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Overview on Glucose Tolerance Testing in Primary Health Care

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

The glucose tolerance test can be performed in a variety of situations. To evaluate a person's capacity to manage a glucose load, a glucose tolerance test is utilised. The test can determine whether or not a person can metabolise a specific amount of glucose. and oral glucose tolerance

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test (OGTT) has been the standard method for detecting prediabetes and type 2 diabetes**.** Diabetes causes anomalies in glucose, lipid, and protein metabolism due to insulin's ineffective action on target tissues**,** so health care providers making this test to determine a person's ability to handle a glucose load**.** In this article we will be looking at the testing procedures, normal and abnormal results and primary heath care role's to improve the results and treatmentof prediabetics .

Keywords: Glucose tolerance; OGTT; prediabetics; type 2 diabetes.

1. INTRODUCTION

A glucose tolerance test is performed to assess a person's capacity to manage a glucose load. A person's ability to metabolise a certain amount of glucose can be determined by this test. There are three types of outcomes: normal, impaired, and abnormal. A glucose tolerance test can be used to identify type 1 diabetes, type 2 diabetes, and gestational diabetes mellitus. It's a blood test that involves taking numerous blood samples over the course of two hours [1].

The glucose tolerance curve, which illustrates how blood glucose levels rise and decrease in response to oral or intravenous glucose delivery, has long been used therapeutically and experimentally in animals and people to assess the efficacy of blood glucose control mechanisms. Many of the published data are inconsistent, and the methodological variations across studies make it hard to compare results. Different responses are frequently produced even when the same method is used in essentially identical conditions [2,3].

For more than a century, the oral glucose tolerance test (OGTT) has been the gold standard for identifying prediabetes and type 2 diabetes (T2DM). Fasting plasma glucose (FPG), 2-hour post-load glucose (2-h PG), and/or HbA1c (prediabetes) have all been used to define intermediate hyperglycemia in recent decades [4]. Despite this, the 2-hour PG is usually regarded as the gold standard for detecting dysglycemia during the OGTT. This article discusses the oral glucose tolerance test and mathematical modelling for analyzing the nature of the glucose curve [5].

The drawbacks of the FPG, the 2-hour PG during the OGTT, and HbA1c are all considered. Finally, the researchers will investigate the relationship between the OGTT's 30-minute and 1-hour plasma glucose (1-h PG) levels and the development of diabetes and its effects. The use of the 1h PG to modify current screening and diagnostic guidelines is supported by a large body of data. When the pancreatic ß-cell function is considerably more intact, monitoring the 1h PG level might improve the probability of detecting high-risk patients, as well as potentially replacing the standard 2h OGTT, making it more acceptable in the clinical environment [6-9].

Testing Procedures and specimen Requirements: For at least 3 days before to the glucose tolerance test, the patient should be urged to eat a normal carbohydrate diet of at least 150 g carbs. On the day of the test, the patient should attend fasting. A fasting sample is taken through phlebotomy or intravenous access to establish a baseline glucose level. The glucose solution will subsequently be consumed by the patient (comes in 2 formulas, either 75 grammes or 100 grams). The dosage is dosed by weight in paediatric patients, at 1.75 g/kg of body weight, with a maximum dose of 75 grammes for all children.

Patients are required to fast for the duration of the test, with the exception of consuming glucose. Following that, samples are taken at various intervals, with the last sample taken 60 or 120 minutes following glucose delivery. During the test, patients should maintain as much stillness as possible, and excessive hydration with liquids should be avoided because it might alter the results.

There are several ways to conduct or perform a glucose tolerance test. The standard one-step glucose tolerance test, which includes a baseline sample and a 60-minute sample, is the first. This is a non-fasting test that is used to identify gestational diabetes in pregnant women between the ages of 24 and 28 weeks.

If the test indicates poor or unusual glucose tolerance, a 2- or 3-hour glucose tolerance test is required.

A glucose tolerance test can also be performed by taking a baseline sample from a fasting participant and then a sample 120 minutes after glucose consumption. This test can be used to

confirm the diagnosis of diabetes if the blood glucose at the baseline or 120-minute time point is abnormal [1].

To complete a glucose tolerance test, several samples can be taken at baseline, 30 minutes, 60 minutes, 90 minutes, and 120 minutes. This enables doctors to examine impaired tolerance and identify whether there is a delay in insulin excretion from the pancreas or delayed glucose absorption in the liver.

