International Journal of Research in Medical Sciences
Unnikrishnan AG et al. Int J Res Med Sci. 2020 Feb;8(2):734-737
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20200032

Case Report

Ambulatory glucose profile as an educational tool in the management of patients with type 2 diabetes mellitus

A. G. Unnikrishnan*, Vedavati Bharat Purandare

Department of Endocrinology, Chellaram Diabetes Institute, Pune, Maharashtra, India

Received: 20 December 2019
Accepted: 03 January 2020

***Correspondence:**
Dr. A. G. Unnikrishnan,
E-mail: unnikrishnan@gmail.com

ABSTRACT

A 60-year-old male patient with Type 2 Diabetes Mellitus (T2DM) since the last two years was presented in the clinic with repeated falls. He was on dietary treatment and was also taking metformin 500 mg twice daily, on and off. His Fasting Plasma Glucose (FPG) was 116 mg/dL, Postprandial Glucose (PPG) was 140 mg/dL and Glycosylated Haemoglobin (HbA1c) was 6.4%. The complete glycaemic profile obtained from the first Ambulatory Glucose Profile (AGP) revealed that the patient was not having hypoglycaemia and has very minimal glucose fluctuations without any post-prandial excursions. The visual cue obtained from Continuous Glucose Monitoring (CGM) / AGP enabled physicians to better inform the patient on the effects of medication and lifestyle on diabetes, thereby allowing the patient to make informed treatment and lifestyle modifications. This case study sheds light on the need to recommend AGP in such cases to provide insights on the glucose trends, thereby improve patient's confidence in the therapy, with lifestyle modification.

Keywords: Ambulatory glucose profile, Diabetes education, Hypoglycaemia, Type 2 diabetes mellitus

INTRODUCTION

India is estimated to have the second highest number of Diabetes Mellitus cases (DM) in the world, with prevalence ranging between 5-17%.[1-6] This is expected to increase as a result of increasing urbanization, changing population demographics, consumption of unhealthy diets, increasing rates of obesity and sedentary lifestyles. The management of T2DM is complex, taking into consideration other major modifiable risk factors such as obesity, diet, physical inactivity, smoking, blood pressure, and dyslipidemia.[7]

The Diabetes Control and Complications Trial indicated that intensive insulin regimens and blood glucose control corresponded with better glycemic control in patients with type 1 diabetes (T1DM), resulting in a significant reduction in diabetes macro- and microvascular complications.[8] A similar finding was noted in the type 2 diabetes (T2DM) population in the United Kingdom Prospective Diabetes Study, which also demonstrated evidence of improved outcomes when participants were engaged in a more intensive management course compared to the conventional treatment.[9] This indicates the need for a holistic approach for diabetes management, with all variables relevant to patients, care providers and the health care system addressed in a complementary fashion.

To evaluate the risk of diabetes complications, it may be necessary to contemplate not solely the patients' mean glycemic control, but conjointly their mean amplitude of glycemic excursions such as postprandial glucose elevations.[10] To assess daily blood glucose excursions, Continuous Glucose Monitoring (CGM) was developed to document patients' daily glucose profiles in detail. The CGM, which provides information on daily glucose fluctuations and shows how the values are affected by

everyday activities and stress levels, is a helpful tool for glycemic variability assessment.[11] Using CGM can allow patients to become more aware of the silent variations in blood glucose levels, allowing them to make the needed adjustments to potentially avoid these hypoglycemic episodes. CGM also enables patients to better understand their illness, the effect of lifestyle on glycemic goals and their response to therapy, in turn playing an important role in enabling adherence.[12] Upon obtaining GGM data, the patient can be encouraged to adapt to changes in their diet and lifestyle regimen based on information, for efficient glycemic control.

Here, authors share a case study that illustrates how CGM helped a patient in gaining insight on the glucose trends, and the impact of subsequent lifestyle modifications on glycemic control, thereby facilitating in improving overall clinical outcomes.

