### **Case Report**

DOI: http://dx.doi.org/10.18203/2349-3933.ijam20200028

# Ambulatory glucose profile in managing post-prandial hyperglycaemia in patients with type 2 diabetes mellitus: a case report

#### Banshi Saboo\*

Diabetes Care and Hormone Clinic, Ahmedabad, Gujrat, India

Received: 20 December 2019 Accepted: 30 December 2019

## \*Correspondence: Dr. Banshi Saboo.

E-mail: banshisaboo@hotmail.com

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

#### **ABSTRACT**

The case report describes the potential role of real-time Ambulatory Glucose Profile (AGP) in identifying and managing a patient with hyperglycemia. This 55-years-old male patient with type 2 Diabetes Mellitus (T2DM) was presented to the clinic with weakness, increased urinary frequency, with constipation for the past 3 months. The patient was a known case of T2DM for 10 years, along with dyslipidemia, hypertension, and obesity. The profile obtained from AGP revealed glucose fluctuations with post-prandial excursions. Consequently, the patient's treatment regimen was changed. The use of glimepiride was discontinued, and the patient was recommended with voglibose 0.2 mg bid with two meals, metformin 100 mg + dapagliflozin 10 mg combination with morning meals, and metformin 1000 mg with evening meals. The treatment for hypertension and dyslipidemia was continued. This case study indicates that CGM can help improve our understanding of glycemic patterns and can have a beneficial effect on glycemic control.

**Keywords:** Ambulatory glucose profile, Continuous glucose monitoring, Postprandial hyperglycemia, Type 2 diabetes mellitus

#### **INTRODUCTION**

More than 400 million people worldwide have diabetes, predominantly type 2 (T2DM), with the prevalence expected to double by the year 2045. 1,2 One of the main challenges and unmet needs in diabetes management is the effective control of post-postprandial hyperglycemia. In patients with T2DM, postprandial hyperglycemia contributes significantly to the overall glycemic burden. Furthermore, hyperglycemia and oscillating blood glucose concentrations are found to be associated with an increased risk of diabetic complications and Cardiovascular Disease (CVD). 4-6

Postprandial Glucose (PPG) peaks were also implicated as a risk factor for microvascular and macrovascular complications.<sup>7</sup> Overall, increased PPG levels have also been associated with increased healthcare resource utilization.<sup>8</sup>

Hence, the precise determination of blood glucose concentration is imperative for effective diabetes management. Most practitioners and clinicians solely rely on Glycosylated Hemoglobin (HbA1c) and Fasting/Postprandial Plasma Glucose concentrations (FBG/PPG) to evaluate and regulate therapeutic strategies. This is not surprising considering that HbA1c and fasting glucose levels are easy to measure, and both have been studied extensively.

In any case, the conventional or surrogate markers of postprandial hyperglycemia, such as self-monitored blood glucose or post-challenge plasma glucose concentrations provide only a preview of the blood glucose concentration, with no much information about the rate of blood glucose change. As a result, despite monitoring

their blood glucose multiple times a day, most patients are unable to reach blood glucose targets.

The Continuous Glucose Monitoring System (CGM) provides real-time information on current blood glucose concentrations, provides short-term feedback about the effectiveness of diabetes interventions, and alerts if blood glucose concentrations are excessively high or low. The Ambulatory Glucose Profile (AGP) developed from a CGM is a simplified, visual representation which abridges glycemic information and its graphic insights in a clinically significant format. In this way, the AGP offers a simple and visual means of identifying periods of increased risk of hypoglycemia and hyperglycemia, which will help physicians and patients to address the underlying reasons for suboptimal diabetes control.

The following case report describes the potential role of real-time AGP in identifying and managing a patient with hyperglycemia.

#### **CASE REPORT**

This case involves a 55 years-old male patient presented to the clinic with weakness, increased urinary frequency, with constipation for 3 months. Patient was a known case of T2DM for 10 years, along with dyslipidemia, hypertension and obesity. The patient was on metformin + glimepiride (1000/1 mg) combination once daily with

breakfast, metformin 500 mg before dinner, telmisartan 40 mg before breakfast, and atorvastatin 10 mg during bedtime.

The FBG was 136 mg/dL, PPG was 240 mg/dL and HbA1c was 7.8%.

The patient was consequently recommended Free Style Libre Pro flash (Abbott, Alameda, CA) professional CGM to facilitate more frequent review of his blood glucose levels and to understand glycemic variability (GV), if any.