For three days before to the test, the patient should eat a regular diet or one that comprises around 150 grammes of carbohydrates each day. Before the test, the patient should fast for at least eight hours (unless the patient is undergoing a non-fasting test). If the patient does not arrive fasting, the test should be postponed.

The test can be performed using several phlebotomies or the insertion of a BC-shielded IV catheter.

It is necessary to collect a fasting sample as well as record the time point. The patient must then drink the required amount of glucose in a maximum of five minutes (up to 75 grammes dependent on weight). [1].

After 30 minutes, 60 minutes, 90 minutes, and 120 minutes, or as recommended by the provider, more samples should be collected. If patient's using a BC-shielded IV catheter, make sure to clean it after each sample with a saline or heparin solution. After 120 minutes, the test is complete, and the blood samples should be processed as needed before being transported to the lab for analysis. [1]

1.1 The Oral Glucose Tolerance Test

The Glucose Absorption Procedure. It's a test that determines how well patient can tolerate glucose in his mouth. The rate of glucose absorption was thought to be "independent of both the absolute amount and the concentration of glucose present in the intestine" and that sugars were absorbed "at a consistent rate up to the point of their depletion from the intestine," with the actual rate determined by the structure of the glucose molecule. The assumption that glucose absorption was equal to its continuous infusion at a constant rate, on the other hand, indicated that glucose absorption was impacted substantially by the concentration of the given solution [2,3].

There is a problem that was recently investigated using a technique that allowed for simultaneous observation of gastric emptying, intestinal transit, and absorption of test substances from the gastro-intestinal tract in an intact, conscious animal, and it was conclusively demonstrated that: (a) glucose is absorbed from the stomach, with the proportion varying with the total glucose load; and (b) glucose is absorbed from the stomach, with the proportion varying with the total glucose load. The fraction of glucose absorbed by the stomach will be minimal under large glucose loads, because the stomach's absorptive capacity is rapidly saturated and seldom surpasses 100 mg per hour, and gastric emptying is the most significant single predictor of total glucose absorption per unit of time. [4,5]

(b) The pace of emptying varies significantly among normal animals, and the concentration of the given fluid has a considerable impact. Gastric emptying becomes increasingly delayed as the concentration of the introduced solutions grows, resulting in an intestinal glucose load that is not equivalent to the total glucose load and glucose being delivered to the small intestine at a rate that is less than its considerable absorption capacity.

As a consequence, total glucose absorption in an hour increases just little in contrast to the higher load, but absorption lasts for a longer, more variable time. Beeler showed that one hour after giving 100 g. glucose orally to normal and diabetic subjects, 22-68 g. of the delivered glucose could be recovered by washing the stomach, with no consistent and significant variation in the glucose' tolerance test, and Leonards and Free observed that 38-62 g glucose could be recovered from the Exton-Rose test in normal adult male subjects, with no consistent and significant variation in the glucose' tolerance test.

Many other variables impact the pace of stomach emptying and hence intestinal glucose absorption, some of which have previously been addressed. Gastric emptying is inhibited by pre-experimental fasting of 48 hours, nausea experienced by certain people after consuming glucose, recumbency or the injection of gas into the stomach, pregnancy, and anticholinergic medications, which might result in a flat glucose tolerance curve. In situations where rapid gastric emptying occurs, such as in individuals who have lost pyloric control owing to gastroenterostomy or

gastrectomy, glucose supply to and absorption from the intestine is excessively rapid. And thus, the blood glucose concentration rises to an unusually high level very quickly [2- 5].

2. RESULTS AND CRITICAL FINDINGS

Normal Results for Type 1 Diabetes or Type 2 Diabetes

- Glucose levels in the fasting range of 60 to 100 mg/dL
- Glucose levels in the one-hour range of less than 200 mg/dL
- Glucose levels in the two-hour range of less than 140 mg/dL

Diabetes Type 1 or Diabetes Type 2: Impaired Results

- Glucose level in the fasting state: 100 to 125 mg/dL
- Glucose levels of 140 to 200 mg/dL after two hours

Type 1 Diabetes or Type 2 Diabetes Abnormal (Diagnostic) Results

- A fasting glucose level of 126 mg/dL or higher
- Glucose level more than 200 mg/dL after two hours

Normal Gestational Diabetes Test Results

- Glucose levels in the fasting state are less than 90 mg/dL
- Glucose level less than 130 to 140 mg/dL after in one hour
- Glucose level less than 120 mg/dL in two hours

Gestational Diabetes Test Results That are abnormal

- Glucose levels in the fasting state that are more than 95 mg/dL
- one-hour glucose levels are larger than 140 mg/dL
- and two-hour glucose levels are greater than 120 mg/dL. [1]

Imrove results of Primary health care Team: A glucose tolerance test is most likely to be prescribed by a medical doctor or advanced nurse practitioner. The successful administration of the test needs collaboration among professionals. The provider or nurse must ensure that the patient has received enough instructions on how to prepare for the test as well as what to expect throughout the procedure.

