailed information regarding COVID-19 vaccination is captured.

***Keywords**: Hyperglycaemia; Covid-19 Vaccination*

Abbreviations

BG: Blood Glucose; CGM: Continuous Glucose Monitoring

Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is responsible for causing the COVID-19 vaccine. Until now 608,070 cases have been reported in the United Arab Emirates (UAE) with 1747 deaths [1].

Patients with diabetes who develop COVID-19 infection are at increased risk of severe infection and mortality [2]. We have recently published the largest cohort of patients with diabetes admitted to hospital with COVID-19 infection in the UAE [3]. This single-centre cross-sectional study showed that approximately 25% of patients admitted with COVID-19 had prediabetes or diabetes. Poor glycaemic control is also associated with worse clinical outcomes in terms of hospitalisations and death [4]. In United States of America, the Centers for Disease Control and Prevention (CDC) has categorized diabetes in patients infected with COVID-19 in terms of 'increased risk of severe illnesses' [5].

Since effective COVID-19 vaccinations have become available worldwide, patients with diabetes are considered to be in the highest priority group to be vaccinated [6]. To date, 3 vaccines are available in the UAE. These include Pfizer-BioNTech, Sinopharm, and Sputnik V vaccines. The Pfizer-BioNTech ribonucleic acid (RNA) vaccine is composed of nucleoside-modified messenger RNA (modRNA) which encodes a mutated form of the spike protein of SARS-CoV-2 and this is encapsulated in lipid nanoparticles. Administration is by two injections at least 21 days apart. In contrast, Sinopharm is a whole virus vaccine which is chemically inactivated. It is administered by two injections at least 21 - 28 days apart. The Sputnik V vaccine has a human adenoviral vector-based platform and is also administered via 2 doses.

We describe 2 cases of diabetic patients with stable glycaemic control, who post-COVID-19 vaccination developed acute transient glycaemic deterioration.

Case Presentations

Case 1: A 51-year-old Asian male known to have type 2 diabetes was reviewed in the ambulatory care setting after COVID-19 vaccination. His recent glycaemic control was good with glycosylated haemoglobin (HbA1c) 3 months before presentation of 7.5%. His usual medications for glycaemic control included: Xultophy injection (i.e. fixed-ratio combination of insulin degludec and liraglutide) 14 units at night, in addition to oral metformin 1000 mg twice daily. He had a history of ischaemic heart disease which was stable on medication. He felt completely well prior to taking his first dose of Pfizer-BioNTech vaccine on 30th December 2020. His blood glucose (BG) values before and after taking 1st-dose of vaccination are tabulated in table 1 and 2.

	Breakfast (mg/dl)		Dinner (mg/dl)	
Date	**Fasting**	**2hrs-post Breakfast**	**Before evening meal**	**2hrs-post evening meal**
17.11.20	89	124	96	121
18.11.20	91	121	94	130
19.11.20	101	101	117	125
23.11.20	100	130		110
24.11.20	106	103	103	114
25.11.20	94			
01.12.20	102			
02.12.20	106			
04.12.20	98			
05.12.20	101		129	
06.12.20	112	139	111	
07.12.20	116			
08.12.20	118			
09.12.20	118	134		
23.12.20	107	138		
28.12.20	113			

Table 1: *Capillary blood glucose (mg/dl) before vaccination (1st dose).*

	Breakfast (mg/dl)		Dinner (mg/dl)	
Date	**Fasting**	**2hrs-post Breakfast**	**Before evening meal**	**2hrs-post evening meal**
Day 1	160	148		150
Day 2	138			
Day 3	190			
Day 4	180	186		
Day 5	224	223	173	
Day 6	188	186	256	255
Day 7	113			

Table 2: *Capillary blood glucose (mg/dl) post-COVID-19 vaccination (1st dose).*

As highlighted in table 1 (pre-COVID-19 vaccination 1st dose), all BG levels are within normal range (i.e. fasting or pre-meal 80 - 130 mg/dl; and 2 hour post-meal < 180 mg/dl) [7]. In contrast, table 2 (post-COVID-19 1st dose) demonstrates that fasting BG levels are elevated from Day 1 through Day 6, with return to normal by Day 7. Post-breakfast BG levels are also increased from Day 4 through Day 6. Similarly, evening pre-meal BG levels are elevated on Day 5 and 6; with 2-hour post meal BG level also increased on Day 6. He was asymptomatic during this period.

He took his second dose of Pfizer-BioNTech vaccine on 20th January 2021. His blood glucose values after taking the 2nd vaccine dose are tabulated in table 3.

	Breakfast (mg/dl)		Dinner (mg/dl)	
Date	**Fasting**	**2hrs-post Breakfast**	**Before evening meal**	**2hrs-post evening meal**
Day 1	102			137
Day 2	93		117	
Day 3	90	122	112	
Day 4	98	122		

Table 3: *Capillary blood glucose (mg/dl) before vaccination (2nd dose).*

As highlighted in table 3 (pre-COVID-19 vaccination 2nd dose), all BG levels are within normal range. In contrast, table 4 (post-COVID-19 2nd dose) demonstrates that fasting BG levels was elevated on Day 2 only. Similarly, evening pre-meal BG levels are elevated on Days 1, 4 and 6; with 2-hour post meal BG level also increased on Day 2. He was also asymptomatic during this period.

