

Case Report

Ambulatory glucose profile in managing hypoglycemia in patients with type 2 diabetes mellitus: a case report

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ABSTRACT

Continuous glucose monitoring (CGM) was done in a 41 years-old female patient with type 2 diabetes mellitus (T2DM) to evaluate the glucose fluctuations, to achieve better glycemic control. The patient presented to the clinic with lethargy, on/off episodes of extreme weakness, sweating, and tingling sensation in the feet (B/L), with leg pains for the past 3 months. She did not have any history of hypertension and cardiovascular disease. On examination, her blood pressure was found to be 120/70 mm Hg. The fasting plasma glucose was 96 mg/dL, postprandial glucose was 160 mg/dL, and glycosylated hemoglobin was 6.8%. The patient was on metformin (500mg)- glimepiride (2mg) combination, once daily, before breakfast, and metformin (500mg) after dinner. Since the symptoms were related to glucose fluctuations and hypoglycemia, the patient was consequently recommended professional CGM to analyze the complete glycemic profile. The profile obtained from Ambulatory Glucose Profile (AGP) revealed glucose fluctuations observed as hypoglycaemia and hyperglycemic episodes. Consequently, the patient's treatment regimen was changed. The use of glimepiride was discontinued, and the patient was recommended with vildagliptin (50 mg) and metformin combination (1000 mg) bid with meals. This case study indicates that the use of CGM may help in improving our understanding of glycemic patterns and may have a beneficial effect on glycemic control.

Keywords: Ambulatory glucose profile, Continuous glucose monitoring, Hypoglycemia

INTRODUCTION

Hypoglycemia is a limiting factor in the effective management of diabetes. Episodes of hypoglycemia not only affects cognitive function but can also lead to stroke, cardiovascular outcomes and even death.¹⁻⁵ Further, recurrent exposure to hypoglycemic episodes may exacerbate the established microvascular and macrovascular complications.⁶

Though the measurement of glycosylated hemoglobin (HbA1c) has been the traditional method for assessing glycemic control, it does not, however, represent intra- and inter-day glycemic excursions that may result in acute events of hypoglycemia. Further, HbA1c provides only an estimated measure of glucose control; it does not

address hypoglycemic or short-term glycemic variability, which are two important risk factors for diabetes-related complications.

Continuous glucose monitoring (CGM) is a tool that helps clinicians and patients with diabetes to overcome the limitations of HbA1c in diabetes management. Time spent in the glycemic target range and time spent in hypoglycemia is the main CGM metrics that provide a more personalized approach to diabetes management. Continuous and precise information acquired with CGM, such as the occurrence of asymptomatic hypoglycemia, is often not accessible with standard blood glucose self-monitoring.¹ Ambulatory glucose profile (AGP) developed from a CGM system is a simplified report, with standardized statistics and visual representation of

time in standardized glycemic ranges, glucose variability, and glycemic exposure over a single 24-h day.

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

CASE REPORT

This case involves a 41 years-old female patient with type 2 diabetes mellitus (T2DM) presented to the clinic with lethargy, on/off episodes of extreme weakness, sweating, and tingling sensation in the feet (B/L), with

leg pain for the past three months. The patient did not have any history of hypertension and cardiovascular disease. She was a vegetarian and a non-smoker.

On examination, her blood pressure was found to be 120/70 mm Hg. All other examination findings were normal. The fasting plasma glucose (FPG) was 96 mg/dL, postprandial glucose (PPG) was 160 mg/dL and HbA1c was 6.8%.

The patient was on metformin (500mg)/glimepiride (2mg) combination, once daily, before breakfast and metformin (500mg) after dinner.

