Health promotion

Self-monitoring of blood glucose for type 2 diabetes mellitus patients

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Introduction

Among the many rising global health epidemics, diabetes mellitus can be argued to be one of the most concerning ones with over 246 million people affected worldwide currently and 380 million people expected by 2025. Type 2 diabetes mellitus (T2DM), or non-insulin dependent diabetes, accounts for 95% of all cases of diabetes, and results in significant morbidity and long-term complications affecting multiple organ systems, such as microvascular pathology in the retina, peripheral neuropathy, nephropathy, and most importantly, macrovascular disease affecting arteries supplying the heart, brain, and lower extremities. In fact, the risk of developing cardiovascular complications in T2DM is two- to fourfold higher for men and women respectively, relative to a non-diabetic population.

Tight blood glucose control is one of the pillars of patient-centred self-management, but the role for testing glucose levels in order to achieve tight control has been met with many challenges and debate. Technology that allows glucose levels in order to achieve tight control has been met with many challenges and debate. Technology that allows

Current evidence

The current clinical evidence supporting the use of SMBG on improving the outcomes of non-insulin dependent T2DM patients is controversial and inconclusive. Most published trials of SMBG use the glycosylated hemoglobin (A1C) (HbA1C) levels as a surrogate marker for overall glycemic control and risk of secondary complications, but the methods utilized with respect to the intervention (e.g. frequency of SBGM, follow-up, and education) have been heterogeneous and hence difficult to generalize.

A recent key study conducted by the DiGEM (Diabetes Glycemic Education and Monitoring) Trial Group used an open, parallel group randomized control trial methodology. It was concluded that there was no convincing evidence to recommend routine SMBG for all T2DM patients, nor any evidence of improved glycemic control relative to usual care monitored by HbA1C levels.

However, in contrast, a meta-analysis conducted by Jansen et al. looking at 13 randomized controlled trials was able to report conclude that SMBG improved the HbA1C by more than 0.40% and this reduction nearly doubled after providing medical feedback. Similarly, Towfigh et al. concluded from their meta-analysis of 9 randomized control trials that T2DM patients not on insulin using SMBG had a statistically significant although modest improvement in glycemic control relative to those without SBMG. Moreover, a study by McGeoch et al. suggested that there may be a subset of T2DM patients who benefit from SBMG. Specifically, they conducted a systemic review of 3 randomized trials and 13 observational studies published since 1990. Based on results from a patient group managed with oral hypoglycemic agents and/or diet alone, their conclusion was that only larger studies with a higher initial HbA1C of > 8% showed improvement in glycemic control with SMBG.

Challenges and Limitations

It has been difficult to consolidate data and compare research on SMBG in T2DM patients due to inconsistency of outcome measures, as well as a lack of using other measures beyond the HbA1C value to monitor efficacy. Welschen et al. suggest that additional factors such as quality of life, well-being, patient satisfaction, and hypoglycemic episodes should also be comprehensively incorporated into the outcome measures.

Another limitation of the current literature is that many studies have not reported use of a validated or standardized algorithm for patients to implement changes in therapy. For example, in the Juvenile Diabetes Research Foundation study, patients were instructed to calculate their insulin dose and adjust it according to their blood glucose levels according to standardized protocols. Use of such protocols not only allows for more consistency by reducing confounding factors affecting the outcome measures, but also helps to encourage patient self-education and interpretation around SMBG. Accordingly, both education and ongoing support have been cited as areas requiring further development in adopting a SMBG intervention for T2DM patients who need more guidance on the course of action when observing a high blood glucose level. In fact, patients with chronic hyperglycemia may develop increased anxiety, feel more burdened with their health care, and even perform inappropriate actions if they do not possess an adequate understanding of normal fluctuations of blood glucose.

Recommendations

While there has been a lack of consensus on whether to adopt SMBG as part of routine care for all T2DM patients,
there has been some agreement that certain subpopulations may benefit from regular SMBG. Specifically, tight glycemic control is very important during pregnancy as preventing fetal malformation, stillbirth, neonatal hypoglycemia, and respiratory distress. Furthermore, changes in HbA1C levels are too slow and retrospective to be used as an accurate measure of glycemic control during this sensitive time period. Similar parallels can be drawn with other special circumstances such as new diagnosis of T2DM, initiation or change in medication, or concurrent illnesses where SMBG may prove to be of benefit. Given that a goal of SMBG is to promote self-management skills in the T2DM patient, identification of behavioural and personal characteristics which may predispose a patient to maximally benefit from SMBG would likely result in improved and long-term outcomes. For instance, “ideal” patients have been identified as those who know how to take a reading, interpret the reading relative to target values, formulate a connection between deviant readings and prior behaviour, create and implement action plans, and evaluate glucose readings in a non-judgmental framework.

Conclusion and Future

Tight glycemic control is an important goal of self-management in T2DM in order to prevent secondary complications. While there has been evidence supporting the use of SMBG for insulin-dependent diabetes, most research studies lack sufficient consistency and homogeneity in methodology, clinical follow-up, and patient populations to make a conclusive recommendation for its use in the routine daily management of T2DM patients.

Future areas for productive research in this area include developing more educational and ongoing support for T2DM patients to improve understanding of blood glucose readings and their associated clinical implications. Also, defining other relevant outcomes for SMBG beyond the A1C would be relevant. There may be subpopulations of T2DM patients who would benefit more from SMBG due to their need for tighter glycemic control during special circumstances, such as during pregnancy, new diagnosis, a change of medications, or other co-morbidities. Despite the current challenges with consolidating evidence on the benefits of SMBG for the T2DM patient population, it remains possible that SMBG can play an important role in the glycemic control with the appropriate supportive clinical education and follow-up of patients.

References