

Oral Glucose Tolerance Test

Administrative Procedure #575

PURPOSE:

To provide detailed instructions to Pathology staff for scheduling, coordinating, administering, and collecting specimens for Oral Glucose Tolerance Tests (OGTT) within the UC Davis Health System. Procedure includes instructions for collection of glucose tolerance panels for pregnant and non-pregnant outpatients. Inpatient glucose tolerance testing will be administered and collected by nursing staff.

PRINCIPLE:

Diabetes is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The vast majority of cases of diabetes fall into two broad categories. Type 1 diabetes, or immune-mediated diabetes, accounts for only 5-10% of those with diabetes, and results from a cellular-mediated autoimmune destruction of the β -cells of the pancreas. Type 2 diabetes, the more prevalent category, is caused by a combination of resistance to insulin action and an inadequate compensatory insulin secretory response.¹ Gestational Diabetes Mellitus (GDM) is glucose intolerance with onset or first recognition during pregnancy; women with diabetes who become pregnant are not included in this category.²

The laboratory diagnosis of diabetes is made exclusively by the demonstration of hyperglycemia. The OGTT, which evaluates a patient's response to a bolus or "load" of glucose, can contribute to the classification and characterization of the diabetes including GDM.

ACCEPTABLE SPECIMENS:

13 x 75 Gray Top Tube, sodium fluoride anticoagulant.
Terumo Gray Top micro-container, sodium fluoride anticoagulant.

APPOINTMENT SCHEDULING:

OGTT collections are scheduled in advance with select individual draw sites. The Ambulatory Care Center (ACC) at the Medical Center and most of the Primary Care Network (PCN) sites require appointments for OGTT collections.

CONSUMABLE / EQUIPMENT:

- a. 50-gram, 75-gram, and 100-gram bottles of glucose tolerance beverage.
- b. Measuring Cup.
- c. Glucose Tolerance Beverage Volume Conversion Chart (see Appendix A).
- d. Oral Glucose Tolerance Test Instructions and Reference Sheet (see Appendix B).
- e. Patient Return time slip (See Appendix C).

PROCEDURE:

1. Glucose Tolerance Panel

- a. Verify with the patient that they have not consumed any food or drink within the last eight hours. If they have done so, instruct the patient that they must reschedule the test.
- b. Have the patient read and sign the Oral Glucose Tolerance Test Instructions and Reference Sheet.
- c. Collect the fasting glucose specimen.
- d. Review the clinician order.
 - i. If ≥ 16 years of age, measure and provide 75 gm (7.5 fluid oz. or 222 ml) of glucose tolerance beverage in a graduated cup.
 - ii. If < 16 years of age, measure and provide the dose ordered by the clinician.
- e. Provide the patient with a “Return Time” slip for the next specimen collection at 120 minutes (specimens must be collected within 5 minutes of the scheduled time).
- f. Instruct the patient:
 - i. Not to eat anything for the duration of the OGTT collection.
 - ii. Small sips of water are acceptable during the OGTT collection.
 - iii. To remain in the waiting room area for the duration of the test.
 - iv. To return to the reception window at the time indicated on the Return Time slip.
- g. Collect the final specimen after 120 minutes have elapsed.

2. Glucose Tolerance Panel, Pregnant

- a. Verify with the patient that they have not consumed any food or drink within the last eight hours. If they have done so, instruct the patient that they must reschedule the test.
- b. Have the patient read and sign the Oral Glucose Tolerance Test Instructions and Reference Sheet.
- c. Collect the fasting glucose specimen.
- d. Review the clinician order.
 - i. If ≥ 16 years of age, measure and provide 75 gm (7.5 fluid oz. or 222 ml) of glucose tolerance beverage in a graduated cup.
 - ii. If < 16 years of age, measure and provide the dose ordered by the clinician.
- e. Provide the patient with a “Return Time” slip for the next specimen collection at 60 minutes (specimens must be collected within 5 minutes of the scheduled time).
- f. Instruct the patient:
 - i. Not to eat anything for the duration of the OGTT collection.
 - ii. Small Sips of water are acceptable during the OGTT collection.
 - iii. To remain in the waiting room area for the duration of the test.
 - iv. To return to the reception window at the time indicated on the Return Time slip.
- g. Collect the second specimen once 60 minutes have elapsed.
- h. Instruct the patient to return to the waiting area, and then return to the reception window at the time indicated on the Return Time slip.
- i. Collect the final specimen after 120 minutes have elapsed.