CASE REPORT

This case involves a 60-year-old male patient with T2DM of 2 years' duration, who presented to the clinic with repeated falls. He was on dietary treatment and was also on metformin 500mg twice daily, on and off. His Self-Monitoring of Blood Glucose (SMBG) results were not available.

His Fasting Plasma Glucose (FPG) was 116 mg/dL, Postprandial Glucose (PPG) was 140 mg/dL and Glycosylated Hemoglobin (HbA1c) was 6.4%. The patient was worried about hypoglycemia and was getting falls even on the days when he was not taking metformin. The patient was asked to discontinue metformin treatment and recommended to use FreeStyle Libre Pro professional CGM system to facilitate more frequent review of his blood glucose levels, to understand glycemic variability, if any.

The major concern of the patient was related to hypoglycemia. Patient use to feel that repeated falls were due to hypoglycemia. This concern was completely ruled out with the AGP report - as there was no hypoglycaemia or potential hypoglycaemia observed (Figure 1).

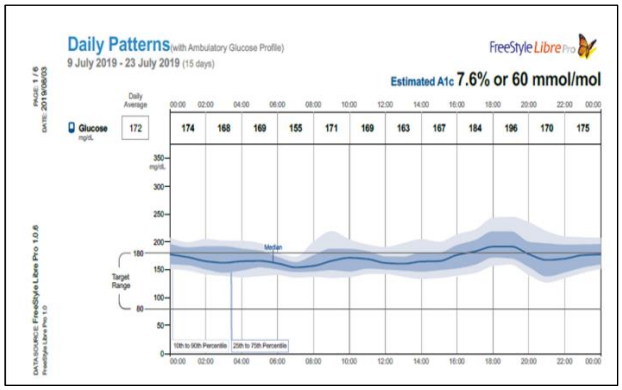

Figure 1: Ambulatory glucose profile (AGP) report based on the data obtained from CGM.

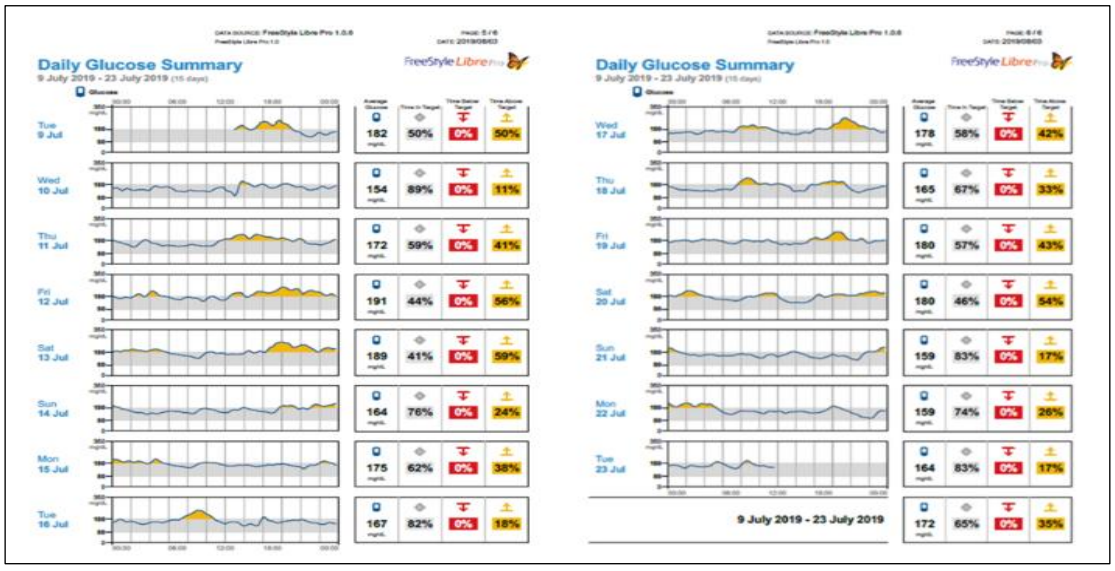

Figure 2: Daily glucose patterns.

