A Practitioner's Simple Mnemonic for Managing Diabetes: "GLUCOSE BAD"

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ABSTRACT

Diabetes is a chronic disease resulting from defects in insulin production, insulin action, or both, which ultimately can lead to elevated blood glucose levels, causing serious health complications and premature death. Diabetes is the seventh leading cause of death in the US and contributes to many complications, including eye, kidney, and heart disease, and lower limb amputation. The Diabetes Control and Complications and the Epidemiology of Diabetes Interventions and Complications trials have shown that, with intensive therapy and optimal blood glucose control, there is a reduction in complications, leading to the development of clinical guidelines for the management of diabetic patients. The "GLUCOSE BAD" mnemonic can assist the practitioner in remembering those guidelines.

Keywords: DCCT, diabetes, EDIC, guidelines, microvascular complications

DIABETES

In 2014, the United States Centers for Disease Control and Prevention (CDC) stated that 29.1 million children and adults in the US had diabetes, a chronic disease resulting from defects in insulin production, insulin action, or both.[1] The resulting high blood glucose levels can lead to serious complications and premature death for those who live with diabetes. According to the CDC, diabetes was the seventh leading cause of death in the US with an estimated 234,051 annual deaths in 2010.[1] Diabetes contributes to many health complications, including eye, kidney, and heart disease, and lower limb amputation.[1] The 2014 *Statistics About Diabetes* from the American Diabetes Association (ADA) showed that diabetics had additional complications as well: 71% had hypertension (HTN); 28.5% had some type of eye disease or blindness; 44% had kidney disease; and 60% had nontraumatic lower limb with amputations.[2] Risk factors contributing to these statistics included: obesity; lack of education and exercise; age; and genetics.[3] With such staggering statistics in morbidity, mortality, and macrovascular and microvascular complications, it is imperative for practitioners to be aware of what the current guidelines are for the treatment and management of diabetic patients. A simple mnemonic, "GLUCOSE BAD," is an easy way to remember these guidelines.

DIABETES CONTROL AND COMPLICATIONS TRIAL/ EPIDEMIOLOGY OF DIABETES INTERVENTIONS AND COMPLICATIONS TRIAL

According to the *National Diabetes Fact Sheet*, extensive global studies have shown that improved blood sugar control benefits all patients with diabetes.[4] The Diabetes Control and Complications Trial (DCCT) (1982-1993) was a controlled clinical trial constructed to determine whether patients with type 1 diabetes who maintained their glucose levels as if they were without diabetes could reduce or prevent complications.[5] The trial compared conventional insulin therapy, which at the time consisted of 1 or 2 injections daily, with intensive multiple daily injection treatment along with stringent blood glucose monitoring.[6] According to Pirola, the DCCT proved there was a correlation between better glucose control with intensive insulin therapy and a lower prevalence and development of microvascular complications, such as nephropathy, neuropathy, and retinopathy.[6] The intensive therapy patients sustained a hemoglobin (HbA_{1c})

level of 7% as compared with the conventional group at 9%.[6] The reduction in microvascular complications that may occur in the kidneys, eyes, or nerves can be decreased by 40% with every HbA_{1c} percentage point drop in blood sugar levels.[4]

The DCCT ended in 1993, a year early, due to the compelling benefits of intensive insulin therapy and the proven reduction of complications.[5,6] Due to the DCCT's shortened data period, the Epidemiology of Diabetic Intervention and Complications (EDIC) trial began in 1994, as a follow-up to the DCCT interventions, investigating complications occurring over a longer period of time.[6] The EDIC examined cardiovascular, renal, and retinal disease complications that were in a more serious or advanced stage, as these usually need a longer time period to evolve.[6] Pirola noted that the findings of the DCCT study were also prevalent in the EDIC outcomes, thus implying a possible "glycemic" or "metabolic memory."[6(p1460)] These findings indicate that there was a continuous positive effect on diabetic complications after duration of improved glucose control despite a possible earlier period of uncontrolled glucose. The DCCT and EDIC outcomes data led to the development of monitoring glucose control for those with type 1 and type 2 diabetes and, more importantly, led to clinical guidelines for management of diabetic patients, as established by the ADA and other councils.[7] Patients (or clients) with diabetes can reduce the risk of complications and morbidity with assistance from their support networks and education from their health care teams.[8] The mnemonic "GLUCOSE BAD" assists the practitioner in remembering the necessary guidelines in managing diabetic patients.

G—GLYCEMIC CONTROL

Glycemic control can be assessed using 2 methods: HbA_{1c} and self-monitoring of blood glucose.[9] HbA_{1c} testing shows average glucose control over several months and is a predictor for possible future diabetic complications.[10] According to the ADA, HbA_{1c}s should be completed consistently about every 3 months.[9,10] Recommendations for HbA_{1c} goals for nonpregnant adult patients is $< 7\%$, and a goal of $< 6.5\%$ for those patients with minor cardiovascular disease (CVD), minor hypoglycemic episodes, short diagnosis time with diabetes, and long life expectancy.[9]

An HbA_{1c} goal of $< 8\%$, however, should be considered for those patients with significant comorbidities, progressive micro- or macrovascular complications, or shorter life expectancies.[9] HbA_{1c} testing can be performed twice a year for those patients who have been able to achieve treatment goals and that have glycemic control considered stable by their providers.[9,10]

Self-monitoring of blood glucose goals are 80-130 mg/dL preprandial, and < 180 mg/dL 1-2 hours postprandial.[9,11] These goals should be individualized based on the patient's comorbidities, current health status, age or life expectancy, and hypoglycemic unawareness.[9]

L—LIPIDS

The Collaborative Atorvastatin Diabetes Study in 2004 had a direct effect on identifying the importance of lipid control in the management of diabetes. The study addressed the effects of atorvastatin compared with placebo in order to determine the effectiveness of statin therapy for prevention of coronary events for patients with type 2 diabetes.[12] The study ended early due to the outstanding findings proving that, within 1 year of starting statin therapy, there were reductions of cardiovascular events by 37%, stroke by 48%, and acute coronary heart disease by 36%.[12] These were major findings as many type 2 diabetics have insulin resistance that is also correlated with dyslipidemia, ultimately leading to high CVD risk.[13] Stroke and heart disease, according to the American Heart Association, are the most frequent causes of mortality and disability among patients with type 2 diabetes.[14] Those with diabetes are 2-4 times more likely to have a stroke or heart disease, and approximately 65% of diabetics will die from stroke or heart disease.[14]

Annual assessment of fasting lipid profiles are recommended by the ADA with the following target goals: triglyceride levels < 150 mg/dL; high-density lipoprotein cholesterol (HDL-C) > 40 mg/dL in men and > 50 mg/dL in women; and low-density lipoprotein cholesterol (LDL-C) < 100 mg/dL. However, for those with diabetes who have low-risk lipid values, lipids can be assessed every 2 years instead