CASE REPORT

Type 2 Diabetes Remission Through Intense Lifestyle Modification with Three-Year Follow-Up of an Elderly Male on High Insulin Dosage: A Case Report

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Abstract

An elderly obese male patient (60 yrs.) diagnosed Type 2 Diabetes (T2D) presented to our clinic. He was on 94 units of insulin and oral hypoglycemic agents during his initial consultation visit. After obtaining informed consent, he was enrolled into intense lifestyle modification program for a duration of six months, with a three-year follow-up after the intervention. The patient underwent complete remission losing 13 kg of body weight and also successfully clearing oral glucose tolerance tests (OGTT) for three consecutive years. We present three unique features in the current case report: (1) Elderly age of the patient (2) OGTT clearance along with normalisation of HbA_{1c}, and (3) High initial insulin dosage at baseline. A few of the common positive predictors of T2D remission documented in earlier studies include younger age and minimal or low doses of insulin. The current case study shows that older age and higher dosage of insulin, it is possible to undergo complete T2D remission along with OGTT clearance through intense holistic lifestyle modification. Future experimental studies with adequate sample sizes would help substantiate our observation.

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Introduction

Type 2 diabetes (T2D) remission is being widely reported across the world through surgical and non-surgical lifestyle interventions.[1,2] Long-term follow-up of remission, however, is mostly reported with surgical interventions such as bariatric surgery.[3,4] T2D is a chronic disorder and the sustained long-term impact of interventions is of utmost importance. T2D remission is defined as HbA_{1c} < 6.5% (48 mmol/mol), for at least a period of three months without glucose-lowering medications.[5]

Oral glucose tolerance test (OGTT) is reported to be a more robust marker in understanding the glycemic status of an individual when compared to fasting plasma glucose, post-prandial plasma glucose, or HbA_{1c}, which are documented to have performance limitations.[6,7] However, previous evidence on T2D remission has mostly reported the normalization of HbA_{1c} levels alone, and not OGTT. Similarly, a few studies include the common factors that influence T2D remission including the duration of diabetes, the current age of the patient, and minimal dosage of oral hypoglycemic agents.[8] The current case study reports diabetes remission in an elderly male with T2D on a high dose of insulin at baseline, who underwent complete T2D remission measured through HbA_{1c} levels. He also cleared OGTT consecutively for a period of 3 years.

Case Report

We report a case of a 60-year-old obese (BMI 31.67 kg/m^2) male with a history of T2D (duration of 3 years and 5 months) and albuminuria, who visited our clinic in December 2019. During the first consultation at our clinic, he was on 94 units of insulin, a combination of insulin (Aspart (30%) & insulin aspart protamine (70%) (54 units – 0 - 40 units) daily in combination with oral hypoglycemic medicine Glibenclamide (5 mg), and Metformin (500 mg) twice daily. He was also on taurine (500 mg) & acetylcysteine (150mg) twice daily for microalbuminuria. His T2D was previously diagnosed during a routine medical check-up in July 2016 He had a maternal family history of diabetes. Other significant history include microalbuminuria, fatty liver- grade 1, and mild prostate gland enlargement.

Table 1. Changes in anthropometric and biochemical parameters over a period of 30 months

GTT attempt	Year	HbA_{1c}	Fasting BSL	2hr BSL
1st attempt	2020	4.9	87	68
2nd attempt	2021	5.1	94	65
3rd attempt	2022	5.4	89	128

Parameters	Dec 2019	Feb 2020	May 2020	Oct 2020	Mar 2021	July 2021	Nov 2021	Jun 2022
Weight (kgs)	97		86	77.1	81	83	83	84
BMI (kg/m²)	31.67		28.08	25.18	26.45	27.1	27.1	27.43
Urine microalbumin (µg/ml)	106.58[a]	8.08		3.2		2.9		3.4
HbA_{1c} (%)	8.7[a]		5.1	4.9	4.9	4.8	5.1	5
Fasting Blood Glucose (mmol/L)	5.9[a]	5.6	4.6	5.4		5.2	5.6	4.9
Post Prandial Blood Glucose (mmol/L)	11.8[a]	5.6	4.5	6.1			7.3	5.9
Insulin Fasting (pmol/L)	108.6[a]			24.3		43.08	115.8	85.8
HOMA-IR	4.8[a]			1		1.7	4.8	3.1
hsCRP (mg/L)	6			2.6		1.66		3.8

[a]With medication

Abbreviations: BMI, body mass index; HDL, high-density lipoprotein; TG, triglycerides; LDL, low-density lipoprotein; VLDL, very low-density lipoprotein; HbA_{1c}, glycated hemoglobin; hsCRP, high-sensitivity C-reactive protein.