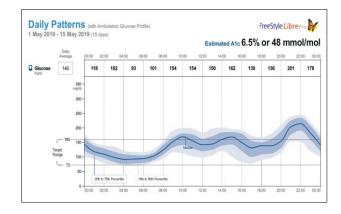


Figure 1: Ambulatory glucose profile report based on the data obtained from continuous glucose monitoring system.

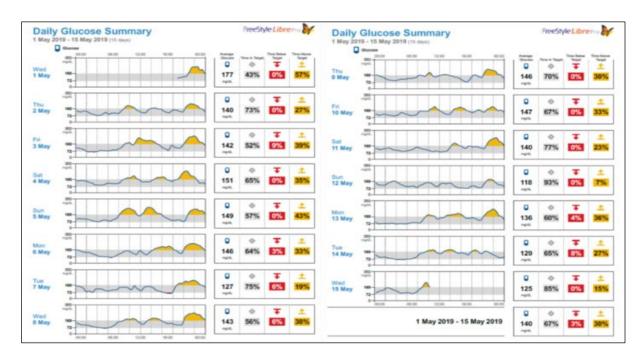


Figure 2: Daily glucose patterns.

#### Interpretation

Target range

On average, blood glucose levels were in the target range for  $\sim$ 67% of the time, and below the target range for  $\sim$ 3% of the time; glucose levels were above the target for  $\sim$ 30% of the time.

Patterns of hypoglycemia

Hypoglycemic patterns were not observed in this case.

The shape of the median curve

The median curve showed downward and upward trends, indicating glycemic instability. Hyperglycemic events were observed between 14:00 to 12:00 hrs.

Inter-Quartile Range (IQR) 25 to 75 percentile

The IQR was relatively narrow in most time of the day, however, IQR was relatively wide midnight and early morning (02:00 to 06:00 hrs). This fluctuation may be due to either medication or other factors.

Inter-Decile Range (IDR) 10 to 90 percentile

The inter-decile range was wider in the midnight (12:00 am) indicating that either the patient was being too rigid on his diet or not able to estimate the carbohydrates in the food or was incapable of maintaining a proper time for meals or other factors like physical activity.

#### Customized treatment based on AGP report

The complete glycemic profile obtained from the first AGP revealed that the patient was having glucose fluctuations with post-prandial excursions. The patient's medications were changed accordingly.

The use of glimepiride was discontinued, and the patient was recommended with voglibose 0.2 mg bid with two meals, metformin 100 mg + dapagliflozin 10 mg combination with morning meals, and metformin 1000 mg with evening meals. The treatment for hypertension and dyslipidemia was continued. The patient was counselled about the diabetes diet and exercises. A follow-up visit was suggested after a month or in-case his symptoms worsen.

#### **DISCUSSION**

Postprandial hyperglycemia is considered as an important facet of the GV and may result in oxidative stress, in turn inducing endothelial dysfunction and inflammation, all of which are widely known risk factors for CVD. 11-13

The Indian diabetes patients differ from their western counterparts, especially in postprandial hyperglycemia, resulting from a high dietary intake of carbohydrate. This may be considered as a major factor influencing glycemic excursions and control. The 2019 American Association of Clinical Endocrinologists and American College of Endocrinology consensus statement suggest the use of professional CGM in T2DM patients who have not reached their glycemic target after three months of the initial antihyperglycemic therapy. <sup>14</sup> Based on the concern areas identified by an AGP report, the physicians would be able to

tailor treatments to individual patients, resulting in better clinical outcomes. The patient in this case study hence was also recommended with the use of CGM.

Studies using CGM have shown that  $\alpha$  glucosidase inhibitors minimize GV due to their ability to lower PPG levels. Hence in this T2DM patient with post-prandial hyperglycemia identified on an AGP,  $\alpha$  glucosidase inhibitor was considered the preferred choice of therapy. The  $\alpha$  glucosidase inhibitors are found to lower PPG levels by inhibiting disaccharidase in the small intestine and delaying monosaccharide absorption.

