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Advances in Diabetes Control During Pregnancy

Hybrid Systems

Pregnancy is a time of joy and expectations for many women, but for those living with diabetes, it can be a challenging experience that requires careful management of blood glucose to ensure the health of both the mother and the

baby. In recent decades, we have witnessed significant advancements in medical technology that have revolutionized diabetes management, and one of the most exciting developments is the emergence of hybrid systems, also known as closed-loop systems.

WHAT ARE HYBRID SYSTEMS?

Hybrid systems are devices that combine continuous glucose monitoring with an insulin pump, utilizing smart algorithms to automatically adjust the insulin dose based on the patient's blood glucose levels. This represents a significant advancement in the treatment of diabetes for individuals with type 1 diabetes, as it eliminates the need for the patient to manually calculate insulin doses and can help prevent both hypo- and hyperglycemia.

Hybrid glucose systems not only offer physiological benefits in diabetes management but can also have a positive impact on the psychosocial well-being of individuals living with this disease. Below are some of these benefits:

- 1) Reduction of anxiety and stress:** Constant diabetes management can generate anxiety and stress in patients, especially when it comes to manually controlling glucose levels. Hybrid glucose systems can help reduce this anxiety by automating part of the glucose monitoring process, allowing patients to trust that the system will make decisions based on their individual needs.
- 2) Improvement in quality of life:** The need to regularly monitor blood glucose levels and calculate insulin doses can be a significant burden for individuals with diabetes. Hybrid glucose systems simplify this process by automatically making dosing decisions, which can free up time and energy for patients to focus on other areas of their lives, thus improving their quality of life.
- 3) Empowerment and autonomy:** The use of hybrid glucose systems can help empower patients by giving them a greater sense of control over their disease. By allowing them to actively participate in diabetes management in a more simplified and less invasive way, these systems can increase feelings of autonomy and self-efficacy among patients.
- 4) Greater peace of mind and confidence:** The ability of hybrid systems to prevent both hypoglycemia and hyperglycemia can provide patients with greater peace of mind and confidence in their ability

to manage their disease. Knowing that the system is constantly monitoring and adjusting their glucose levels gives them a sense of security and emotional well-being.

In summary, hybrid glucose systems not only offer benefits in controlling blood glucose levels but can also significantly impact the psychosocial well-being of patients by reducing anxiety and stress, improving quality of life, fostering empowerment and autonomy, and providing greater peace of mind and confidence in disease management. These benefits can contribute to a more positive and satisfying experience for individuals living with diabetes.

BENEFITS DURING PREGNANCY

During pregnancy, it is crucial for women with diabetes to maintain stable blood sugar levels to ensure the health of both the mother and the baby. During this important period, it is recommended that blood sugar levels be kept as close as possible to those of a woman without diabetes. This means that careful monitoring of glucose levels throughout the day is essential. Hybrid systems offer an innovative solution to this challenge, as they can automatically adjust the insulin dose according to changes in blood sugar levels, which can be especially beneficial during pregnancy, where hormonal changes lead to constant fluctuations in blood glucose levels.

Currently, there are several hybrid systems available on the market, specifically designed for individuals with type 1 diabetes mellitus. Each of these systems has its unique features. However, among them, only one, known as CamAPS FX, has been specifically approved for use during pregnancy. This system allows us to set a minimum blood glucose target of 80 mg/dL, which is very useful for maintaining proper control during this crucial stage. It is important to mention that the algorithm of this system is integrated into an application that, unfortunately, is currently only available for Android mobile devices. There are other hybrid systems available that are not specifically approved for pregnancy but are used by some pregnant women with type 1 diabetes mellitus who were already prior users of these systems before becoming pregnant, or who need them during pregnancy due to difficulties in »

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BEFORE STARTING TO USE A HYBRID SYSTEM DURING PREGNANCY, IT IS IMPORTANT FOR WOMEN TO CONSULT WITH A MEDICAL TEAM SPECIALIZED IN DIABETES AND PREGNANCY

	Ypsomed con CamAPS FX	Minimed 780G	Tandem t:Slim X2 con control-IQ
Glucose Target	80-198 mg/dL	100-120 mg/dL	110 mg/dL
Active Insulin	2-5 hours	2-5 hours	5 hours
Temporary Target	Boost Ease-off	150 mg/dL	Sleep: 110-120 mg/dL Exercise: 140-160 mg/dL
Sensor	Dexcom G6 or G7 Freestyle Libre 3	Guardian Sensor 4	Dexcom G6 or G7
Indications	Pregnant women, adults and children ≥ 1 year	Adults and children ≥ 7 years	Adults and Children ≥ 6 years
Compatibility Mobile App	Android	Android	Android iOS

» blood sugar control (either due to hyperglycemia or hypoglycemia). The characteristics of the different hybrid systems available are described in the table below.