3. Two-Step Gestational Diabetes Screening

- a. The two-step Gestational Diabetes Screening consists of a 1-hour Glucose Challenge Test (GCT), and if indicated, a 3-hour Glucose Tolerance Test (GTT). With the two-step screening process, patient fasting is not required for the GCT (Step 1). If the 3-hour Glucose Tolerance Test is indicated, verify with the patient that they have not consumed any food or drink within the last eight hours. If they have done so, instruct the patient that they must reschedule the test.
- b. Have the patient read and sign the Oral Glucose Tolerance Test Instructions and Reference Sheet.
- c. Review the clinician order.
 - i. If ≥ 16 years of age, measure and provide 50 gram of glucose tolerance beverage in a graduated cup.
 - ii. If < 16 years of age, measure and provide the dose ordered by the clinician.
- d. Step-1: Collect the 50 gram glucose screen non-fasting specimen one-hour following administration of the glucose tolerance beverage.
- e. If the plasma glucose is < 140 mg/dL, then testing is complete. Review the clinician order.
- f. If the plasma glucose is ≥ 140 mg/dL after the 50 gram load proceed to Step-2 that will require a new patient visit.
- g. Step-2 is a 3-hour Oral Glucose Tolerance Test (OGTT) and is comprised of glucose testing at fasting, and followed by a 100 gram glucose beverage challenged with subsequent plasma glucose testing at 1-hour, 2-hour, and 3-hour.
- h. Step-2: Verify with the patient that they have not consumed any food or drink within the last eight hours. If they have done so, instruct the patient that they must reschedule the test.
- i. Have the patient read and sign the Oral Glucose Tolerance Test Instructions and Reference Sheet.
- j. Collect the fasting glucose specimen.
- k. Review the clinician order.
 - i. If ≥ 16 years of age, measure and provide 100 gm of glucose tolerance beverage in a graduated cup.
 - ii. If < 16 years of age, measure and provide the dose ordered by the clinician.
- l. Provide the patient with a "Return Time" slip for specimen collections at 1-, 2-, and 3 hours (specimens must be collected within 5 minutes of the scheduled time).
- m. Instruct the patient:
 - i. Not to eat anything for the duration of the OGTT collection.
 - ii. Small sips of water are acceptable during the OGTT collection.
 - iii. To remain in the waiting room area for the duration of the test.
 - iv. To return to the reception window at the time indicated on the Return Time slip.
- n. Collect the second specimen once 60 minutes have elapsed.
- o. Instruct the patient to return to the waiting area, and then return to the reception window at the time indicated on the Return Time slip.
- p. Collect the third specimen after 120 minutes have elapsed.
- q. Instruct the patient to return to the waiting area, and then return to the reception

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- window at the time indicated on the Return Time slip.
- r. Collect the fourth and final specimen after 180 minutes have elapsed.

GLUCOSE TOLERANCE BEVERAGE DOSE CALCULATION:

The volume of glucose tolerance beverage to administer to patients < 16 yrs. of age will be automatically calculated in the EMR system using the following equation:

Dose of glucose tolerance beverage (g) = 1.75 x Body Weight (kg), to a maximum dose of 100 g.

PROCEDURE NOTES:

1. Release each order from EMR at the time in which the collection is due: Fasting, 60-minutes (if applicable), 120-minutes and 180 minutes. Document exact collection time on specimen labels.
2. Receive each test in LIS as it is released from EMR.
3. For manual requisitioning for non-pregnant patients, use mnemonics (GTTFBG, GTT60, GTT120). For pregnant patients use (GTTFAST for the Glucose Challenge Test (GCT), GTT3HR). Enter each mnemonic at the time in which the test is due.
4. Occasionally a patient will become ill after drinking the glucose tolerance beverage or during the collection process. In such situations, contact the ordering physician or clinic and:
 - a. Follow the directions as provided.
 - b. If not given specific instructions, do not dispose of any specimens collected before the patient became ill. Send the specimens and request slip to the attention of the supervisor with a written explanation of what occurred.
5. For any pediatric patient under 16 years of age, the gram dosage of glucose tolerance beverage to be administered is to be calculated (see Calculation above) and stated in the test request. If this information is not stated in the request, contact the clinic for this information. If you are unable to do so, ask the parent of the child to return to the clinic to obtain this information.

