MAYO CLINIC LABORATORIES

Test Definition: GAST

Gastrin, Serum

Overview

Useful For

Investigation of patients with achlorhydria or pernicious anemia

Investigation of patients suspected of having Zollinger-Ellison syndrome

Diagnosis of gastrinoma

Method Name

Automated Chemiluminescent Immunometric Assay

NY State Available

Yes

Specimen

Specimen Type

Serum

Specimen Required

Patient Preparation:

1. Fasting: 12 hours, required

2. For 12 hours before specimen collection, patient **should not** take multivitamins or dietary supplements (eg, hair, skin, and nail supplements) containing biotin (vitamin B7).

3. For 1 week before specimen collection, if medically feasible, patient **should not** take proton pump inhibitors (omeprazole, lansoprazole, dexlansoprazole, esomeprazole, pantoprazole, and rabeprazole).

4. For at least 2 weeks before specimen collection, patient **should not** take or receive drugs that interfere with gastrointestinal motility (eg, opioids).

Supplies: Sarstedt Aliquot Tube, 5 mL (T914)

Collection Container/Tube:

Preferred: Serum gel

Acceptable: Red top

Submission Container/Tube: Plastic vial

Specimen Volume: 1 mL Serum

Collection Instructions:

1. If multiple specimens are collected, submit each vial under a separate order.

2. Label specimens with corresponding collection time.

3. Within 2 hours of collection, centrifuge at refrigerated temperature. Refrigerated centrifugation is preferred but not required.

4. Immediately aliquot serum into a plastic vial.

Forms

If not ordering electronically, complete, print, and send 1 of the following forms with the specimen:
-Oncology Test Request Form (T729)
-Benign Hematology Test Request Form (T755)

Specimen Minimum Volume

Serum: 0.5 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	OK
Gross icterus	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Frozen (preferred)	30 days	
	Refrigerated	24 hours	

Clinical & Interpretive

Clinical Information

Gastrin is a peptide hormone produced by mucosal G cells of the gastric antrum. It is synthesized as preprogastrin and then cleaved to progastrin, which undergoes several posttranslational modifications, particularly, sulfation. It is finally processed into the mature 34-amino acid, gastrin-34. Gastrin-34 may be cleaved further into the shorter 17-amino acid, gastrin-17. Either may be secreted as a C-terminal amidated or unamidated isoform. A number of additional, smaller gastrin fragments, as well as gastrin molecules with atypical posttranslational modifications (eg, absent sulfation), may also be secreted in small quantities. Gastrin's half-life is short, 5 minutes for amidated gastrin-17, and 20 to 25 minutes for amidated gastrin-34. Elimination occurs through peptidase cleavage and renal excretion.

Gastrin-17 I (nonsulfated form) and gastrin-17 II (sulfated) appear equipotent. Their biological effects are chiefly associated with the amidated isoforms and consist of promotion of gastric epithelial cell proliferation and differentiation to acid-secreting cells, direct promotion of acid secretion, and indirect stimulation of acid production through histamine release. In addition, gastrin stimulates gastric motility and release of pepsin and intrinsic factor. Most gastrin isoforms with atypical posttranslational modifications and most small gastrin fragments display reduced or absent bioactivity. This assay measures predominately gastrin-17. Larger precursors and smaller fragments have little or no cross-reactivity in the assay.

Intraluminal stomach pH is the main factor regulating gastrin production and secretion. Rising gastric pH levels result in increasing serum gastrin levels, while falling pH levels are associated with mounting somatostatin production in gastric D cells. Somatostatin, in turn, downregulates gastrin synthesis and release. Other weaker factors that stimulate gastrin

secretion are gastric distention, protein-rich foods, and elevated secretin or serum calcium levels.

