

## CASES REPORTS

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# Continuous glucose monitoring during gestation in patients with pregestational type 2 diabetes mellitus

## Monitoreo continuo de glucosa durante la gestación en pacientes con diabetes mellitus tipo 2 pregestacional

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### ABSTRACT

Pregestational diabetes requires strict glycemic control during pregnancy. Continuous glucose monitoring (CGM) devices measure interstitial glucose levels without the need for capillary puncture. Four pregnant women with pregestational type 2 diabetes mellitus were studied with the aid of CGM during 2 weeks of their gestation. They had weekly nutritional sessions and medical controls with an endocrinologist. The average glucose level ranged from 82 to 171 mg/dL. The CGM allowed early changes in the treatment of one patient with hypoglycemia. All patients stated that the GCM helped them in their food selection. In conclusion, the GCM helped in carbohydrate recognition and treatment readjustment. The CGM was well accepted for use.

**Key words:** Pregnancy in diabetics, Blood glucose self-monitoring

### RESUMEN

La diabetes pregestacional requiere un control glicémico estricto durante el embarazo. Los dispositivos de monitoreo continuo de glucosa (MCG) miden niveles de glucosa intersticial sin necesidad de punción capilar. Se estudió 4 gestantes con diabetes mellitus tipo 2 pregestacional con la ayuda del MCG durante 2 semanas de su gestación. Ellas tuvieron sesiones nutricionales semanales y controles médicos con un endocrinólogo. El promedio de nivel de glucosa osciló entre 82 y 171 mg/dL. El MCG permitió cambios tempranos en el tratamiento de una paciente con hipoglicemia. Todas las pacientes manifestaron que el MCG les ayudó en la selección de sus alimentos. En conclusión, el MCG ayudó en el reconocimiento de carbohidratos y en el reajuste del tratamiento. El MCG tuvo buena aceptación de su uso.

**Palabras clave.** Embarazo en diabéticas, Automonitoreización de la glucosa sanguínea

### INTRODUCCIÓN

In pregestational diabetes (PGD) glycemic control should be strict, with frequent monitoring of glucose levels to adjust treatment as pregnancy progresses<sup>(1)</sup>. Capillary glucose monitoring is the most commonly used method for glucose monitoring and is recommended up to 7 times per day<sup>(2)</sup>. Continuous glucose monitoring (CGM) is an alternative that measures interstitial glucose<sup>(3)</sup>. The sensor contains the enzyme glucose oxidase, which causes interstitial glucose to react with oxygen and the electrons released from this reaction are measured by the sensor in a glucose concentration-dependent manner<sup>(4)</sup>.

The American Diabetes Association (ADA) and the American College of Obstetrics and Gynecology (ACOG) have established specific goals for pregnant women using CGM.

The use of CGM during pregnancy in Peru is limited. The present case study evaluated the glycemic parameters of CGM in patients with pregestational type 2 diabetes mellitus for 2 weeks during gestation, as well as the impact it had on diabetes management.



## CASE REPORT

This communication presents four cases of pregnant women over 18 years of age with PGD seen at the endocrinology clinic of the Hospital Nacional Docente Madre Niño San Bartolomé, Lima, Peru. The pregnant women were fitted with a FreeStyle 2 CGM for two weeks and participated in weekly nutrition education videoconferences that included nutrition concepts, carbohydrate counting and daily food intake records. Additionally, they had weekly checkups with their endocrinologist. Insulin was initiated when the time above 140 mg/dL was >20%.

The study was approved by the Hospital Ethics Committee. All participants signed an informed consent form.