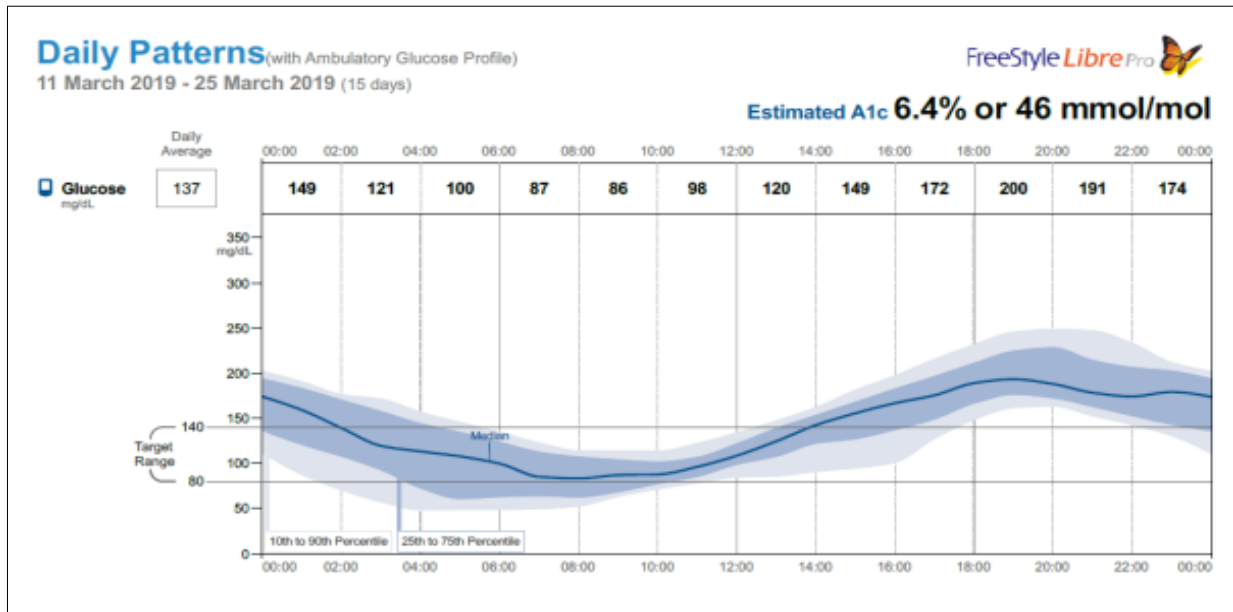


Figure 1: Ambulatory Glucose Profile report based on the data obtained from continuous glucose monitoring.

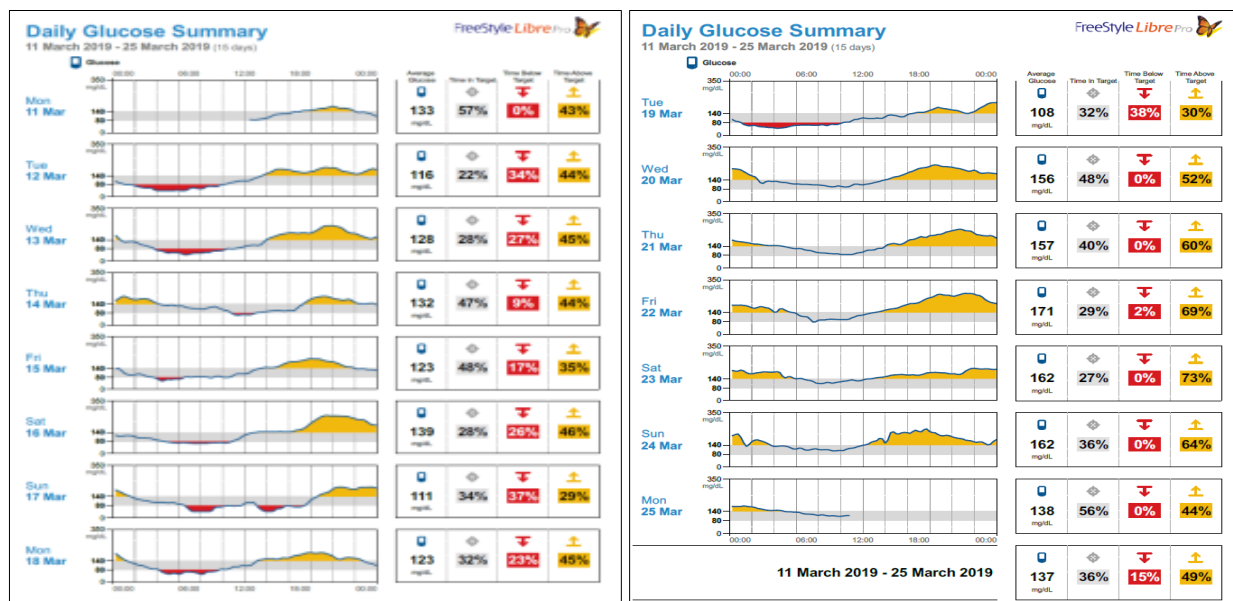


Figure 2: Daily glucose patterns.