Serum gastrin levels may also be elevated in gastric distention due to gastric outlet obstruction and in a variety of conditions that lead to real or functional gastric hypo- or achlorhydria (gastrin is secreted in an attempted compensatory response to achlorhydria). These include atrophic gastritis with or without pernicious anemia, a disorder characterized by destruction of acid-secreting (parietal) cells of the stomach; gastric dumping syndrome; and surgically excluded gastric antrum. In atrophic gastritis, the chronic cell-proliferative stimulus of the secondary hypergastrinemia may contribute to the increased gastric cancer risk observed in this condition.

Gastrin levels are pathologically increased in gastrinoma, a type of neuroendocrine tumor that can occur in the pancreas (20%-40%) or in the duodenum (50%-70%). The triad of non-beta islet cell tumor of the pancreas (gastrinoma), hypergastrinemia, and severe ulcer disease is referred to as the Zollinger-Ellison syndrome. Over 50% of gastrinomas are malignant and can metastasize to regional lymph nodes and the liver. About 25% of gastrinomas occur as part of the multiple endocrine neoplasia type 1 (MEN 1) syndrome and are associated with hyperparathyroidism and pituitary adenomas. These MEN 1-associated tumors have been observed to occur at an earlier age than sporadic tumors and often follow a more benign course.

Basal and secretin-stimulated serum gastrin measurements are the best laboratory tests for gastrinoma.

Reference Values

<100 pg/mL

There is no evidence that fasting serum gastrin levels differ between adults and children. Although 8-hour fasts are difficult or impossible to enforce in small children, serum gastrin levels after shorter fasting periods (3-8 hours) may be 50% to 60% higher than the 8-hour fasting value.

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

Interpretation

Achlorhydria is the most common cause of elevated serum gastrin levels. The most common cause for achlorhydria is treatment of gastroduodenal ulcers, nonulcer dyspepsia, or gastroesophageal reflux with proton pump inhibitors (substituted benzimidazoles, eg, omeprazole). Other causes of hypo- and achlorhydria include chronic atrophic gastritis with or without pernicious anemia, gastric ulcer, gastric carcinoma, and previous surgical or traumatic vagotomy.

If serum B12 levels are significantly low (<150 ng/L), even if the intrinsic factor blocking antibody tests are negative, a serum gastrin level above the reference range makes it likely the patient is suffering from pernicious anemia.

Hypergastrinemia with normal or increased gastric acid secretion is suspicious of a gastrinoma (Zollinger-Ellison syndrome). Gastrin levels less than 100 pg/mL are observed so uncommonly in untreated gastrinoma patients with intact upper gastrointestinal anatomy as to virtually exclude the diagnosis. The majority (>60%) of patients with gastrinoma have very significantly elevated serum gastrin levels (>400 pg/mL). Levels above 1000 pg/mL in a gastric- or duodenal-ulcer patient without previous gastric surgery, on no drugs, who has a basal gastric acid output of greater than 15 mmol/hour (>5 mmol/hour in patients with prior acid-reducing surgery) are considered diagnostic of gastrinoma. If there are any doubts about gastric acid output, an infusion of 0.1 M HCl (hydrochloric acid) into the stomach reduces the serum gastrin in patients with achlorhydria but not in those with gastrinoma.

Other conditions that may be associated with hypergastrinemia in the face of normal or increased gastric acid secretion include gastric and, rarely, duodenal ulcers, gastric outlet obstruction, bypassed gastric antrum, and gastric dumping. Occasionally, diabetes mellitus, autonomic neuropathy with gastroparesis, pheochromocytoma, rheumatoid arthritis, thyrotoxicosis, and paraneoplastic syndromes can also result in hypergastrinemia with normal acid secretion. None of these conditions tends to be associated with fasting serum gastrin levels above 400 pg/mL, and levels above 1000 pg/mL are virtually never observed.