CLINICAL SIGNIFICANCE:

The diagnosis of diabetes mellitus depends solely on the demonstration of hyperglycemia. For Type 1 diabetes, the diagnosis is usually easy because hyperglycemia appears abruptly, is severe, and is accompanied by serious metabolic derangements. Diagnosis of type 2 diabetes may be difficult because the metabolic changes are often not severe enough for the patient to notice symptoms.² For GDM, is diagnosed by two-step strategy. UC Davis Health currently employs both methods. Current criteria for diagnosis of diabetes mellitus and GDM are described below.¹

DIABETES MELLITUS Any one of the following is diagnostic:
1. Classic symptoms of diabetes and a random plasma glucose ≥ 200 mg/dL
2. Fasting plasma glucose ≥ 126 mg/dL (Fasting is defined as no caloric intake for at least 8 hours.)
3. 2-hour plasma glucose ≥ 200 mg/dL during the OGTT
IMPAIRED GLUCOSE TOLERANCE Two criteria must be met:
1. Fasting plasma glucose < 126 mg/dL
2. 2-hour plasma glucose between 140 and 199 mg/dL
GESTATIONAL DIABETES BY TWO-STEP STRATEGY Two or more criteria must be met following 100-gram glucose beverage
1. Fasting plasma glucose ≥ 95 mg/dL
2. 1-hour plasma glucose ≥ 180 mg/dL
3. 2-hour plasma glucose ≥ 155 mg/dL
4. 3-hour plasma glucose ≥ 140 mg/dL

Glucose tolerance testing is affected by a large number of factors, including those involving patient preparation before the test, the administration of the glucose, and other factors including the time of day the test is performed, and the patient's anxiety, activity, smoking and/or caffeine intake during the test itself. Additionally, several endocrine disorders may cause impaired glucose tolerance in the absence of diabetes mellitus.

Several complications are associated with diabetes, including acute life-threatening disorders such as diabetic ketoacidosis or hyperosmolar coma, and long-term complications such as retinopathy, renal failure, neuropathy, and atherosclerosis. Early recognition and treatment of the disease is important in minimizing long-term complications of diabetes. Although usually asymptomatic and not life threatening to the mother, GDM is associated with an increased incidence of neonatal mortality and morbidity. Women with GDM are also at a significantly increased risk of subsequent diabetes, predominantly Type 2. Recognition of GDM is important because therapy can reduce the perinatal complications associated with the disorder, and identifies a woman with increased risk of developing Type 2 diabetes later in life.²

REFERENCES

1. American Diabetes Association, Diagnosis and Classification of Diabetes Mellitus, Diabetes Care. 2012 Jan; 35 Suppl 1:S64-71.
2. Tietz Fundamentals of Clinical Chemistry, 6th Edition, C. Burtis, E. Ashwood, D. B

Appendix A:

Glucose Tolerance Beverage Volume Conversion Charts

Volume of Beverage to Provide Patient From: 50g Bottle		
Load Requested (grams)	Fluid oz.	mL
5	1.0	30
10	2.0	59
15	3.0	89
20	4.0	118
25	5.0	148
30	6.0	177
35	7.0	207
40	8.0	237
45	9.0	266
50	10.0	296

Volume of Beverage to Provide Patient From: 75g Bottle		
Load Requested (grams)	Fluid oz.	mL
5	0.7	20
10	1.3	39
15	2.0	59
20	2.7	79
25	3.3	99
30	4.0	118
35	4.7	138
40	5.3	158
45	6.0	177
50	6.7	197
55	7.3	217
60	8.0	237
65	8.7	256
70	9.3	276
75	10.0	296

Volume of Beverage to Provide Patient From: 100g Bottle		
Load Requested (grams)	Fluid oz.	mL
5	0.5	15
10	1.0	30
15	1.5	44
20	2.0	59
25	2.5	74
30	3.0	89
35	3.5	104
40	4.0	118
45	4.5	133
50	5.0	148
55	5.5	163
60	6.0	177
65	6.5	192
70	7.0	207
75	7.5	222
80	8.0	237
85	8.5	251
90	9.0	266
95	9.5	281
100	10.0	296

Appendix B:

***Oral Glucose Tolerance Test Instructions and Reference Sheet
(Non-Pregnant)***

Please Read and Sign

You must be fasting at least 8 hours before the start of this test.

You are about to be administered **75** grams (or dose ordered by Clinician) of dextrose (glucose) in the form of a sweetened drink. The total amount of this drink is 10 ounces (or dose ordered by Clinician), which you will be asked to consume within 5 (five) minutes or less immediately after your **fasting** blood specimen is drawn. Your next blood draw (after the drink) will be at **120 minutes for a total of two (2) separate blood draws.**

You may experience some minor discomfort such as nausea or headache during the 2 hours after the drink, but this is rare. However, in the event that you do begin to experience any side effects from this drink, please notify your laboratory staff immediately.

