Editorial

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Significance of HbA1c Test in Diagnosis and Relationship between Glycosylated Haemoglobin

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Abstract

Using the American Diabetes Association's 7% rule, this retrospective chart review will determine if there are any correlations between elevated HbA1c and diabetic foot peripheral neuropathy.

Diabetes is a global endemic with rapidly increasing prevalence in both developing and developed countries. The American Diabetes Association has recommended glycated haemoglobin (HbA1c) as a possible substitute to fasting blood glucose for diagnosis of diabetes. HbA1c is an important indicator of long-term glycaemic control with the ability to reflect the cumulative glycaemic history of the preceding two to three months. HbA1c not only provides a reliable measure of chronic hyperglycaemia but also correlates well with the risk of long-term diabetes complications. Elevated HbA1c has also been regarded as an independent risk factor for coronary heart disease and stroke in subjects with or without diabetes. The valuable information provided by a single HbA1c test has rendered it as a reliable biomarker for the diagnosis and prognosis of diabetes. This review highlights the role of HbA1c in diagnosis and prognosis of diabetes patients.

Diabetes is a worldwide epidemic whose incidence is rapidly rising in both developed and developing nations. Gyrated haemoglobin (HbA1c) has been suggested as an alternative to fasting blood glucose for diabetes diagnosis by the American Diabetes Association. With the ability to reflect the cumulative glycaemic history of the two to three months prior, HbA1c is an important indicator of long-term glycaemic control. In addition to being a reliable indicator of chronic hyperglycaemia, HbA1c has a strong correlation with the likelihood of developing complications from diabetes over time. Subjects with or without diabetes have also been thought to have an independent risk factor for coronary heart disease and stroke with elevated HbA1c. A single HbA1c test has become a reliable biomarker for diabetes diagnosis and prognosis due to the valuable information it provides. The significance of HbA1c in diabetes diagnosis and prognosis is emphasized in this review.

Keywords: Diabetes • HbA1c • Diagnosis • Prognosis • Blood test

Introduction

An individual's average blood glucose levels over the previous two to three months, which is the predicted half-life of red blood cells (RBCs), can be determined by analysing glycated haemoglobin (HbA1c) in their blood. For testing and monitoring diabetes, particularly type 2diabetes, the HbA1c is now recommended as a standard of care (SOC). Heisman et al. were the first to isolate HbA1c in history. In 1958, it was identified as a glycoprotein by Book chin and Gallop4 in 1968. In 1969, it was discovered that diabetic patients had elevated HbA1c levels. In 1975, discovered the pathway that results in the formation of HbA1c. In 1976, the idea of using HbA1c as a biomarker to monitor glucose levels in diabetic patients was first put forth[1].

Analysis of glycated haemoglobin (HbA1c) in blood provides evidence about an individual's average blood glucose levels during the previous two to three months, which is the predicted half-life of red blood cells (RBCs).1 The HbA1c is now recommended as a standard of care (SOC) for testing and monitoring diabetes, specifically the type 2diabetes. Historically, HbA1c was first isolated 1958 and characterized in 1968, as a glycoprotein. The elevated levels of HbA1c in diabetic patients identified the pathway leading to the formation of HbA1c in 1975[2]. Using the HbA1c as a biomarker for monitoring the levels of glucose among diabetic patients was first proposed in 1976.

Diabetes's rising global prevalence is a major cause for concern. As a result, the diabetes complications that go along with it are on the rise. Large-scale studies in the past have demonstrated that elevated glycosylated haemoglobin (HbA1c) is a significant risk factor for diabetic complications[3]. Diabetic foot complications are among the most dreaded of these complications. The most common cause of foot ulceration and lower limb amputation is peripheral neuropathy. In order to prevent and manage this pathology, it is essential to evaluate early risk factors due to the lack of treatment that targets the primary nerve damage[4].

Method

Over the course of four months, 227 diabetic foot assessments were carried out with a 10g monofilament, neurotics, a 128Hz tuning fork, and occasionally a sudoscan on 20 Type 1 and 207 Type 2 diabetics from a specific diabetes center. This study made use of the most recent HbA1c from the previous year. Two diabetic foot assessments were inconclusive out of 227 subjects. Out of 225 participants, 67 (29.8%) had clinical peripheral neuropathy and/or neuropathy symptoms[5]. Due to a lack of HbA1c data, eight of the neuropathic subjects were therefore excluded. In addition, the HbA1c of 37 of the 59 neuropathic patients (62.7%) was above 7%. There is also evidence that nitric oxide (NO)-related relaxation of human mesenteric vessels is hindered by glycosylation of haemoglobin. In rabbit aortic rings, lowered NO bioavailability and impaired vasodilatation have been linked to haemoglobin glycosylation altering NO binding. Glycosylation of haemoglobin also lowers oxygen-carrying capacity, promoting hypoxia and its related systemic vascular vasodilatory adaptations and responses88. This is another mechanism by which glycosylation of haemoglobin is proposed to be vasoactive[6].