	Breakfast (mg/dl)		Dinner (mg/dl)	
Date	**Fasting**	**2hrs-post Breakfast**	**Before evening meal**	**2hrs-post evening meal**
Day 1	114	138	148	150
Day 2	133	126		235
Day 3	114			138
Day 4	106	131	133	146
Day 5	122	165	134	
Day 6	120		121	170
Day 7	105			

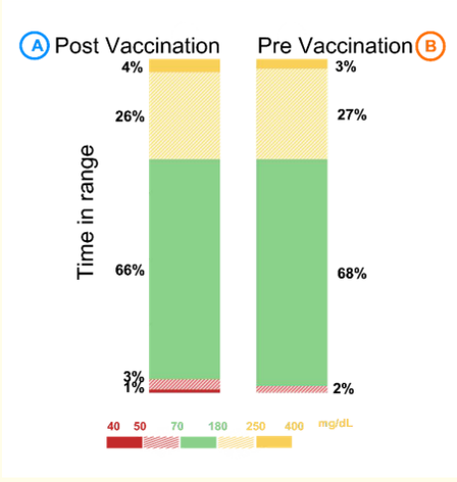
Table 4: *Capillary blood glucose (mg/dl) post-COVID-19 vaccination (2nd dose).*

Case 2

A 30-year-old female known to have type 1 diabetes was reviewed in the ambulatory care setting following COVID-19 vaccination. She was on continuous subcutaneous insulin infusion (CSII) for her glycaemic control. Her HbA1c within last 3 months was 8.3% prior to presentation. She received Sinopharm vaccination on 18th January 2021 and 2nd dose on 8th February 2021. Clinically she was asymptomatic.

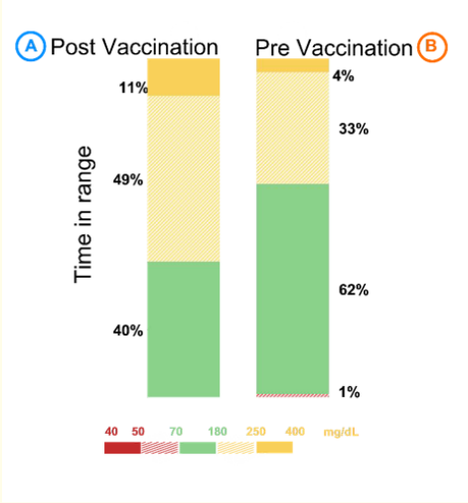
Time in range (TIR) represents the time patient has been in target BG range between 70 -180 mg/dl, reducing time in hypoglycaemia and hyperglycaemia for patients using continuous glucose monitoring (CGM) [7].

Her CGM data shows TIR of 68% one week before 1st dose of vaccination and it dropped to 66% one week after 1st dose of vaccination (Shown in graph 1).



Graph 1: *One week before and after 1st vaccination dose.*

Her TIR was 62% one week before 2nd dose and it dropped down to 40% week after 2nd dose (Shown in graph 2). She was asymptomatic during this period.



Graph 2: *One week before and after 2nd vaccination dose.*

She had less than 1% hypoglycaemia before and after vaccination. Her average BG was 175 ± 41 mg/dl before her first vaccination and 188 ± 61 mg/dl before her 2nd vaccination. After 1st dose of vaccination it was 177 ± 60 mg/dl, however it increased to 204 ± 66 mg/dl after 2nd dose of vaccination.

Discussion

Our case series demonstrates temporaneous acute transient hyperglycaemia post COVID-19 vaccination. Acute transient hyperglycaemia has been reported post-influenza vaccination in patients with diabetes [8]. However, no specific recommendations for BG monitoring post-influenza vaccination are noted in the American Diabetes Association (ADA) Standards of Medical Care in Diabetes-2021 [7].

Transient hyperglycaemia post COVID-19 vaccination is most likely caused by activation of immune system post exposure to the antigen resulting in physiological acute phase response [9].

Physicians and other healthcare professionals will face many questions regarding the science, safety, and efficacy of the first wave of COVID-19 vaccines to be authorized and distributed [10]. The most common side-effects reported for COVID-19 vaccines are soreness at the site of injection. Other general symptoms include fatigue, headache, muscle aches, chills, joint pain, and possibly some fever. Hyperglycaemia is not noted as an adverse reaction in vaccine prescribing information. However, several professional organisations such as Diabetes UK [11] and US *diaTribe* [12] which are aimed at improving the lives of people with diabetes have stated that transient hyperglycaemia can occur post-COVID-19 vaccination. They also recommend that people with diabetes should consider monitoring BG levels for at least 48-hours post-COVID-19 vaccine and have a sick-day management plan ready. However, in our case series the transient BG elevations were demonstrated up to 6 days post-vaccination.

Conclusion

The purpose of this case series is to make healthcare professionals aware of potential transient hyperglycaemia post-COVID-19 vaccination in patients with diabetes. We strongly recommend vaccination for people with diabetes as benefits far outweighs the risk. However, patients should be educated by their healthcare professional in advance for close blood glucose monitoring post vaccination and regarding sick-day rules. As ADA 2021 recommendations were developed before COVID-19 vaccines were widely available, no detailed information regarding COVID-19 vaccination is captured in current guidelines [7].

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