

Implementation of Technology in the Follow-up of Patients with Diabetes: Is it Possible in a South American Country?

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Despite better treatments and technology available in usual clinical practice, achieving a good glycemic control in patients with diabetes is challenging. In times of SARS-CoV-2/COVID-19 infection, chronic diseases like diabetes have been associated with adverse outcomes [1]. Regardless of the limited information, it is known that individuals with diabetes are at risk of respiratory infections [2]. This risk can be reduced by achieving good glycemic control and for this reason, the care of patients with diabetes is a main concern.

In Colombia the first case of COVID-19 was reported in March of 2020 and after one week, the government and insurance companies established the response plan including mandatory isolation at national level to face this challenge in world health [3], restraining the displacement to health care centers of patients with diabetes. However, in a country like Colombia, where patients' access to medical care is usually limited, strategies to contain and mitigate SARS-CoV-2/COVID-19 infection make access to health care worse for patients with chronic pathologies. So, we have learned to implement and valued the role of technology in treatment, follow-up and communication with our patients and their families.

The use of platforms and telemedicine in patients with Type 1 (T1D) and Type 2 Diabetes (T2D).

Pre-COVID pandemic studies, such as DiaTel, a randomized clinical trial in patients diagnosed with T2D, showed that, compared to the monthly care coordination phone call group, the active care management group with home telemonitoring showed a decrease in HbA1c at 3 months (1.7 vs. 0.7%, $p < 0.001$) and this difference was maintained until 6 months [4]. Since 2010, the use

of virtual platforms added to standard care has shown an improvement in results such as HbA1c with a decrease of between 0.3 and 0.5% [4]. The addition of platforms in telemedicine such as DIABEO system. This is a class IIB CE (Conformité Européenne or European Commission)-marked medical device which combines a mobile app for patients with a web portal for health care providers. DIABEO system allows real-time monitoring as well as therapeutic decision-making, integrating both, basal and bolus dose calculation improving metabolic control in patients with T1D and T2D.

TELEDIAB 1, a randomized clinical trial included subjects with T1D and poor glycemic control. This pilot trial showed a significant reduction in HbA1c in the arm treated with usual care, in addition to DIABEO system and teleconsultation every two weeks compared to usual care alone [5]. Recently, TELESAGE trial a randomized multicenter study which include T2D and T1D patients with HbA1c $\geq 8.0\%$ treated with multiple doses of insulin or continuous subcutaneous insulin infusion in conditions near to real-life during 12 months of follow-up [6]. This trial compared standard care alone (group 1) vs DIABEO system alone (group 2) vs DIABEO system with nurse-assisted tele-monitoring and teleconsultation added to standard care (group 3) [6]. The average change in HbA1c compared to baseline was significant in arms using DIABEO system: (group 2 - group 1 = -0.41%, 95% CI = -0.65%; -0.16%), $P = 0.001$, and group 3 - group 1 = -0.51% [CI95% = -0.73%; -0.30%], $P \leq 0.001$). There was no difference in hypoglycemia events [6].

There is a more complex insulin therapy like Hybrid closed-loop (HCL) systems which use various combinations of control algorithms, glucose sensors, and

insulin pumps and require a structured education program [7]. HCL system automatically increases, decreases, and suspends insulin delivery in response to continuous glucose monitoring [7]. HCL has demonstrated increased time in range and reductions in HbA1c, hyperglycemia and hypoglycemia [8]. During COVID-19 pandemic the combination of telemedicine and platforms also played an important role in education programs for patients who are upgraded to this technology. Glycemic outcomes from CareLink™ Personal database from patients who were new to using the HCL system compared the face-to-face training and virtual training using teleconsultation and CareLink Platform outcomes. In both groups Time In Range (TIR) was similar (70.4 vs 68.4%), suggesting that virtual training of individuals results comparable with in-person training [9].

Advantages and Disadvantages of Telemedicine

The advantages of implementing telemedicine within clinical practice are the improvement in metabolic control in patients with T1D and T2D and the positive impact on comorbidities such as high blood pressure and weight reduction [4], improvement in adherence and access to health services especially for subjects living in remote areas [10]. However, it requires standardization of the care performed by teleconsultation including availability of technical support for the use of the platform, additionally a basic software and hardware infrastructure is required that includes precise devices to measure weight, heart rate, oxygen saturation that could increase the cost [11]. The coverage of this service may be limited by access to the internet or cell phone network in those patients without availability of these services [11]. Finally, telehealth reimbursement policies in some countries are not regulated.

Colombian Experience

Access to technology has increased throughout the world facilitating the implementation of telemedicine. 96.4% of households in Colombia, at least one person had a cell phone [12]. 97.5% of the people who live in the capital cities and 92.2% of the people who live in populated centers and dispersed rural areas report having a cell phone [12]. In addition, the mobile Internet service by subscription at the end of the third quarter of 2018 reached a total of 11,223,377 subscribers [12].

Before the pandemic, in the Hospital Universitario San Ignacio, in the Endocrinology unit we had adopted telemedicine combined with several software which allowed us to keep in touch with patients with diabetes who lived outside of the city, independently of the device that they were using. Also, we implemented telemedicine

using TIDEPOOL, a free software designed by a nonprofit organization [13] which allows a two-way communication between patient and physician. It also shows Self-Monitoring Blood Glucose (SMBG) data from some devices available in Colombia and Intermittent Continuous Glucose Monitoring (iCGM) or flash glucose monitoring data. Using this software, it was possible to communicate with our patients in a remote way and to make insulin adjustments when required and giving additional support and information [14].

Nowadays, automatic transmission and remote interpretation of patient data for follow-up and preventive interventions are available, including connection tools such as Bluetooth and Wi-Fi and continuous glucose monitoring (CGM) with availability of information in the “cloud” (cloud-based Software) [4]. Unfortunately, the use of integrated platforms and telemedicine is not usual clinical practice and it is not available in some regions. After the mandatory isolation was declared, we increased the use of these tools for medical and educational purposes with most of our patients. As a referral center of insulin pump and CGM, we developed a virtual course to keep the education program of users of insulin pump who are updating to newer technology. This course has virtual classes including carb counting education and workshops about different settings of the new device. It also allows us to continue their weekly follow-up which includes the download and review of CGM data, adjustments and education using the latest Medtronic software.

Telemedicine combined with this software has allowed us to continue the monthly follow-up of our ambulatory patients using hybrid close loop system (HCL). With this technology, patients can upload CGM data remotely. It also allows health personnel to assess glucose data and make device adjustments, without the patient leaving home, reducing emergency consultations related to diabetes decompensation and the risk of COVID-19 contagion. Recently, we describe our experience with a virtual education program in T1D patients who were upgraded to HCL. 48% of those patients did not have experience using CGM or telemedicine tools [7]. However, all patients increase their time in range (TIR) between 70 and 180 mg/dl using manual mode reaching TIR above 70% and they have a significant increase of TIR two weeks after auto mode feature was turn on [7]. Those outcomes are very similar to face-to-face education programs [7]. After these results, we have continued with the virtual training courses even though most of the restrictions for COVID-19 pandemic were removed.

Conclusion

Efforts have been made over the years to increase the use of connection systems at all socioeconomic levels in our

country [15]. However, from our experience we know that we have a long way to go to implement telemedicine in the treatment of patients with diabetes. In the near future, we predict that because of its advantages (availability, simplicity, low cost for patients and payers) this modality of care will be adapted in primary care for treatment of patients with diabetes and other chronic diseases even when we overcome the pandemic.

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