The How-To for Type 2

An Overview of Diagnosis and Management of Type 2 Diabetes Mellitus

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KEYWORDS

• Type 2 diabetes • Hyperglycemia • Hemoglobin A1C • Metformin
• Microvascular complications • Macrovascular complications • Individualized care

KEY POINTS

- Type 2 diabetes and its associated comorbidities and complications are a national and world health issue.
- Patients with type 2 diabetes can develop various complications, including microvascular issues such as nephropathy, retinopathy, and peripheral neuropathy, as well as macrovascular damage.
- Targets for glycemic control, as well as nonpharmacological and pharmacologic interventions, should be individualized based on patient-specific characteristics.

INTRODUCTION

Type 2 diabetes (T2DM) and its associated comorbidities and complications are a national and world health issue. According to the World Health Organization (WHO), an estimated 180 million adults had diabetes in 1980, which climbed to 422 million by 2014.[1] T2DM, which previously was considered an adult-onset disorder, is increasing among children, adolescents, and young adults.[2] Since 1980, age-standardized diabetes prevalence has at best been unimproved in every country, and in most countries, numbers have increased.[1] The projected worldwide prevalence of diabetes is anticipated to reach 642 million by 2040.[3] T2DM, characterized by insulin resistance and increased hepatic glucose output, accounts for most of these cases.[4,5]

When diabetes is not well managed, and hyperglycemia persists for prolonged periods of time, patients with T2DM can develop various complications, including both microvascular issues such as nephropathy, retinopathy, and peripheral neuropathy, as well as macrovascular damage (eg, cardiovascular disease).[4] These complications

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and associated comorbidities account for a huge medical cost burden. The full economic impact is considered difficult to estimate given its multifactorial nature, which includes both direct medical costs in addition to intangible factors such as a reduction quality of life due to stress, anxiety, and other psychosocial sequelae. Direct medical costs alone were estimated to total at least $129 million worldwide in 2003 for people aged 20 to 79 years.[4] The World Health Organization (WHO) estimated that in 2001, nearly 960,000 deaths worldwide were caused by diabetes, accounting for approximately 3% of all deaths caused by noncommunicable diseases.[4] In order to prevent diabetes-related complications, costs, and deaths, glycemic control measures have consistently been part of national and international diabetes and endocrinology guidelines. For example, the 2016 Consensus Statement by the American Association of Clinical Endocrinologists (AACE) lists hemoglobin A1C (A1C) targets and self-monitoring of blood glucose (SMBG) as foundational principles for T2DM management.[6] Because of the variety of socioeconomic, cultural, and age groups affected by the disease, guidelines advise a holistic patient-centered approach to care.[6] Additionally, guidelines encourage comprehensive medical evaluation and management of comorbidities. According to the American Diabetes Association (ADA), comorbidity evaluation should include, but is not limited to, cardiovascular disease, microvascular disease, foot care, obesity management, and various psychosocial factors.[7]

DIAGNOSIS OF TYPE 2 DIABETES

To understand recommended management of an illness, diagnostic criteria should first be addressed. The diagnosis of T2DM, according to the 1997 criteria of the ADA, include a fasting plasma glucose (FPG) value greater than or equal to 126 mg per deciliter (7.0 mmol/L), or plasma glucose value greater than or equal to 200 mg per deciliter (11.1 mmol/L) 2 hours after 75 g oral glucose load (2hPG).[8] A random plasma glucose of greater than or equal to 200 mg per deciliter in a patient with classic symptoms of hyperglycemia is also considered diagnostic.[9] Lastly, a hemoglobin A1C greater than or equal to 6.5% is defined as diagnostic when standardization is validated. A1C testing has become a widely used marker of more chronic hyperglycemia, as it reflects a 2- to 3-month average of blood glucose levels.[9] Although the test initially lacked standardization, the assays have now improved, and the International Expert Committee in 2008 endorsed A1C use for the diagnosis of diabetes.[10] FPG, 2hPG, and A1C criteria were redefined in 1997 by the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus based on epidemiologic studies that evaluated the association between glucose values and the presence of retinopathy. The committee observed that retinopathy increased in a linear fashion above the glycemic thresholds noted here.[10] The choice of which test to employ is at times debated. Some argue that A1C has several advantages to testing plasma glucose levels, as it does not require fasting or have as strong a potential to be skewed by day-to-day variations affected by stress or illness.[9] However, A1C can misleading in certain groups such as those with certain hemoglobinopathies or anemia that can affect red blood cell turnover.[9] **Table 1** defines these criteria for the diagnosis of diabetes.

Although these criteria outline diagnosis of diabetes, they do not clarify etiology. Determining etiology often depends on the history of present illness and presenting circumstances. At diagnosis, a practitioner's evaluation should consider variables such as pancreatitis, use of exogenous steroids, pregnancy, ketonuria, and family history of type 1 diabetes in order to determine if additional testing is needed to establish etiology. If type 1 diabetes or other cause for beta (β)-cell destruction is anticipated, then plasma C-peptide level and markers of immune destruction such as