Oral Glucose Tolerance Test for Gestational Diabetes

In the twentieth century, researchers developed the oral glucose tolerance test, or OGTT, as a method to diagnose different types of diabetes, a medical condition that causes blood sugar levels to become abnormally high. During the test, a healthcare provider measures a person's blood sugar levels before and after the person consumes a predetermined amount of glucose solution. While not exclusively used for pregnant women, an OGTT may test for gestational diabetes which, according to the International Diabetes Federation, affected one in six pregnancies worldwide in 2019. Generally, the results from an OGTT can inform a patient and her physician how her body is responding to glucose during pregnancy, and high levels may increase her risk of developing adverse pregnancy outcomes such as heavy bleeding during delivery and a high blood pressure condition known as preeclampsia. An OGTT can help to accurately diagnose, treat, and monitor gestational diabetes in pregnant women, which can reduce health and pregnancy complications for the woman and the fetus.

While physicians may also use the OGTT to diagnose type 2 diabetes, they often use the test as a regular screening test for pregnant women. Physicians administer the OGTT to women when they are around twenty-four to twenty-eight weeks pregnant, because that is typically when pregnant women first develop gestational diabetes. Although gestational diabetes typically goes away after delivery, affected women are at higher risk of developing diabetes again later in life. According to the American College of Obstetricians and Gynecologists, up to seventy percent of women with gestational diabetes will go on to develop a form of permanent diabetes later in life. Elevated blood sugar during pregnancy can also cause the fetus to grow larger than normal, which may result in an increased risk for cesarean section delivery. Although the test has been around since the mid-1900s, as of 2020 there is no unanimous consensus on the exact values found during an OGTT that quantify a gestational diabetes diagnosis.

Before the advent of the OGTT, scientists were researching what led diabetes to develop in the general population, in addition to why it appeared to affect pregnant women at a high rate. In the first half of the twentieth century, researchers determined that a healthy person's blood sugar levels will quickly return to normal after the initial elevation caused by a meal. They also determined that pregnant women with diabetes delivered stillborn neonates with abnormalities of the pancreas, which is the organ often implicated in diabetes based on its management of insulin. In the 1920s, physicians first began treating diabetes with insulin, which is a hormone produced within the pancreas that stabilizes the blood glucose levels among other tasks. As of 2020, patients with both type 1 and type 2 diabetes use insulin to treat their conditions. In type 1 diabetes, the pancreas does not produce insulin, and in type 2 diabetes, the pancreas does produce insulin, but the body does not respond to it, thus resulting in high levels of blood glucose.

According to author Randi Minetor, physicians Jerome Conn and Stefan Fajans collaborated on research that led to the development of the first form of OGTT in the 1940s at the University of Michigan Medical School in Ann Arbor, Michigan. While the first OGTT was a one-step approach, researchers also developed two-step approaches that they specifically used for pregnant women. By 1957, in Boston, Massachusetts, physician John O'Sullivan helped invent the two-step approach to improve gestational diabetes diagnoses for women without known risk factors. O'Sullivan and statistician Claire Mahan worked together to establish threshold blood sugar values for diagnosis, later known as the O'Sullivan criteria. Although many organizations, such as the American Diabetes Association, adopted the O'Sullivan criteria, researchers have not yet established a universal consensus as of 2020. Although physicians may disagree on what levels quantify a diabetes diagnosis, patients continue to receive both the one-step or two-step OGTT around the world.

As of 2020, a patient may receive a one-step OGTT for both non-gestational and gestational diabetes testing. The preparation and procedure steps remain the same for patients being tested for both forms of diabetes, but the resulting interpretation differs between the two. In preparation for the OGTT to measure gestational diabetes, medical professionals typically advise patients to eat how they normally do in the days leading up to the test in order to ensure the most accurate results. The patient must abstain from eating or drinking anything besides water for eight hours before the test, establishing a fasted state, which is when you have completely digested your most recent meal and your insulin levels return to a baseline level. When the patient arrives at their doctor's office or lab, a health care professional takes a small amount of blood from a vein in the patient's arm in order to measure their baseline glucose levels. The patient must then drink a syrupy solution containing 75 g of sugar and wait one hour before the provider obtains another sample of blood from their arm. After another hour passes, the healthcare professional takes one more sample of blood and the test is done. If one of the three measurements taken during the OGTT is above the normal threshold, a doctor will diagnose the patient with gestational diabetes and explain their treatment plan.