Since the symptoms were related to glucose fluctuations and hypoglycemia, the patient was consequently recommended Freestyle Libre Pro flash (Abbott, Alameda, CA) professional CGM to analyze the complete glycemic profile, which would facilitate to better understand her glucose variability.

The ambulatory glucose profile (Figure 1) revealed Hypoglycemic patterns between 02:00 a.m. to 08:00 a.m. The median curve showed downward and upward trends, indicating glycemic instability. Hyperglycemic events were observed between 2:00 p.m. to 12:00 a.m. (midnight). The Inter Quartile Range was relatively narrow in most time of the day, however, IQR was relatively wide midnight and early morning (02:00 a.m. to 06:00 a.m.). This fluctuation may be due to either her medication or other factors. The inter-decile range was wider at the midnight (12:00 a.m.) indicating either the patient was being too rigid on her diet or was not able to estimate the carbohydrates in the food or did not maintain a proper time for meals or other factors like physical activity.

The daily glucose patterns report (Figure 2) showed that, on an average, 36% of the time blood glucose levels were in target range; for ~15% of the time blood glucose levels were below the target range.

Based on the above findings, treatment plan for this patient was modified. The use of glimepiride was discontinued, and the patient was recommended with vildagliptin (50 mg) and metformin combination (1000 mg) bid with meals. She was also prescribed with medications for symptoms of tingling sensation in the feet and pain in the leg, which were the symptoms of peripheral neuropathy. She was prescribed with pregabalin (75 mg) and mecobalamin (1000 mg) at bedtime.

Further, the patient was counselled about the diabetes diet and exercises. A follow-up visit was suggested to her after a month or in-case her symptoms worsen.

DISCUSSION

Fear of hypoglycemia is a recognized impediment in improving glycemic control, prompting patients and clinicians to be cautious in the management. CGM has the potential to aid patients avoid hypoglycemia, improve their glycemic control and even overcome hypoglycemia unawareness.⁷

The 2019 American Diabetes Association guidelines recommend CGM use for all patients with diabetes who have hypoglycemia unawareness and/or frequent hypoglycemia.⁸ The 2019 American Association of Clinical Endocrinologists and American College of Endocrinology consensus statement suggest use of professional CGM in T2DM patients who have not

reached their glycemic target after 3 months of the initial antihyperglycemic therapy and for those who require therapy that is associated with risks of hypoglycemia (sulfonylurea, glinide, or insulin), with frequency of use depending on stability of therapies. Furthermore, the use of personal CGM devices is suggested for T2DM patients with a history of hypoglycemia unawareness, or those with recurrent hypoglycemia, with the frequency of use on a continual basis in most patients.⁹ The Indian consensus guidelines on CGM use published in 2019 also recommends CGM in clinical practice for T2DM patients on hypoglycemic treatment under self-monitoring of blood glucose, who encounter one of the following situations: severe hypoglycemia or repeated hypoglycemia; asymptomatic hypoglycemia and nocturnal hypoglycemia; refractory hyperglycemia, especially when fasting; or large blood glucose excursions.¹⁰

The 6-month REPLACE trial (FreeStyle Libre) in patients with T2DM on basal-bolus insulin therapy and a baseline HbA1c of 8.7% showed a significant reduction in the time in hypoglycemia, but no change in HbA1c. The flash glucose-sensing technology was found to be safe and effective when used in place of standard SMBG for glycemic management of T2DM with intensive insulin therapy.¹¹ In another study of 29 patients with T2DM controlled on metformin plus sulfonylureas, the use of CGM demonstrated that 18 patients (62%) had 65 episodes of silent, symptom-free hypoglycemia (interstitial glucose <70 mg/dL).¹² This indicates that CGM can allow patients to be more cognizant of these silent changes in blood glucose levels, allowing them to make the necessary adjustments to such hypoglycemic episodes.

Research using CGM has shown that dipeptidyl peptidase-4 (DPP4) inhibitors are less associated with hypoglycemia, which could be attributed to their mechanism of action. Hence, the use of these drugs may help reduce hypoglycemia incidence and thereby glycemic variability in patients with T2DM who have an increased risk of hypoglycemia. Scherbaum et al, in their study reported no episodes of hypoglycemia with vildagliptin over a 2-year period in T2DM patients.¹³ Similar findings were reported by He et al, with vildagliptin therapy.¹⁴ Thus, DPP4 inhibitors may be a useful treatment option in T2DM patients with an increased risk of hypoglycemia. Therefore, in this case, sulfonylurea therapy was withdrawn and the therapy involving the DPP4 inhibitor was initiated.