A randomized study assessing the effect of 16 weeks of treatment with acarbose 100 mg versus glibenclamide 5 mg thrice-daily in combination with metformin 500 mg thrice-daily on GV was assessed in Taiwanese T2DM patients inadequately controlled on metformin, with HbA1c 7.0%-11.0%. The data indicated that the acarbose-metformin combination was more effective in reducing the intraday and inter day GV compared to the glibenclamide-metformin combination; both combinations reduced the overall glucose level equally. <sup>15</sup>

In another randomized parallel-group study, the effect of 16 weeks treatment with acarbose (50 mg thrice daily) versus glibenclamide (2.5 mg thrice daily) in combination with metformin 500 mg thrice-daily on GV and oxidative stress was assessed in Taiwanese T2DM patients inadequately controlled on metformin, with HbA1c 7.0%-11.0%. The dosage was doubled in both groups after 4 weeks, for the subsequent 12 weeks. Only acarbose significantly decreased the Mean Amplitude of Glycemic Excursion (MAGE) without significant change in oxidized LDL levels or 8-iso PGF2α excretion rates. β-cell response to postprandial glucose increments improved significantly with acarbose. <sup>16</sup>

In another cross-over study, changes in glucose levels after administration of sitagliptin 50 mg/day and voglibose 0.9 mg/day were assessed using CGM. Sitagliptin significantly decreased the 24-h mean glucose level, mean glucose level during daytime and PPG levels compared with voglibose. However, the glucose curve after breakfast and dinner rose rapidly with sitagliptin compared with voglibose. Results demonstrated voglibose to more significantly reduce PPG elevations compared with sitagliptin.<sup>17</sup> In another study, the effect of voglibose with or without high-fibre dietary intervention was assessed on GV in Indian patients with T2DM, whose HbA1c levels ranged from 7.0% to 10.0%. Combination therapy using high-fiber intervention and voglibose was significantly more effective than monotherapy in reducing HbA1c and the mean of daily differences, whereas no significant differences were found in MAGE and largest amplitude of glycemic excursions. 18

The above data demonstrated the role of alphaglucosidase inhibitors in controlling postprandial hyperglycemia, thereby also minimizing GV in T2DM patients. Hence, in T2DM patients with post-prandial hyperglycemia, alpha-glucosidase inhibitors may be considered as the preferred choice of therapy.

Therefore, in this case, voglibose was added to the to control the post-prandial therapy current hyperglycemia. Since the patient was a known case of hypertension and was obese, a Sodium-Glucose Transport protein 2 (SGLT2) inhibitor treatment was also initiated. The SGLT2 inhibitor like dapagliflozin was chosen based on the 2019 American Diabetes Association guidelines and 2019 ESC Clinical Practice Guidelines Diabetes-in collaboration with the European Association for the Study of Diabetes (EASD), which recommend an SGLT2 inhibitor as a choice of antidiabetic therapy in cases of T2DM with multiple cardiovascular risk factors, and T2DM with an established atherosclerotic CVD. 19,20 The patient was also counseled on the importance of a healthy diabetic diet and regular physical activity.

#### **CONCLUSION**

To conclude, it may be helpful to consider AGP in patients with impaired glycaemic control or patients with difficulty in managing their blood glucose and those who cannot identify or understand the causes of hyperglycaemic episodes. Using CGM may enable clinicians and patients to better understand glycaemic trends and may have beneficial effects on glycaemic control.

#### **ACKNOWLEDGEMENTS**

Author would like to thank Abbott Healthcare Pvt Ltd for providing editorial support for this manuscript.

Funding: No funding sources Conflict of interest: None declared Ethical approval: Not required

#### **REFERENCES**

- 1. Kaiser AB, Zhang N, Der Pluijm WV. Global Prevalence of Type 2 Diabetes over the Next Ten Years (2018-2028). Diabetes. 2018;67(1):202.
- Aynalem SB, Zeleke AJ. Prevalence of diabetes mellitus and its risk factors among individuals aged 15 years and above in Mizan-Aman town, Southwest Ethiopia, 2016: a cross sectional study. Inter J Endocrinol. 2018; 9317987.
- 3. Nathan DM. for the Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications (DCCT/EDIC) study research group. Intensive diabetes treatment and cardiovascular disease in patients with type 1 diabetes. N Engl J Med. 2005;353:2643-53.
- 4. Monnier L, Lapinski H, Colette C. Contributions of fasting and postprandial plasma glucose increments to the overall diurnal hyperglycemia of type 2