The two-step method, which physicians solely use to diagnose pregnant patients with gestational diabetes, follows similar steps to the one-step OGTT with a few key differences. Medical professionals refer to the first step as either a glucose loading test or a glucose challenge test, which does not require fasting beforehand. A healthcare worker gives the patient a syrupy solution containing 50 g of glucose to drink, and then after waiting an hour, a medical technician takes a sample of blood from the patient's arm and tests their blood glucose levels. If the blood sugar level is abnormally high, then the patient has to return for a second test. The second test is a three hour long 100 g glucose version of the one-step OGTT, and similarly, a medical worker draws blood from the patient's arm at the beginning and every sixty minutes thereafter.

In 2008, the International Association of Diabetes and Pregnancy Study Group, or IADPSG, held an international conference in order to establish universal guidelines for diagnosing gestational diabetes. The IADPSG ultimately recommended that women who are twenty-four to twenty-eight weeks pregnant undergo the one-step 75 g OGTT, and also recommended normal blood sugar cut off values for the test. One significant recommendation IADPSG made was that if, out of the three blood sugar measurements taken during the test, the patient has only one abnormal value, a doctor will diagnose her with gestational diabetes. Many medical experts opposed the recommendation to diagnose based on one abnormal value because it was expected to increase the incidence of gestational diabetes from around five to six percent to fifteen to twenty percent of all pregnant women, which researchers alleged could create potential undue burden on medical systems, meaning there might not be enough resources to accommodate every person who is in need of treatment. Although some medical organizations did not adopt the IADPSG's recommendations, other organizations that did included the American Diabetes Association and the National Association for Clinical Biochemistry.

Because the 50 g glucose beverage used in the glucose challenge test can cause side effects such as nausea, headache, and dizziness, researchers have looked into alternative sources of glucose for the tests, including jellybeans. Twenty-eight jellybeans contain 75 g of total carbohydrates, and 50 g of those carbohydrates are in the form of simple sugars. Scientists from the Texas A&M University Health Science Center College of Medicine in Bryan, Texas, found that administration of the 50 g glucose drink or administration of twenty-eight jellybeans did not result in any significant differences in blood sugar values. However, women who consumed the jellybeans exhibited an eighteen percent decrease in side effects. Therefore, there is potential flexibility in the variation of testing materials despite the common disagreements on diagnosis values.

Because resource-limited areas in the world may not have adequate access to formal labs or medical workers trained to draw blood, researchers from a program called Women in India with GDM Strategy, or WINGS, examined whether they could use capillary blood for testing in OGTT. Researchers typically do not use blood from capillaries, or microscopic blood vessels typically derived from the finger, for OGTT testing. Up to seventy-two percent of people in India live in rural areas, and in 2011 alone, 62.4 million people in India were reported to have non-gestational diabetes, and four million people were reported to have gestational diabetes. The researchers ultimately found that handheld finger-prick testing is not sensitive or specific enough to replace traditional venous blood

samples in OGTT. However, in environments with constrained resources, they stated that healthcare providers can use finger-prick measurements for an initial screening of patients. If a patient tests positive for gestational diabetes in the initial screening, a medical worker can then refer them to a clinical lab where they can receive a traditional OGTT.

As of 2019, according to the American Diabetes Association, existing studies that compare population-wide pregnancy outcomes with the one-step and two-step approaches have shown inconsistency with their findings. Proponents of the one-step method, such as the IADPSG, argue that it helps improve pregnancy outcomes with cost savings. They also assert that even mild gestational diabetes is associated with adverse pregnancy outcomes and can be managed by lifestyle changes alone. In comparison, proponents of the two-step method, such as the National Institutes of Health, state that the two-step method is preferable because its first step does not require women to fast and only involves one blood draw. They also cite the potential negative consequences of using the IADPSG criteria to diagnose a larger group of women with gestational diabetes. Despite the conflicting guidelines, the American Diabetes Association emphasizes that there is significant data to support each strategy, and as of 2020, researchers are conducting long-term pregnancy outcome studies and clinical trials to establish a uniform consensus.

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