Other important findings noted from the AGP (figure 1) include:

- Hyperglycemia was seen throughout the day with more pronounced rise between 16:00 to 20:00 hrs.

- The median curve showed slight multiple upward and downward changes between 15:00 to 18:00 hrs indicating slight instability during this period. The rest of it was overall stable, consistent with meal timings as in a patient with diabetes.

- The Inter Quartile Range was relatively narrow in most time of the day, however it was slightly wide post dinner between 20:00 to 22:00 hrs. The rest was acceptable.

- The inter-decile range was wider in the 08:00 to 10:00 hrs, 14:00 hrs and 18:00 to 22:00 hrs, which was consistent with post meal timings. Since the Inter-Decile Range (IDR) was not parallel to the IQR, this pointed towards diet being at play on some of the days leading to the deflections noted.

It was noted that, time-in-target range (80-180 mg/dL) was 65% with 0% in time below target range (<80 mg/dL). ~35% of the time glucose levels were above the target range (>180 mg/dL) (Figure 2). The major concern of the patient i.e. risk of hypoglycemia was ruled out with the AGP report. He was advised about the zero hypoglycemic risk and was asked to start Tab. Metformin 500 mg twice daily. He was subsequently referred to a neurologist for further evaluation and management.

DISCUSSION

The AGP report based on the CGM data provided consistent statistics, targets and visual representation of time in standardized glycemic ranges, glycemic variability, and glycemic exposure over a single 24-h day. The use of CGM and AGP can be a helpful instrument in counseling patients, as the report's visual displays can enable physicians to better inform patients on the effects of medication and lifestyle on diabetes, thereby allowing patients to make an informed decision about the medications, diet, and physical activity. Together with CGM, lifestyle and behavioral counseling are reported to facilitate increased treatment satisfaction and decreased disease-related distress.[13,14] The AGP thus would allow patients and clinicians to decide on a personalized therapy plan to improve the glucose profile while avoiding substantial hypoglycemia.[15]

Allen et al, in their study observed that T2DM patients who received counseling feedback on their CGM graph, with the detail information depicting glucose reductions in response to physical activity, along with the general diabetes education, had significantly higher self-efficacy scores for adhering to activity/resisting relapse, and significant reduction in the risk factors for diabetes-related complications compared with those who only received general diabetes education.[16]

In another 3-month study in poorly controlled T2DM patients, the use of CGM was reported to be useful in modifying patients' diet and exercise habits and induce better glycemic control than SMBG. A significant reduction in total calorie intake and an increase in exercise time per week was noted in patients using CGM.[17]

In another 3-month study in women with suboptimal glycemic control advised with CGM, counseling resulted in significantly greater problem-solving skills, and greater dietary adherence, moderate activity transcripts, weight loss, and higher intervention satisfaction than general diabetes education.[18] A 12-week lifestyle intervention coupled with CGM has also shown to have resulted in a rise in absolute step counts.[19]

CONCLUSION

This case study thus sheds light on the usability of CGM data for readily identifying the discrepancies in glucose trends and gain insight on the impact of diet, activity, and medications on glycemic control. AGP reports with visual cues will enable physicians to better inform patients on the effects of medication and lifestyle to guide treatment decisions. This case study emphasizes the need to recommend AGP in such cases to improve patient's confidence in the therapy and lifestyle modification.

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. Little M, Humphries S, Patel K, Dodd W, Dewey C. Factors associated with glucose tolerance, pre-diabetes, and type 2 diabetes in a rural community of south India: a cross-sectional study. Diabetol Metab Synd. 2016 Dec;8(1):21.
2. Ramachandran A, Snehalatha C, Kapur A, Vijay V, Mohan V, Das AK, et al. Diabetes Epidemiology Study Group in India (DESI. High prevalence of diabetes and impaired glucose tolerance in India: National Urban Diabetes Survey. Diabetologia. 2001 Sep 1;44(9):1094-101.
3. Barik A, Mazumdar S, Chowdhury A, Rai RK. Physiological and behavioral risk factors of type 2 diabetes mellitus in rural India. BMJ Open Diabe Res Care. 2016 Aug 1;4(1):e000255.
4. Tripathy JP, Thakur JS, Jeet G, Chawla S, Jain S, Pal A, et al. Prevalence and risk factors of diabetes in a large community-based study in North India: results from a STEPS survey in Punjab, India. Diabetol Metab Synd. 2017 Dec;9(1):8.
5. Anjana RM, Pradeepa R, Deepa M, Datta M, Sudha V, Unnikrishnan R, et al. Prevalence of diabetes and prediabetes (impaired fasting glucose and/or

