MAYO CLINIC LABORATORIES

Test Definition: GLP

Glucagon, Plasma

Overview

Useful For

Diagnosis and follow-up of glucagonomas and other glucagon-producing tumors

Assessing diabetic patients with problematic hyper- or hypoglycemic episodes (extremely limited utility)

Method Name

Enzyme-Linked Immunosorbent Assay (ELISA)

NY State Available

Yes

Specimen

Specimen Type

Plasma EDTA

Specimen Required

Patient Preparation:

Fasting: 8 hours, required

Supplies: Sarstedt Aliquot Tube, 5 mL (T914)

Collection Container/Tube: Lavender top (EDTA)

Submission Container/Tube: Plastic vial

Specimen Volume: 2 mL Plasma

Collection Instructions:

1. Pre-chill lavender top (EDTA) tube at 4 degrees C before collecting the specimen.
2. Draw blood into the pre-chilled tube and process as follows:
 a. Chill filled tube in wet ice for 10 minutes.
 b. Centrifuge in a refrigerated centrifuge or in a pre-chilled centrifuge carrier.
 c. Immediately after centrifugation, aliquot plasma into a plastic vial and freeze.

Forms

If not ordering electronically, complete, print, and send an Oncology Test Request (T729) with the specimen.

Specimen Minimum Volume

Plasma: 0.45 mL

Reject Due To

Gross hemolysis	Reject

Gross lipemia	Reject
Gross icterus	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Plasma EDTA	Frozen	90 days	

Clinical & Interpretive

Clinical Information

Glucagon is a single-chain polypeptide of 29 amino acids that is derived from a larger precursor peptide (big plasma glucagon), which is cleaved upon secretion. The main sites of glucagon production are the hypothalamus and pancreatic alpha-islet cells. The function of hypothalamic glucagon is incompletely understood and currently no clinical disorders of hypothalamic glucagon function have been defined. Pancreatic islet glucagon is secreted in response to hypoglycemia, with resultant increases in blood glucose concentration. Glucagon's hyperglycemic effect is produced by stimulating hepatic glycogenolysis and gluconeogenesis; it has no effect on muscle glycogen. Once blood glucose levels have normalized, glucagon secretion ceases.

Excessive glucagon secretion can lead to hyperglycemia. Excessive and inappropriate glucagon secretion can sometimes be observed in diabetes, particularly during ketoacidosis, and can complicate management of the disorder. In rare cases, it also can occur in tumors of pancreatic islets (glucagonoma), hepatocellular carcinomas, carcinoid tumors, and other neuroendocrine neoplasms. Patients with glucagon-secreting tumors may present with classic glucagonoma syndrome, consisting of necrolytic migratory erythema, diabetes, and diarrhea, but can also have more subtle symptoms and signs.

Decreased or absent glucagon response to hypoglycemia can be seen in type I diabetes (insulin-dependent diabetes) and can contribute to severe and prolonged hypoglycemic responses.

Glucagon is routinely measured along with serum glucose, insulin, and C-peptide levels during the mixed-meal test employed in the diagnostic workup of suspected postprandial hypoglycemia. However, it plays only a minor role in the interpretation of this test.

Reference Values

<1 year: Not established
> or =1 year: < or =159 pg/mL

For International System of Units (SI) conversion for Reference Values, see www.mayocliniclabs.com/order-tests/si-unit-conversion.html.

Interpretation

Elevated glucagon concentrations in the absence of hypoglycemia may indicate the presence of a glucagon-secreting tumor. Successful treatment of a glucagon-secreting tumor is associated with normalization of glucagon levels.

Inappropriate elevations in glucagon concentrations in patients who are hyperglycemic and have type I diabetes indicate

that paradoxical glucagon release may contribute to disease severity. This can be observed if insulin treatment is inadequate and patients are ketotic. However, glucagon measurement plays little, if any, role in the diagnostic workup of diabetic ketoacidosis.

In patients with diabetes, low glucagon concentrations (undetectable or in the lower quartile of the normal range) in the presence of hypoglycemia indicate impairment of hypoglycemic counter regulation. These patients may be particularly prone to recurrent hypoglycemia. This can be a permanent problem due to islet alpha-cell destruction or other less well understood processes (eg, autonomous neuropathy). It can also be functional, most often due to over-tight blood glucose control and may be reversible after decreasing insulin doses.