CONCLUSION

CGM with AGP provides comprehensive data that tracks glucose levels 24-h a day, unlike traditional blood glucose monitoring which looks at just a few points in time. This data enables patients to augment their glycemic control, thereby minimizing hypoglycaemic

event frequency and severity. Thus, in those patients with poor glycemic control, or patients who struggle to manage their blood glucose, and those who cannot define or comprehend the causes of hypoglycaemic episodes, AGP may be a helpful tool to consider. The use of CGM may help to improve our understanding of glycemic patterns and may have beneficial effects on glycemic control. Nevertheless, the significance of diet and physical activity that also has a significant impact on the prevention of episodes of hypoglycemia should also be indicated to the patient.

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REFERENCES

- Ishikawa T, Koshizaka M, Maezawa Y, Takemoto M, Tokuyama Y, Saito T, et al. Continuous glucose monitoring reveals hypoglycemia risk in elderly patients with type 2 diabetes mellitus. *J Diabetes Investig.* 2018 Jan;9(1):69-74.
- Gerstein HC, Miller ME, Byington RP, Goff DC Jr, Bigger JT, Buse JB, et al. Effects of intensive glucose lowering in type 2 diabetes. *N Engl J Med.* 2008 Jun;358(24):2545-59.
- Lin CH, Sheu WH. Hypoglycaemic episodes and risk of dementia in diabetes mellitus: 7-year follow-up study. *J Intern Med.* 2013 Jan;273(1):102-10.
- Araki A, Iimuro S, Sakurai T, Umegaki H, Iijima K, Nakano H, et al. Non-high-density lipoprotein cholesterol: an important predictor of stroke and diabetes-related mortality in Japanese elderly diabetic patients. *Geriatr Gerontol Int.* 2012 Apr;12 Suppl 1:18-28.
- Stahn A, Pistrosch F, Ganz X, Teige M, Koehler C, Bornstein S, et al. Relationship between hypoglycemic episodes and ventricular arrhythmias in patients with type 2 diabetes and cardiovascular diseases: silent hypoglycemias and silent arrhythmias. *Diabetes Care.* 2014 Feb;37(2):516-20.
- Tandon N, Ali MK, Narayan KM. Pharmacologic prevention of microvascular and macrovascular complications in diabetes mellitus: implications of the results of recent clinical trials in type 2 diabetes. *Am J Cardiovasc Drugs.* 2012 Feb;12(1):7-22.
- Wolpert HA. Use of continuous glucose monitoring in the detection and prevention of hypoglycemia. *J Diabetes Sci Technol.* 2007 Jan;1(1):146-50.
- American Diabetes Association. Diabetes Technology: Standards of Medical Care in Diabetes-2019. *Diabetes Care.* 2019 Jan;42(Suppl 1):S71-S80.
- 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.
- Chawla M, Saboo B, Jha S, Bhandari S, Kumar P, Kesavadev J, et al. Consensus and recommendations on continuous glucose monitoring. *J Diabetol.* 2019;10(1):4-14.
- Haak T, Hanaire H, Ajjan R, Hermanns N, Riveline JP, Rayman G, et al. Flash Glucose-Sensing Technology as a Replacement for Blood Glucose Monitoring for the Management of Insulin-Treated Type 2 Diabetes: a Multicenter, Open-Label Randomized Controlled Trial. *Diabetes Ther.* 2017 Feb;8(1):55-73.
- Simonyi G, Csitári G, Gasparics R, Kollár R, Hegedüs Á, Pál Z, et al. Silent hypoglycaemic episodes among well controlled type 2 diabetic patients treated with sulfonylureas [abstract]. *Diabetologia.* 2015;58(Suppl 1):S465.
- Scherbaum WA, Schweizer A, Mari A, Nilsson PM, Lalanne G, Wang Y, et al. Evidence that vildagliptin attenuates deterioration of glycaemic control during 2-year treatment of patients with type 2 diabetes and mild hyperglycaemia. *Diabetes Obes Metab.* 2008 Nov;10(11):1114-24.
- He YL, Foteinos G, Neelakantham S, Mattapalli D, Kulmatycki K, Forst T, et al. Differential effects of vildagliptin and glimepiride on glucose fluctuations in patients with type 2 diabetes mellitus assessed using continuous glucose monitoring. *Diabetes Obes Metab.* 2013 Dec;15(12):1111-9.

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