The glucose tolerance test can be used in a number of circumstances. The test can be performed at a provider's office if appropriate equipment and personnel are available. The glucose tolerance test can also be performed in the laboratory. Although glucose tolerance tests are not often performed in the inpatient section of a hospital, the outpatient or clinical research department may have extra time set aside to complete the test. [1]

Nurses, medical assistants, and phlebotomists can perform the test. The practitioner must properly describe the type of test, the length of time, and the number of samples ordered.

Anyone taking the test should be aware of the test's criteria, particularly the fasting requirement and the pre-test dietary carbohydrate requirement. To ensure effective specimen processing, as well as secure storage and shipment, collaboration with laboratory staff is important (if necessary).

2.1 Treatment for Prediabetics

- Lifestyle inervention

By increasing physical activity and adopting nutritional changes, lifestyle intervention programmes aim to reduce modifiable risk factors for prediabetes and diabetes.

The advantages were discovered to be dependant on the person's completion of the intervention's pre-defined goals. Weight loss of more than 5%, total fat consumption of less than 30% of calories, saturated fat intake of less than 10% of calories, fibre intake of greater than or equal to 15 g per 1000 kcal, and exercise of more than 4 hours per week were all targets [10,11].

- Pharmacotherapy
- Several types of antidiabetic medications, including Biguanides, Thiazolidinediones, -Glucosidase Inhibitors, GLP-1 analogues, and non-antidiabetic treatments and therapies, such as anti-obesity drugs and bariatric surgery, have been studied in the setting of prediabetes.
- Bariatric surgery

A variety of methods are used in bariatric surgery to reduce calorie intake by creating a mal-absorptive state, a restrictive condition, or a combination of the two. [12,13]

3. DISCUSSION

T2DM is on the rise, with the number of people living with the disease expected to rise from 171 million in 2000 to 366 million by 2030. Between 2019 and 2045, the number of adults with T2DM in the United States is expected to rise from 463.0 million to 700.2 million. During this time, the total yearly expenditures of treating this condition are anticipated to rise from 760.3 billion USD to 845.0 billion USD. As a result, identifying IGT is critical for T2DM preventive measures in high-risk individuals. The OGTT has been offered as a means of achieving this. The use of glycated haemoglobin (HbA1c) levels as an alternative to the OGTT has been advocated. Using just HbA1c to diagnose diabetes, on the other hand, misses more than half of the diabetes cases discovered by the OGTT. As a result, the OGTT was introduced as the best approach [14-18].

There were at least six different sets of criteria for diagnosing diabetes before 1979. This meant that a person may have diabetes according to one set of criteria but not according to another. The prevalence of diabetes in the community varied dramatically depending on the parameters employed. The National Diabetes Data Group suggested one set of criteria in 1979, which the World Health Organization only significantly adjusted 31 years later. These criteria were chosen based on the findings of three prospective trials in which 1,213 people without diabetic retinopathy were given oral glucose tolerance tests and monitored for three to eight years, during which time 77 of them acquired the condition. A 2-hour glucose concentration of 11.11 mmol/L (200 mg/dL) was set as the oral glucose tolerance test criteria for the diagnosis of diabetes based on these individuals' 2-hour results [19-26].

It is advised that patient perform the test while laying down or sitting, and that he refrain from eating, drinking, or smoking until the last blood sample is obtained. In the days preceding up to the test, it's also critical that he eat a healthy, balanced diet. Significant changes in his eating habits, such as going on a diet, might affect the test findings and make them less accurate. Some medicines might also cause findings to be misleading. patient and his doctor can discuss what he need to be cautious about ahead of time. [27]

4. CONCLUSION

Oral Glucose tolerance test is one the most used tests to evaluate glucose tolerance and glucose blood levels in individuals and is used to diagnose prediabetes and diabetic patients. it was standardized by establishing an oral glucose load of 75 g and 2-h post-glucose load glycemia. The successful administration of the test needs collaboration among professionals. moreover Anyone taking the test should be aware of the test's criteria, particularly the fasting requirement and the pre-test dietary carbohydrate requirement. The test can also be combined with other testing techniques for Diabetic patients to achive most accuarte diagnosis.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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