You must remain seated and calm in the laboratory waiting area between blood draws and for the duration of this phlebotomy visit after consuming the drink. Small sips of water while waiting are okay.

It is your responsibility to check in at reception 5 minutes before the prescheduled collection time. Checking in later than 5 minutes after any prescheduled Collection time will result in having to reschedule this test for another day.

Glucose Tolerance Beverage given at (date/time): _____ / _____
(This section to be completed by Laboratory Staff)

Phlebotomy times:

Fasting: _____
120 min: _____

(Lab will note time(s) here.)

(You should arrive in Lab 5 minutes before these times.)

I have read and fully understand this reference and instruction sheet. I will arrive in the laboratory on time and will notify the laboratory staff should I begin to feel ill or sick.

Patient's Name: _____

Patient's Signature: _____

Initials of staff administering Glucose Tolerance Beverage: _____

Amount of Glucose Tolerance Beverage administered: _____ (grams)

Appendix B:

***Oral Glucose Tolerance Test Instructions and Reference Sheet
(Pregnant)***

Please Read and Sign

You must be fasting at least 8 hours before the start of this test.

You are about to be administered **75** grams of dextrose (glucose) in the form of a sweetened drink. The total amount of this drink is 10 ounces, which you will be asked to consume within 5 (five) minutes or less immediately after your **fasting** blood specimen is drawn. Your next blood draws (after the drink) will be at **60 minute, 120 minute intervals for a total of three (3) separate blood draws.**

You may experience some minor discomfort such as nausea or headache during the 2 hours after the drink, but this is rare. However, in the event that you do begin to experience any side effects from this drink, please notify your laboratory staff immediately.

You must remain seated and calm in the laboratory waiting area between blood draws and for the duration of this phlebotomy visit after consuming the drink. Small sips of water while waiting are okay.

It is your responsibility to check in at reception 5 minutes before **each** prescheduled collection time. Checking in later than 5 minutes after any prescheduled collection time(s) will result in having to reschedule this test for another day.

Glucose Tolerance Beverage given at (date/time): _____ / _____
(This section to be completed by Laboratory Staff)

Phlebotomy times:

(Lab will note time(s) here.)

Fasting: _____
60 min: _____
120 min: _____

(You should arrive in Lab 5 minutes before these times.)

I have read and fully understand this reference and instruction sheet. I will arrive in the laboratory on time and will notify the laboratory staff should I begin to feel ill or sick.

Patient's Name: _____

Patient's Signature: _____

Initials of staff administering Glucose Tolerance Beverage: _____

Amount of Glucose Tolerance Beverage administered: _____ (grams)

Appendix B:

Oral Glucose Two-Step Tolerance Test Instructions and Reference Sheet

STEP 1 (Pregnant)

Please Read and Sign

You must be fasting at least 8 hours before the start of this test.

You are about to be administered **50** grams of dextrose (glucose) in the form of a sweetened drink. The total amount of this drink is 10 ounces, which you will be asked to consume within 5 (five) minutes or less immediately after your **fasting/non fasting** blood specimen is drawn. Your next blood draws (after the drink) will be at **60 minutes** for a **total of four (2) separate blood draws**.

You may experience some minor discomfort such as nausea or headache during the 2 hours after the drink, but this is rare. However, in the event that you do begin to experience any side effects from this drink, please notify your laboratory staff immediately.

You must remain seated and calm in the laboratory waiting area between blood draws and for the duration of this phlebotomy visit after consuming the drink. Small sips of water while waiting are okay.

It is your responsibility to check in at reception 5 minutes before **each** prescheduled collection time. Checking in later than 5 minutes after any prescheduled collection time(s) will result in having to reschedule this test for another day.

Glucose Tolerance Beverage given at (date/time): _____ / _____
(This section to be completed by Laboratory Staff)

Phlebotomy times:

Fasting/Non Fasting: _____

60 min: _____

(Lab will note time(s) here.)

(You should arrive in Lab 5 minutes before these times.)

I have read and fully understand this reference and instruction sheet. I will arrive in the laboratory on time and will notify the laboratory staff should I begin to feel ill or sick.

Patient's Name: _____

Patient's Signature: _____

Initials of staff administering Glucose Tolerance Beverage: _____

Amount of Glucose Tolerance Beverage administered: _____ (grams)

Appendix B:

Oral Glucose Two-Step Tolerance Test Instructions and Reference Sheet

STEP 2 (Pregnant)

Please Read and Sign

You must be fasting at least 8 hours before the start of this test.