Intervention

After obtaining informed consent, he enrolled in the one-year Freedom from Diabetes- Holistic Transformation Program (FFD-HTP). FFD-HTP is a customized lifestyle program that include dietary modifications (plant-based diet, low in carbohydrates, rich in proteins, more vegetables and green smoothies), a personalised exercise plan (walking, asanas, cardio workout), and stress management support (psychological counseling, yoga, mindfulness meditation) in addition to medical management.

Blood glucose levels (fasting & post-prandial) were monitored every day through a mobile application. Based on the glucose levels, the insulin dosage was steadily tapered down by a physician. Within 30 days of enrolling in the program, on Jan 3rd 2020, his insulin was stopped. However, his oral hypoglycaemic agents were continued for the next 20 days. Medicine dosage was reduced based on his sugar levels and was stopped completely on Jan 23rd 2020. His blood glucose levels were monitored and were within the normal range even after stopping the medications. His urine microalbuminuria normalized on Feb 12th 2020. The FFD-HTP intervention was delivered through online mode during the COVID-19 lockdown. He lost 13 kg of body weight during the course of the program. His anthropometric parameters, glycated haemoglobin (HbA_{1c}), fasting and urine microalbumin levels were measured and blood glucose every 3-4 months (Table 1). During his subsequent visit on May 2nd 2020, his HbA_{1c} levels came down to the non-diabetic range of 5.1%, achieving complete remission. Additionally, the patient also underwent oral glucose tolerance test (OGTT) in December 2020 and successfully cleared it. During the two-year follow-up, he continued to be in remission while successfully clearing the OGTT in the years 2021 as well as 2022.

Discussion

To our knowledge, this is the first ever report of a 60-year old T2D patient to successfully undergoing T2D remission and also clearing the oral glucose tolerance testing (OGTT) thrice- at post-intervention and during the two-year follow-up. The associated co-morbidity of microalbuminuria has also been successfully reversed following the intervention. The T2D remission could be attributed to the weight loss of 13 kgs which is in line with a few of the previous observations.[8]

The three unique features in this particular case report are: (1) The advanced age of the patient, (2) OGTT clearance and (3) High initial insulin dosage. Various factors influence T2D remission rates and it is documented to be greater in T2D patients who are younger, with a shorter duration of diabetes, and lower insulin usage at baseline.[3,9] Age is consistently reported as an independent predictor of T2D remission.[9] The remission was found to be better in individuals who are less than 45 years old, and the remission rate decreases by 20% for every additional 12 years increase in age.[10]

A previous study reporting T2D remission in newly diagnosed T2D patients through intense lifestyle modification have shown that remission could be sustained, if weight regain is avoided post-remission.[11] The BMI of the patient during the first visit was 31.67 kg/m², which decreased to 28.08 kg/m² when the patient achieved remission. The patient's weight was sustained for the next two years at 27.43 kg/m² when he cleared his OGTT on the third consecutive year.

Secondly, the patient not only showed sustained weight loss and optimal HbA_{1c} levels, but was also able to successfully process the 75 g of glucose load given during the OGTT. To our knowledge, no previous reports on T2D

remission have not shown OGTT clearance as one of the outcome measures, especially during the long term follow-up. This is the first documentation to include both outcome measures within a case report.

Thirdly, one of the primary predictors of T2D remission is minimal oral glucose lowering medications and low or no insulin dosage at baseline. In the current case report, the insulin dosage of the patient at baseline was 94 units (54 units – 0 - 40 units) of mixed insulin (combination of insulin aspart (30%) & insulin aspart protamine (70%)) daily. Following the intense holistic lifestyle transformation program (FFD-HTP), the patient's insulin dosage was gradually tapered and completely stopped once his blood glucose levels were in the normal range.

The beneficial effects may be attributed to the intense lifestyle modification which includes a plant-based diet and structured physical activity.[1] Psychological support was also provided to the patient through psychological counseling, meditation and yoga,[12] as anxiety and depression are documented to be negative predictors of T2D remission.[8]

Conclusion

In conclusion, a structured, individualized holistic lifestyle transformation program may be beneficial in bringing about T2D remission, even in elderly patients who are on high doses of insulin. The patient did not only achieved normal HbA_{1c} levels, but also cleared the OGTT test consecutively for 3 years. Future, adequately sampled experimental studies are warranted to further conclude our observation.

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