Conclusion

The findings indicate a link between peripheral neuropathy and elevated HbA1c. As a result, health professionals ought to concentrate on preventative measures by attempting to keep HbA1c levels below 7 present in order to lessen the likelihood of nerve damage that will result in peripheral neuropathy. Diabetes affected 425 million people worldwide in 2017, or 8% of adults between the ages of 20 and 79. In addition, it is anticipated to reach 629 million by 2045. The diabetes pandemic's emergence can be partially attributed to established causes, particularly the growing number of elderly people, obesity, and inactivity. It is anticipated that the number of diabetes-related complications will rise as the prevalence rises. As a result, it is absolutely necessary to take preventative measures to lessen the usual dangers associated with diabetes [7]. Pathologies like retinopathy, nephropathy, and peripheral neuropathy are the primary diabetic complications that affect the eyes, kidneys, and nervous system. Additionally, type 2diabetes has the potential to affect the macro vascular system, raising the risk of cardiovascular disease and stroke. Diabetes of type 2 is the leading cause of blindness, renal failure, and amputations of the lower limbs. The disease's effects on the micro vascular system are the cause of these complications [8]. Diabetes-related foot ulceration is a prerequisite for amputation of the lower limbs. Patients face a serious issue with diabetic foot ulcers. Preventing complications in the first place relies heavily on the prompt identification of risk factors. Male gender, poor glycaemic control, diabetes for a long time, peripheral arterial disease (PAD), foot deformity, a history of ulcers or amputations, and peripheral neuropathy are all risk factors for diabetic foot ulcers. Peripheral neuropathy caused by diabetes can take many different forms. Distal symmetric polyneuropathy (DSPN), diabetic autonomic neuropathy, and cardiovascular autonomic neuropathy (CAN) are the conditions that have received the most research. Any one of these neuropathies can be present in a patient. We will concentrate on DSPN in this investigation because it frequently causes peripheral neuropathy by affecting the nerves in the lower limbs. Diabetes can lead to an insidious and persistent condition called DSPN. As the leading cause of disability due to foot ulceration and amputation, gait disturbances, and fall-related injury, DSPN affects approximately 50% of diabetics over their lifetimes. A "symmetrical length-dependant sensorimotor polyneuropathy attributable to metabolic and micro vessel alterations as a result of chronic hyperglycaemia exposure and cardiovascular risk covariates" has been assigned to DSPN by the Toronto Consensus Panel on Diabetic

Neuropathy. Sensory symptoms like numbness, tingling, burning, and pins and needles start in the toes and spread to the upper and lower limbs over time in a pattern called the "Glove and Stocking Effect." It is essential to keep in mind that more than half of people with DSPN are asymptomatic. As a result, patients should still be examined regardless of whether they have a complaint [9]. Since there is currently no treatment that targets the primary nerve damage, early detection and preventative measures are essential for diabetic patients' care. Currently, studies have been published to see if there is a link between neuropathy and micro vascular complications like intensively controlled HbA1c below 7% (the American Diabetes Association's recommendation). 3867 Type 2diabetics who had just been diagnosed were the subjects of the UK Prospective Study (UKPDS). They were placed in either an intensive or conventional control group at random. The median haemoglobin A1C (HbA1c) for the intensive glycaemic control group was 7%, while the conventional group's was 7.9%. The impact of strict glycaemic control on macro vascular complications was statistically insignificant after ten years of follow-up. However, they discovered that the intensive group had a 25% lower overall risk of developing peripheral neuropathy or other micro vascular diabetic complications [10]. The randomized prospective study: Over 6.5 years, 1441 participants in the Diabetes Control and Complications Trial (DCCT) were analysed. They concluded with absolute certainty that the risk of micro vascular complications like nephropathy, retinopathy, and neuropathy is lower. In addition, they discovered that strict glycaemic control slowed the onset and progression of neuropathy. A four-year study with 50 asymptomatic diabetics was published in 2009 by Khalid et al. 25 patients were included in this study's well-controlled glycaemic group, with an HBA1c of 7 present of the patients were placed in the uncontrolled group, while the remaining 25 had an HbA1c of 7%. They found that, in addition to diabetes duration, HbA1c was the most important predictor of neuropathy. Overall, their findings demonstrated that compared to well-controlled diabetes, poorly controlled diabetes is 11 times more likely to cause neuropathy.

The HbA1c is an accurate and easy-to-administer test with on-the-spot results availability and can be an effective tool in establishing the diagnosis of diabetes, especially in low- and middle-income countries and hard-to-reach populations. Even though HbA1c has been endorsed for diagnosis of diabetes, in most of the countries worldwide, some testing strategies and cutoff ranges are still being debated. However, combination of FGT and HbA1c significantly enhances the diagnostic accuracy of these individual tests. The prognostic potential of HbA1c lies in its unique ability of assessing retrospective glycemic control as well as predicting the lipid profile in diabetic patients. As the epidemic of diabetes continues to grow worldwide, HbA1c test may continue to be implemented as part of the diagnostic and prognostic tool, leading to better patient care and successful clinical outcomes.

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Conflict of Interest

None

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