You are about to be administered **100** grams of dextrose (glucose) in the form of a sweetened drink. The total amount of this drink is 10 ounces, which you will be asked to consume within 5 (five) minutes or less immediately after your **fasting** blood specimen is drawn. Your next blood draws (after the drink) will be at **60 minute, 120 minute and 180 minute intervals for a total of four (4) separate blood draws.**

You may experience some minor discomfort such as nausea or headache during the 2 hours after the drink, but this is rare. However, in the event that you do begin to experience any side effects from this drink, please notify your laboratory staff immediately.

You must remain seated and calm in the laboratory waiting area between blood draws and for the duration of this phlebotomy visit after consuming the drink. Small sips of water while waiting are okay.

It is your responsibility to check in at reception 5 minutes before **each** prescheduled collection time. Checking in later than 5 minutes after any prescheduled collection time(s) will result in having to reschedule this test for another day.

Glucose Tolerance Beverage given at (date/time): _____ / _____
(This section to be completed by Laboratory Staff)

Phlebotomy times:

(Lab will note time(s) here.)

Fasting: _____
60 min: _____
120 min: _____
180 min: _____

(You should arrive in Lab 5 minutes before these times.)

I have read and fully understand this reference and instruction sheet. I will arrive in the laboratory on time and will notify the laboratory staff should I begin to feel ill or sick.

Patient's Name: _____

Patient's Signature: _____

Initials of staff administering Glucose Tolerance Beverage: _____

Amount of Glucose Tolerance Beverage administered: _____ (grams)

Appendix C:

Glucose Tolerance Return Time Slip
(Non-Pregnant)

It is your responsibility to check in with the reception desk (5) five minutes before each prescheduled collection time. Checking in later than (5) minutes after any prescheduled collection time will result in having to reschedule this test for another day.

Patient Name: _____ MR# _____

Collection time as follows:

120 min _____

Appendix C:

**Glucose Tolerance Return Time Slip
(Pregnant)**

It is your responsibility to check in with the reception desk (5) five minutes before each prescheduled collection times. Checking in later then (5) minutes after any prescheduled collection time(s) will result in having to reschedule this test for another day.

Patient Name: _____ MR# _____

Collection times as follows:

60 min _____

120 min _____

Appendix C:

Glucose Tolerance Two-Step Return Time Slip
STEP 1 (Pregnant)

It is your responsibility to check in with the reception desk (5) five minutes before each prescheduled collection times. Checking in later than (5) minutes after any prescheduled collection time(s) will result in having to reschedule this test for another day.

Patient Name: _____ MR# _____

Collection times as follows:

60 min _____

Appendix C:

Glucose Tolerance Two-Step Return Time Slip
STEP 2 (Pregnant)

It is your responsibility to check in with the reception desk (5) five minutes before each prescheduled collection times. Checking in later than (5) minutes after any prescheduled collection time(s) will result in having to reschedule this test for another day.

Patient Name: _____ MR# _____

Collection times as follows:

60 min _____

120 min _____

180 min _____

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PROCEDURE HISTORY

Date	Written/ Revised by	Revision	Approved Date	Approved by
09/98	D. Wright	New	9/11/98	Dr. E. Larkin
10/00	R. Longoria	Revised	10/00	Dr. E. Larkin
10/02	R. Longoria	Revised	10/02	Dr. E. Larkin
11/02	D. Wright	Revised	11/02	Dr. E. Larkin
11/04	R. Longoria	Revised	11/04	Dr. E. Larkin
08/05	D. Wright	Revised	08/05	Dr. Ralph Green
9/06	D. Wright	Revised	09/06	Dr. R. Green
10/07	D. Wright	Revised	10/07	Dr. R. Green
8/08	C. White	Revised	8/08	Dr. L. Howell
9/09	C. White	Reviewed	12/09	Dr. J. Bishop
06/10	Paul/White	Revised	07/10	Dr. L. Howell
06/11	C. White	Reviewed	06/11	L. Howell
09/11	C. White/D. McGee	Reviewed	09/11	L. Howell
04/12	J. Frey/S. Paul	Revised	04/12	L. Howell
9/13	J. Frey/S. Paul	Revised: GTT panels	10/13	L. Howell
4/16	J. Frey	Reviewed	08/16	L. Howell
7/17	N. Tran/R. Scott/M. Sawyer	Revised		