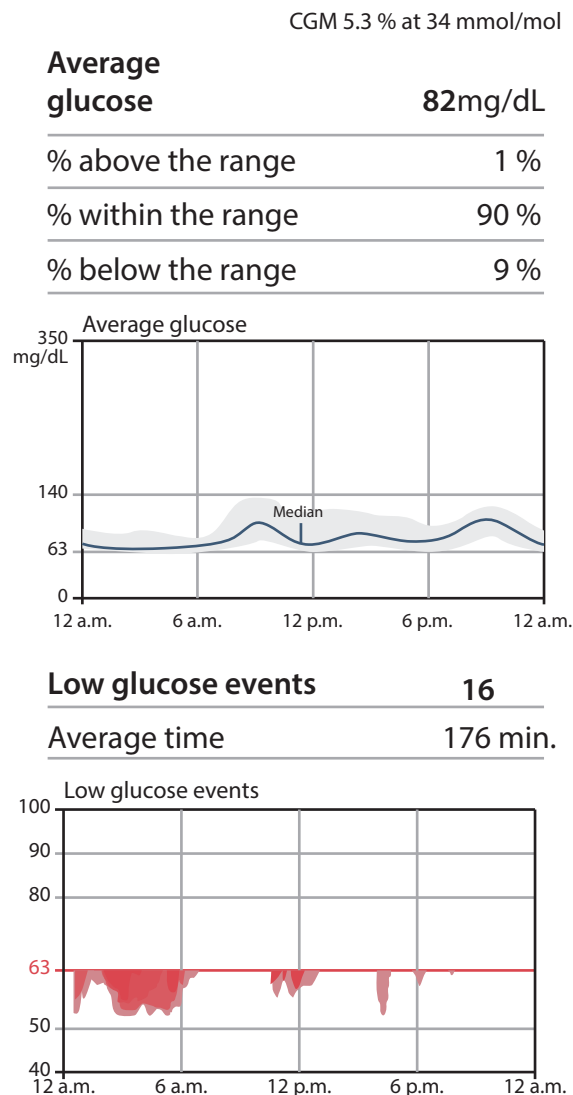
## CASE DESCRIPTION

Pregnant 1: 34 years of age, without previous treatment. The CGM was placed at 32 weeks of gestation, insulin detemir was started and the dose was decreased 3 times due to nocturnal hypoglycemia (Figure 1). The outcome was cesarean section at term, with a newborn weighing 4.3 kg.

Pregnant 2: 29 years old, with a history of hypothyroidism, previous treatment with metformin and glibenclamide. During gestation, treatment was started with NPH and regular insulin; the dose was adjusted 2 times prior to the use of the CGM. The CGM was placed at 22 weeks of gestation. The outcome was a 3 kg fetal death at 37 weeks of gestation.

Pregnant 3: 39 years old, previously treated with metformin and glibenclamide, with a history of hypothyroidism. During gestation she was started on NPH and regular insulin and the doses were adjusted 8 times before the CGM. CGM was placed at 8 weeks of gestation. The outcome was a missed abortion at 10 weeks gestation.

FIGURE 1. REPORT OF AVERAGE GLUCOSE AND HYPOGLYCEMIA EVENTS IN PREGNANT WOMEN 1.



Pregnant 4: 31 years old, previously treated with metformin. The sensor was placed at 17 weeks gestation; the sensor did not calculate the estimated HbA1c. The patient required only dietary management. She was admitted at 39 weeks and 3 days for suspected intrahepatic cholestasis, polyhydramnios and fetal macrosomia. During

TABLE 1. GLUCOMETRIC CHARACTERISTICS OF CONTINUOUS MONITORING OF PREGNANT WOMEN.

	Patient 1	Patient 2	Patient 3	Patient 4
Estimated Hb A1c (%)	5.30	7.40	5.80	-
Mean glucose (mg/dL)	82	171	105	98
Glycemic variability (%)	23.2	24.9	21.5	23.4
Time above 140 mg/dL (%)	1	76	7	5
Time in range 63 - 140 mg/dL (%)	90	24	92	95
Time below 63 mg/dL (%)	9	0	1	0
Hypoglycemia events (n)	16	0	2	0
Duration of hypoglycemia (minutes)	176	0	68	0



hospitalization, she developed placental insufficiency and underwent an induced cesarean section, with a newborn weighing 3.9 kg.

### DISCUSSION

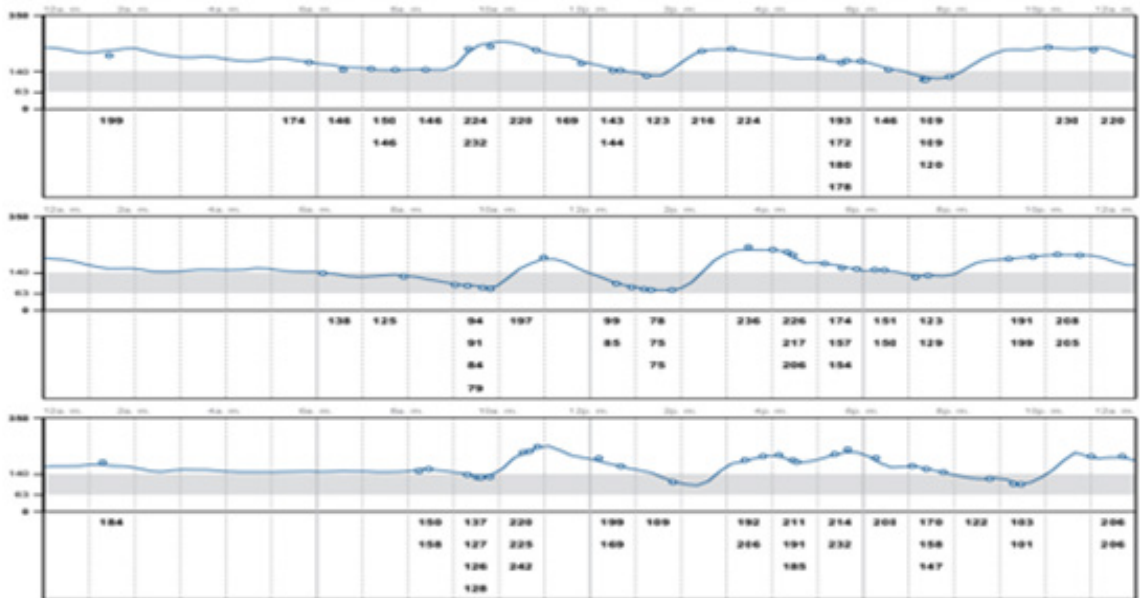
In our study, the CGM helped to establish glycemic patterns and treatment adjustments. These devices served as positive feedback to patients, who modified their diet by seeing in real time the effect of food on their glucose level. Previous studies have shown how the CGM helps to establish early pharmacological treatment in PGD<sup>(4)</sup>.