- diabetic patients: variations with increasing levels of HbA1c. Diabetes care. 2003 Mar 1;26(3):881-5.
- Woerle HJ, Pimenta WP, Meyer C, Gosmanov NR, Szoke E, Szombathy T, et al. Diagnostic and therapeutic implications of relationships between fasting, 2-hour postchallenge plasma glucose and hemoglobin a1c values. Archiv Inter Med. 2004 Aug 9;164(15):1627-32.
- 6. Ceriello A, Esposito K, Piconi L, Ihnat MA, Thorpe JE, Testa R, et al. Oscillating glucose is more deleterious to endothelial function and oxidative stress than mean glucose in normal and type 2 diabetic patients. Diabetes. 2008 May 1;57(5):1349-54.
- Zang L, Shimada Y, Nakayama H, Chen W, Okamoto A, Koide H, et al. Therapeutic silencing of centromere protein X ameliorates hyperglycemia in zebrafish and mouse models of type 2 diabetes mellitus. Fron Genet. 2019;10:693.
- 8. Pfeiffer KM, Sandberg A, Nikolajsen A, Brod M. Postprandial glucose and healthcare resource use: a cross-sectional survey of adults with diabetes treated with basal-bolus insulin. J Med Econom. 2018 Jan 2;21(1):66-73.
- 9. Burge MR, Mitchell S, Sawyer A, Schade DS. Continuous glucose monitoring: the future of diabetes management. Diabe Spectrum. 2008 Apr 1;21(2):112-9.
- 10. Evans M, Cranston I, Bailey CJ. Ambulatory glucose profile (AGP): utility in UK clinical practice. Bri J Diabe. 2017 Mar 21;17(1):26-33.
- 11. Ceriello A. The possible role of postprandial hyperglycaemia in the pathogenesis of diabetic complications. Diabetologia. 2003 Mar 1;46(1):M9-16.
- 12. Cavalot F, Petrelli A, Traversa M, Bonomo K, Fiora E, Conti M, et al. Postprandial blood glucose is a stronger predictor of cardiovascular events than fasting blood glucose in type 2 diabetes mellitus, particularly in women: lessons from the San Luigi Gonzaga Diabetes Study. J Clin Endocrinol Metab. 2006 Mar 1;91(3):813-9.
- 13. Standl E, Schnell O, Ceriello A. Postprandial hyperglycemia and glycemic variability: should we care?. Diabe Care. 2011 May 1;34(2):S120-7.
- 14. Garber AJ, Abrahamson MJ, Barzilay JI, Blonde L, Bloomgarden ZT, Bush MA, et al. Consensus Statement By The American Association Of Clinical Endocrinologists And American College Of Endocrinology On The Comprehensive Type 2 Diabetes Management Algorithm 2019 Executive Summary. Endocr Pract. 2019 Jan;25(1):69-100.
- 15. Lin SD, Wang JS, Hsu SR, Sheu WH, Tu ST, Lee IT, et al. The beneficial effect of  $\alpha$ -glucosidase inhibitor on glucose variability compared with sulfonylurea in Taiwanese type 2 diabetic patients inadequately controlled with metformin: preliminary data. J Diabe Compl. 2011 Sep 1;25(5):332-8.
- 16. Wang JS, Lin SD, Lee WJ, Su SL, Lee IT, Tu ST, et al. Effects of acarbose versus glibenclamide on glycemic excursion and oxidative stress in type 2 diabetic patients inadequately controlled by

- metformin: a 24-week, randomized, open-label, parallel-group comparison. Clin Therap. 2011 Dec 1;33(12):1932-42.
- 17. Seo C, Sakamoto M, Nishimura R, Tsujino D, Ando K, Morimoto A, et al. Comparison of glycemic variability in patients with type 2 diabetes given sitagliptin or voglibose: a continuous glucose monitoring-based pilot study. Diabe Technol Therap. 2013 May 1;15(5):378-85.
- 18. Joshi P, Mishra S, Singh A. Improvement in blood glucose fluctuations in type 2 diabetes mellitus by voglibose with or without high fiber dietary intervention. Sch J App Med Sci. 2017;5(9C):3676-9.
- 19. American Diabetes Association. 7. Diabetes Technology: Standards of Medical Care in Diabetes-2019. Diabe Care. 2019 Jan 1;42(1):S71-80.

 Cosentino F, Grant PJ, Aboyans V, Bailey CJ, Ceriello A, Delgado V, et al. 2019 ESC Guidelines on diabetes, pre-diabetes, and cardiovascular diseases developed in collaboration with the EASD. Eur Heart J. 2019 Aug 31:1-69.

**Cite this article as:** Saboo B. Ambulatory glucose profile in managing post-prandial hyperglycaemia in patients with type 2 diabetes mellitus: a case report. Int J Adv Med 2020;7:326-30.