AI and Diabetes Technology in Diabetic Complications

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IN AN INSIGHTFUL session presented at the European Association for the Study of Diabetes (EASD) Annual Meeting 2024, the speakers discussed the advances in diabetes technology, offering solutions like continuous glucose monitoring (CGM) and hybrid closed-loop insulin pumps to help manage the condition. Tomas Griffin, Galway University Hospital, Ireland, explored how these tools can benefit people on dialysis or with impaired vision, highlighting their potential to improve glycaemic control. Meanwhile, Sufyan Hussain, Guy's and St Thomas' NHS Foundation Trust, London, UK, addressed the limitations of these technologies for patients with severe complications, such as gastroparesis or those on dialysis, and stressed the need for further innovation and research to meet the needs of disadvantaged populations with diabetes.

CAN WE USE DIABETES TECHNOLOGY IN PEOPLE ON DIALYSIS OR WITH IMPAIRED VISION?

A talk delivered by Tomas Griffin, Galway University Hospital, Ireland, explored whether diabetes technology can be used in people on dialysis or with impaired vision, focusing on the complexities of managing diabetes. Firstly, Griffin described diabetes as the leading cause of end-stage renal disease (ESRD), which accounts for approximately 45% of all cases of people with ESRD in the USA.[1] For patients with diabetes who are on dialysis, managing blood glucose levels is complex due to several factors, such as limited medication options, lack of awareness on hypoglycaemia, and fluctuating glucose levels during and after dialysis, contributing to increased cardiovascular risk. Griffin noted that HbA1c, a blood test used to diagnose Type 2 diabetes, may inaccurately reflect glucose control, making CGM necessary. Griffin went on to describe a study that assessed glycaemic control by CGM and HbA1c in patients with ESRD and 'burnt-out' diabetes. The results of this revealed that the number of people with diabetes on dialysis has increased from 41% to 81% over the recent years. The findings also showed that CGM has proved to be more effective than HbA1c in detecting undiagnosed hyperglycaemia, particularly in patients with burnt-out diabetes, where traditional monitoring may fail.[2]

Griffin also described several studies on the use of hybrid closed-loop insulin pump therapy. One multicentre study in particular on patients with Type 2 diabetes on haemodialysis showed that after 3 months of CGM-guided basal-bolus insulin therapy, HbA1c levels significantly decreased, without increased hypoglycaemia.[3] A randomised control trial further demonstrated that closed-loop insulin delivery reportedly helped patients achieve better glucose control during dialysis, with more time spent in the target glucose range and reduced hypoglycaemia.[4]

Griffin explained that for individuals with impaired vision, managing diabetes can be particularly difficult, as diabetic retinopathy along with other complications, can significantly affect a person's ability to manage their condition. Griffin presented several tools such as magnifiers, voice-

enabled glucose meters, and CGMs integrated with voice assistants like Siri (Apple Inc., Cupertino, California, USA) and Alexa (Amazon, Seattle, Washington, USA), that are meant to aid visually impaired people in managing their condition. These smart assistants allow people with visual impairments to receive their glucose data audibly, making it easier for them to manage their condition on their own. As an example, Griffin described the app SugarMate (Tandem Diabetes Care Inc., San Diego, California, USA), which integrates with CGM systems like Dexcom (San Diego, California, USA), providing users with features such as real-time monitoring, personalised alerts, and trend analysis. It can even provide reminders for insulin injections and meal planning through voice commands. To support his point, Griffin described a study by Akturk et al.[5] where legally blind patients who used a Dexcom G6 CGM combined with Siri voice assistant showed significant improvements in glycaemic control over 12 months. Furthermore, the patients reportedly experienced reductions in HbA1c and a decrease in episodes of severe hypoglycaemia. This highlights how voice-enabled CGMs can improve diabetes management for people with visual impairments.[5]

To conclude, Griffin emphasised how diabetes technology has evolved and its potential to be a useful tool in improving outcomes for people on dialysis or with visual impairment. He noted that hybrid closed-loop insulin pumps and CGM systems can provide better glycaemic control, while technological advancements offer increased accessibility and independence for people with visual impairments.

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WHAT CAN WE DO WHEN TECHNOLOGY DOES NOT HELP?

Sufyan Hussain, Guy's and St Thomas' NHS Foundation Trust, London, UK, delivered an insightful talk that aimed to address the limitations of current diabetes technology and what more is needed to improve care for people with diabetes, particularly those with complications such as dialysis, gastroparesis, or microvascular issues. Hussain explained the importance of ensuring equitable access to technology, as those who come from lower socioeconomic or minority backgrounds tend to present with the most severe complications and tend to be excluded from the benefits of advanced technologies, either due to systemic barriers or lack of inclusion in clinical trials.

Hussain emphasised that hybrid closed-loop insulin systems have shown promise in managing Type 1 diabetes; however, their impact is often limited, especially in people with complications. Hussain also pointed out that clinical trials of closed-loop systems typically report modest improvements in HbA1c (0.3% to 0.6%) and focus on people without advanced complications, while real-world evidence in a recent study demonstrated that people with poorer glycaemic control experience larger drops in HbA1c and greater improvements in time in range (TIR).[6] Access to these devices is often limited to people of higher socio-economic status, even in public healthcare systems like the NHS in the UK.

> **Hybrid closed-loop insulin systems have shown promise in managing Type 1 diabetes; however, their impact is often limited**

In individuals with advanced complications, such as those of dialysis or with gastroparesis, closed-loop systems are not effective due to the delayed pharmacokinetics of subcutaneously administered insulin. Gastroparesis and dialysis are situations in which glucose levels can rapidly fluctuate, as such, closed-

loop systems cannot adjust quickly enough, leading to poor glucose control in these individuals. Furthermore, the algorithms that power these systems are designed based on data from people without complications, which limits their applicability in patients with diabetes complications.[7]

One of the key research needs that Hussain highlighted is the need for further studies and product development, especially for algorithm design and options to control the duration of insulin action. Hussain continued to mention the over-represented themes in people with complications like technology rejection, psychological challenges, and anxieties from technology and alarms, which makes it very difficult for patients to manage their condition. Hussain explained that this is a common theme that's being over-represented in people; therefore, more thought needs to be given to how we manage diabetes distress and technology rejection effectively.

Finally, Hussain touched on the future of diabetes management, pointing to emerging therapies such as cell therapy. While still in the early stages, cell therapy offers hope for improved long-term outcomes in people with diabetes, particularly those with severe complications.

To conclude, Hussain noted that more studies are needed in populations with complications to aid optimal device design, algorithm development, features, and simplicity. He highlighted that trials should demonstrate the safety and efficacy of licensing and renumeration. As well as providing better HPC education on the optimal use of hybrid closed-loop systems in those with complications, he also highlighted the issues around staffing and capacity.

CONCLUSION

While diabetes technology offers promise, particularly for those on dialysis or with impaired vision, it has limitations, especially for patients with severe complications. Both Griffin and Hussain emphasised the need for further research, improved algorithms, and more equitable access to ensure these tools can fully benefit all individuals with diabetes.

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