One pregnant woman achieved adequate glycemic control with only nutritional education supported by the use of the sensor (Figure 2). In another patient, insulin dose was reduced due to nocturnal hypoglycemia identified with the CGM, a previously reported finding<sup>(5)</sup>.

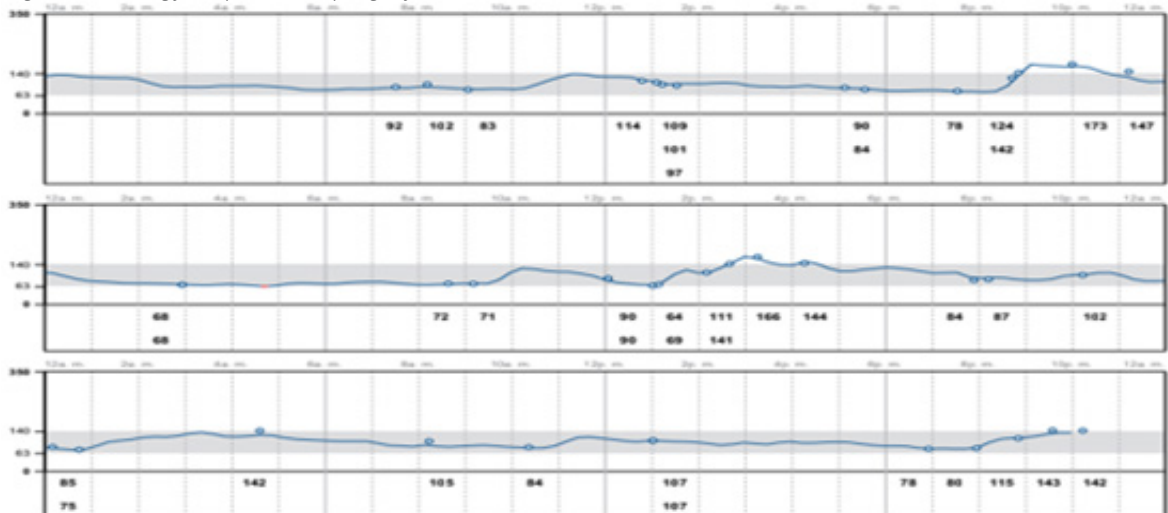
Pregnant 2 had a fetal outcome of fetal death; her time in range (TIR) was the lowest of the group (Figure 2). High TIR and low average daily glucose are associated with a lower risk of neonatal complications<sup>(6)</sup>.

FIGURE 2. GLUCOSE PATTERN COMPARISON IN PREGNANT WOMAN 2 AND PREGNANT WOMAN 4.

*Pregnant 2 with longer time in hyperglycemia requiring management with insulin*



*Pregnant 4 with better glycemic pattern and requiring only nutritional intervention*





Pregnant woman 3 had uncontrolled diabetes, requiring insulin adjustments prior to the use of the CGM. After sensor placement, the patient maintained adequate glycemic control with a TIR of 92%. It is likely that glycemic dyscontrol prior to sensor use may have contributed to the missed abortion, supporting the need for good glycemic control even at preconception<sup>(2)</sup>.

The main benefit of CGM is the reduction of maternal-perinatal pathologies such as preeclampsia, macrosomia, cesarean delivery, and preterm delivery<sup>(7-9)</sup>. The CGM has been related to better glycemic control and lower glycemic variability in pregnant women and consequently better outcomes in neonates<sup>(1)</sup>. The pregnant women in this case series reported a better understanding between their dietary intake and postprandial glycemia values.

In conclusion, the CGM is useful for the management of patients with type 2 diabetes mellitus during pregnancy, allowing the identification of glycemic patterns that require early intervention to avoid maternal-neonatal complications.

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