Cautions

Results obtained with different glucagon assays can differ. This can be caused by use of different calibration standards or variable cross-reactivity with different isoforms of glucagon, not all of which are biologically active.

The monoclonal antibodies used in this assay only detect the full-length glucagon (amino acids1-29) and do not cross react with glucagon fragments or closely related peptides such as glicentin, oxyntomodulin, glucagon-like peptide-1 (GLP-1), GLP-2, or glicentin-related pancreatic polypeptide.

Glucagon serial measurements should always be performed using the same assay.

Patients with diabetes, acromegaly, or Cushing syndrome or who are obese have higher glucagon levels.

Tumor marker tests, including glucagon, are not specific for malignancy. All immunometric assays can, on rare occasions, be subject to hooking at extremely high analyte concentrations (false-low results), heterophilic antibody interference (false-high results), or autoantibody interference (unpredictable effects). If the laboratory result does not fit the clinical picture, these possibilities should be considered.

In rare cases, some individuals can develop antibodies to mouse or other animal antibodies (often referred to as human anti-mouse antibodies [HAMA] or heterophile antibodies), which may cause interference in some immunoassays. Caution should be used in interpretation of results, and the laboratory should be alerted if the result does not correlate with the clinical presentation.

Clinical Reference

1. Tomassetti P, Migliori M, Lalli S, Campana D, Tomassetti V, Corinaldesi R. Epidemiology, clinical features and diagnosis of gastroenteropancreatic endocrine tumours. Ann Oncol. 2001;12 Suppl 2:S95-S99
2. Jiang G, Zhang BB. Glucagon and regulation of glucose metabolism. Am J Physiol Endocrinol Metab. 2003;284(4):E671-E678
3. van Beek AP, de Haas ER, van Vloten WA, Lips CJ, Roijers JF, Canninga-van Dijk MR. The glucagonoma syndrome and necrolytic migratory erythema: a clinical review. Eur J Endocrinol. 2004;151(5):531-537
4. Cruz-Bautista I, Lerman I, Perez-Enriquez B, et al. Diagnostic challenge of glucagonoma: case report and literature review. Endocr Pract. 2006;12(4):422-426
5. Falconi M, Eriksson B, Kaltsas G, et al. ENETS Consensus guidelines update for the management of patients with functional pancreatic neuroendocrine tumors and non-functional pancreatic neuroendocrine tumors. Neuroendocrinology. 2016;103(2):153-171

Performance

Method Description

The glucagon enzyme-linked immunosorbent assay (ELISA) is a quantitative two-step sandwich type immunoassay. In the first step, calibrators, controls, and unknown samples are added to glucagon antibody-coated microtiter wells and incubated with biotinylated glucagon antibody. After the first incubation and washing, the wells are incubated with streptavidin horseradish peroxidase conjugate (SHRP). After the second incubation and washing step, the wells are incubated with substrate solution (tetramethylbenzidine: TMB). After TMB incubation, an acidic stopping solution is added. In principle, the antibody-biotin conjugate binds to the solid phase antibody-antigen complex, which in turn binds to the streptavidin-enzyme conjugate. The antibody-antigen-biotin conjugate-SHRP complex bound to the well is detected by enzyme-substrate reaction. The degree of enzymatic turnover of the substrate is determined by dual wavelength absorbance measurement at 450 nm as primary test filter and 630 nm as reference filter. The absorbance measured is directly proportional to the concentration of glucagon in the samples and calibrators.(Package insert: Glucagon ELISA IFU. Ansh Labs, Revision 09, 01/2023)

PDF Report

No

Day(s) Performed

Tuesday, Friday

Report Available

3 to 7 days

Specimen Retention Time

2 weeks

Performing Laboratory Location

Mayo Clinic Laboratories - Rochester Superior Drive

Fees & Codes

Fees

- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact Customer Service.

Test Classification

This test has been cleared, approved, or is exempt by the US Food and Drug Administration and is used per manufacturer's instructions. Performance characteristics were verified by Mayo Clinic in a manner consistent with CLIA requirements.

CPT Code Information

82943

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
GLP	Glucagon, P	2338-2

Result ID	Test Result Name	Result LOINC® Value
9358	Glucagon, P	2338-2