Journal of Diabetes Science and Technology
2020, Vol. 14(5) 972–973

DOI: 10.1177/1932296820906219
journals.sagepub.com/home/dst
SAGE

Two Subsequent Pregnancies in a Woman With Type 1 Diabetes: Artificial Pancreas Was a Gamechanger

Ingrid Schütz-Fuhrmann, MD[1], Anna K. Schütz[2], Marlies Eichner, MD[1], and Julia K. Mader, MD[3]

Keywords
artificial pancreas, do-it-yourself, DIY-AP, pregnancy, type 1 diabetes

Good glycemic control in women with type 1 diabetes (T1D) during pregnancy is essential to avoid adverse neonatal outcomes.[1] The current strategies for T1D management during pregnancy include insulin pump therapy in combination with continuous glucose monitoring (CGM) but the achievement of treatment goals while avoiding hypoglycemia still requires a lot of effort by each woman.[2] In many women, glycemic targets are unmet or can only be achieved at an increased rate of hypoglycemia.[3]

Over the last decade, a lot of research effort focused on the development of artificial pancreas systems (APS) comprising an insulin pump, a continuous glucose monitor, and a control algorithm that automatically adjusts basal insulin delivery according to insulin requirements derived from the CGM signal. Of recent, open source artificial pancreas (AP) algorithms have gained importance. As many steps need to be performed by the patients themselves, these AP systems are also called do-it-yourself artificial pancreas systems (DIY-APS). In contrast to commercially available APS, patients can individualize glycemic targets in DIY-APS to a certain extent so that they also are becoming of interest for use in T1D pregnancy. The majority of users has mainly positive views on APS as they facilitate diabetes management, relief burden of hypoglycemia, and improve quality of sleep; concerns comprise data privacy and fear of system failure.[4]

We present the case of a woman with a history of 30 years of T1D who underwent two subsequent pregnancies. The first pregnancy was at age 35 when she was using multiple daily injections therapy with insulins glargine and lispro plus flash glucose monitoring.

Prior to the second pregnancy, at that time, 37-year-old woman started to use DIY-APS consisting of the following components: AndroidAPS software algorithm, AccuChek Combo insulin pump, and Dexcom G5 sensor. Do-it-yourself artificial pancreas system was consistently used throughout the second pregnancy.

No relevant differences in HbA1c and body weight changes were observed between the two pregnancies. Table 1 indicates average glucose, time in different glucose ranges, HbA1c, and neonatal outcome for both pregnancies. When using AndroidAP, more time in the recommended target range (63-140 mg/dL) could be observed. During the first pregnancy, the patient reported severe hypoglycemia, while during the second pregnancy no severe hypoglycemia or hypoglycemia unawareness occurred. There were no differences in birth weight or delivery mode between the two pregnancies. Maternal perceptions during both pregnancies were completely different. While the first pregnancy was "the most exhausting time of her entire diabetes life," the second pregnancy was less strenuous. Data from the literature indicate that diabetes is easier to manage when using APS which is similar to the perceptions of our patient.[5]

Our case is the first one to report DIY-AP steered diabetes management throughout the whole duration of pregnancy. What adds to the importance of our case is that the same woman experienced two pregnancies so that a direct comparison was possible. Using APS in pregnant women with T1D can improve metabolic control at reduced risk of hypoglycemia leading to improved quality of life.

[1]Department of Endocrinology and Nephrology, City Hospital Hietzing, Vienna, Austria
[2]Endocrinology and Nephrology, Karl Landsteiner Institute, Vienna, Austria
[3]Department of Internal Medicine, Division of Endocrinology and Diabetology, Medical University of Graz, Austria

Corresponding Author:
Julia K. Mader, MD, Department of Internal Medicine, Division of Endocrinology and Diabetology, Medical University of Graz, Auenbruggerplatz 15, Graz 8036, Austria.
Email: julia.mader@medunigraz.at

Table 1. Glycemic control and neonatal outcome during the two subsequent pregnancies.

	Pregnancy 1	Pregnancy 2
Average glucose[a] (mg/dL)		
First trimester	123 (88; 164)	107 (84; 125)
Second trimester	97 (75; 125)	101 (78; 119)
Third trimester	100 (76; 130)	96 (76; 111)
% Time in range (63-140 mg/dL)		
First trimester	51	74
Second trimester	71	76
Third trimester	69	77
% Time in hypoglycemia (<63 mg/dL)		
First trimester	12	9
Second trimester	13	12
Third trimester	13	14
% Time in hyperglycemia (>140 mg/dL)		
First trimester	37	17
Second trimester	16	13
Third trimester	18	9
HbA1c (%)		
Gestational week 0-2	5.9	6.3
Gestational week 18-20	5.1	5.1
Gestational week 36	4.9	5.0
Weight gain (kg)		
Gestational week 4	2.0	0.0
Gestational week 20	7.5	7.0
Gestational week 36	11.0	13.0
Neonatal outcome		
Gestational age	38 + 4	38 + 5
Birth weight	2820 g	2900 g
Birth length	47 cm	45 cm
Delivery mode	Spontaneous, vaginal delivery Duration: 8 hours	Spontaneous, vaginal delivery Duration: 1.5 hours
APGAR score	9/9/10	9/10/10
Hospital stay	Four nights	Two nights
Breastfeeding	Yes	Yes

Abbreviation: APGAR, Appearance, Pulse, Grimace, Activity, Respiration.
[a]Median and interquartile range.

Consent to Publish

The patient provided written informed consent to publish data of her case.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: ISF received speaker honoraria from Dexcom, Medtronic, and Roche Diabetes Care. JM is a member in the advisory board of Boehringer Ingelheim, Eli Lilly, Medtronic, Prediktor A/S, Roche Diabetes Care, Sanofi-Aventis and received speaker honoraria from Abbott Diabetes Care, Astra Zeneca, Dexcom, Eli Lilly, Medtronic, MSD, NovoNordisk A/S, Roche Diabetes Care, Sanofi, Servier, and Takeda. The other authors do not report any conflicts of interest.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

ORCID iD

Julia K. Mader https://orcid.org/0000-0001-7854-4233

References

1. Persson M, Norman M, Hanson U. Obstetric and perinatal outcomes in type 1 diabetic pregnancies: a large, population-based study. *Diabetes Care*. 2009;32(11):2005-2009.
2. Alexopoulos AS, Blair R, Peters AL. Management of preexisting diabetes in pregnancy: a review. *JAMA*. 2019;321(18):1811-1819.
3. Murphy HR. Continuous glucose monitoring targets in type 1 diabetes pregnancy: every 5% time in range matters. *Diabetologia*. 2019;62(7):1123-1128.
4. Litchman ML, Lewis D, Kelly LA, Gee PM. Twitter analysis of #OpenAPS DIY artificial pancreas technology use suggests improved A1C and quality of life. *J Diabetes Sci Technol*. 2019;13(2):164-170.
5. Farrington C, Zoe Stewart Z, Hovorka R, Helen Murphy H. Women's experiences of day-and-night closed-loop insulin delivery during type 1 diabetes pregnancy. *J Diabetes Sci Technol*. 2018;12(6):1125-1131.