impaired glucose tolerance) in urban and rural India: Phase I results of the Indian Council of Medical Research–INdia DIABetes (ICMR-INDIAB) study. Diabetologia. 2011 Dec 1;54(12):3022-7.
6. Mohan V, Deepa M, Deepa R, Shanthirani CS, Farooq S, Ganesan A, et al. Secular trends in the prevalence of diabetes and impaired glucose tolerance in urban South India-the Chennai Urban Rural Epidemiology Study (CURES-17). Diabetologia. 2006 Jun 1;49(6):1175-8.
7. Ofori SN, Unachukwu CN. Holistic approach to prevention and management of type 2 diabetes mellitus in a family setting. Diabe, Metab Synd Obesity: Targets Therapy. 2014;7:159.
8. Nathan DM. The diabetes control and complications trial/epidemiology of diabetes interventions and complications study at 30 years: overview. Diabe Care, 2014;37(1):9-16.
9. Turner RC, Holman RR. Lessons from UK prospective diabetes study. Diabe Res Clin Pract. 1995 Jan 1;28:S151-7.
10. Temelkova-Kurktschiev TS, Koehler C, Henkel E, Leonhardt W, Fuecker KA, Hanefeld M. Postchallenge plasma glucose and glycemic spikes are more strongly associated with atherosclerosis than fasting glucose or HbA1c level. Diabe Care. 2000 Dec 1;23(12):1830-4.
11. Suh S, Kim JH. Glycemic variability: how do we measure it and why is it important?. Diabe Metab J. 2015 Aug 1;39(4):273-82.
12. 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;25(1):69-100.
13. Mitra A, Dewanjee D, Dey B. Mechanistic studies of lifestyle interventions in type 2 diabetes. World J Diabe. 2012 Dec 15;3(12):201.
14. Taylor PJ, Thompson CH, Brinkworth GD. Effectiveness and acceptability of continuous glucose monitoring for type 2 diabetes management: A narrative review. J Diabe Invest. 2018 Jul;9(4):713-25.
15. Hirsch IB, Battelino T, Peters AL. Role of Continuous Glucose Monitoring in Diabetes Treatment. American Diabetes Association; 2018:1-28.
16. Allen NA, Fain JA, Braun B, Chipkin SR. Continuous glucose monitoring counseling improves physical activity behaviors of individuals with type 2 diabetes: a randomized clinical trial. Diabe Res Clin Pract. 2008 Jun 1;80(3):371-9.
17. Yoo HJ, An HG, Park SY, Ryu OH, Kim HY, Seo JA, et al. Use of a real time continuous glucose monitoring system as a motivational device for poorly controlled type 2 diabetes. Diabe Res Clin Pract. 2008 Oct 1;82(1):73-9.
18. Allen N, Whittemore R, Melkus G. A continuous glucose monitoring and problem-solving intervention to change physical activity behavior in women with type 2 diabetes: a pilot study. Diabe Technol Therap. 2011 Nov 1;13(11):1091-9.
19. Cox DJ, Taylor AG, Singh H, Moncrief M, Diamond A, Yancy Jr WS, et al. Glycemic load, exercise, and monitoring blood glucose (GEM): a paradigm shift in the treatment of type 2 diabetes mellitus. Diabe Res Clin Pract. 2016 Jan 1;111:28-35.

Cite this article as: Unnikrishnan AG, Purandare VB. Ambulatory glucose profile as an educational tool in the management of patients with type 2 diabetes mellitus. Int J Res Med Sci 2020;8:734-7.