Hybrid systems can offer several specific benefits for pregnant women with diabetes:

- 1) Precise glucose control:** The advanced algorithms used in hybrid systems can predict and prevent fluctuations in glucose levels, helping to maintain glucose within a target range throughout the day and night. A recent study conducted with over 100 pregnant women demonstrated that the use of the CamAPS FX system was associated with an approximate 10% increase in time spent within the target glucose range throughout pregnancy. This finding highlights the effectiveness of these systems in helping pregnant women with diabetes maintain optimal glucose control during this crucial period.
- 2) Reduction of stress:** Pregnancy can be a stressful time for many women, and managing diabetes can add an extra layer of anxiety. Hybrid systems can help reduce this stress by automating part of the glucose monitoring process, allowing women to focus on enjoying their pregnancy.
- 3) Improvement in pregnancy outcomes:** Stability in blood sugar levels during pregnancy can help decrease the risk of complications for both the mother and the

baby. However, previous studies have not provided clear evidence that the use of hybrid systems leads to a significant reduction in these complications, although those studies did not specifically focus on that aspect. Recently, an increase in the incidence of babies with higher-than-expected weights was observed in Spanish women using hybrid systems. It is important to consider that women with type 1 diabetes mellitus who use these systems often have more complicated diabetes from the outset, which could influence these outcomes. Therefore, further research is needed to better understand the role of these systems during pregnancy.

CONSIDERATIONS AND PRECAUTIONS

Although hybrid systems can be a powerful tool in managing diabetes during pregnancy, it is important to keep in mind some considerations and precautions:

- 1) Consult with a specialized medical team:** Before starting to use a hybrid system during pregnancy, it is important for women to consult with a medical team specialized in diabetes and pregnancy. The medical team can provide personalized guidance and ensure that the system is suitable for the patient's individual needs.
- 2) Education and training:** Effective use of a hybrid system requires adequate education and training. Pregnant women with diabetes should receive training on how »



» to use the system correctly and how to interpret the data from the continuous glucose monitor.

3) Adjustments during pregnancy: The hormonal and metabolic changes that occur during pregnancy can affect a woman's insulin requirements. Adjust-

ments may be needed in the hybrid system's settings to accommodate these changes and ensure optimal blood glucose control.

In conclusion, hybrid systems represent a significant advancement in the management of diabetes during pregnancy.

They can offer important benefits such as better glucose control and reduced stress. However, it is important to remember that each patient is unique, and it is essential to work closely with a specialized medical team to determine the best treatment strategy for each individual case. **D**

REFERENCES

- 1.- Szmuiłowicz et al. Expert Guidance on Off-Label Use of Hybrid Closed-Loop Therapy in Pregnancies Complicated by Diabetes. *Diabetes Technol Ther.* 2023 May; 25(5): 363-373. doi: 10.1089/dia.2022.0540
- 2.- Lee et al. Automated Insulin Delivery in Women with Pregnancy Complicated by Type 1 Diabetes. *N Engl J Med.* 2023 Oct 26;389(17): 1566-1578.
- 3.- Beato-Víborá et al. A Multicenter Prospective Evaluation of the Benefits of Two Advanced Hybrid Closed-Loop Systems in Glucose Control and Patient-Reported Outcomes in a Real-world Setting. *Diabetes Care.* 2024 Feb 1;47(2):216-224. doi: 10.2337/dc23-1355.
- 4.- Quirós et al. Real-world evidence of off-label use of commercially automated insulin delivery systems compared to multiple daily insulin injections in pregnancies complicated by type 1 diabetes. *Diabetes Technol Ther.* 2024 Feb 28. doi: 10.1089/dia. 2023.0594.