Several provocative tests can be used to distinguish these patients from individuals with gastrinomas. Patients with gastrinoma, who have normal or only mildly to modestly increased fasting serum gastrin levels, respond with exaggerated serum gastrin increases to intravenous infusions of secretin or calcium. Because of its greater safety, secretin infusion is preferred. The best validated protocol calls for a baseline fasting gastrin measurement, followed by an injection of 2 clinical units of secretin per kg body weight (0.4 microgram/kg) over 1 minute and further serum gastrin specimens at 5-, 10-, 15-, 20-, and 30-minutes postinjection. A peak gastrin increase of more than 200 pg/mL above the baseline value has greater than 85% sensitivity and near 100% specificity for gastrinoma. Secretin or calcium infusion tests are not carried out in the clinical laboratory but are usually performed at gastroenterology or endocrine testing units under the supervision of a physician. They are progressively being replaced (or supplemented) by imaging procedures, particularly duodenal and pancreatic endoscopic ultrasound.

All patients with confirmed gastrinoma should be evaluated for possible multiple endocrine neoplasia type 1 (MEN 1), which is the underlying cause in approximately 25% of cases. If clinical, biochemical, or genetic testing confirms MEN 1, other family members need to be screened.

Cautions

Isolated serum gastrin levels can only be interpreted in fasting patients; nonfasting specimens are uninterpretable.

Artifactual hypergastrinemia may be observed in fasting patients who have undergone procedures that result in temporary gastric distention or dysmotility (eg, after gastroscopy).

Kidney failure prolongs the serum half-life of gastrin and is associated with increased serum gastrin levels.

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.

Drugs that interfere with gastric acid secretion, in particular proton pump inhibitors (eg, omeprazole, pantoprazole, dexlansoprazole, lansoprazole, rabeprazole), can lead to significant elevations of serum gastrin levels often above the normal range. These drugs can be discontinued, if feasible, for at least 1 week before serum gastrin measurement in order to avoid gastrin elevation.

Drugs that interfere with gastrointestinal motility (eg, opioids) may also interfere with serum gastrin testing.

Clinical Reference

1. Ellison EC, Johnson JA. The Zollinger-Ellison syndrome: a comprehensive review of historical, scientific, and clinical considerations. Curr Probl Surg. 2009;46(1):13-106. doi:10.1067/j.cpsurg.2008.09.001
2. McColl KE, Gillen D, El-Omar E. The role of gastrin in ulcer pathogenesis. Baillieres Best Pract Res Clin Gastroenterol.

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3. Dockray GJ, Varro A, Dimaline R, Wang T. The gastrins: their production and biological activities. Annu Rev Physiol. 2001;63:119-139. doi:10.1146/annurev.physiol.63.1.119
4. Brandi ML, Gagel RF, Angeli A, et al. Guidelines for diagnosis and therapy of MEN type 1 and type 2. J Clin Endocrinol Metab. 2001;86(12):5658-5671. doi:10.1210/jcem.86.12.8070
5. Ward PC. Modern approaches to the investigation of vitamin B12 deficiency. Clin Lab Med. 2002;22(2):435-445. doi:10.1016/s0272-2712(01)00003-8
6. Dacha S, Razvi M, Massaad J, Cai Q, Wehbi M. Hypergastrinemia. Gastroenterol Rep (Oxf). 2015;3(3):201-208. doi:10.1093/gastro/gov004
7. Ahmed M, Ahmed S. Functional, diagnostic and therapeutic aspects of gastrointestinal hormones. Gastroenterology Res. 2019;12(5):233-244. doi:10.14740/gr1219

Performance

Method Description

The Immulite 2000 Gastrin assay is a chemiluminescent, enzyme-labeled immunometric assay based on a ligand-labeled murine monoclonal capture antibody specific for gastrin and separation by antiligand-coated solid phase. The patient sample along with the ligand-labeled, anti-gastrin monoclonal antibody, an alkaline phosphatase-conjugated rabbit polyclonal anti-gastrin antibody, and an alkaline phosphatase-conjugated murine monoclonal anti-gastrin antibody are simultaneously incubated in the presence of the immobilized antiligand bead in a reaction tube. During the 60-minute incubation, gastrin molecules in the sample form antibody sandwich complexes that, in turn, bind to antiligand on the solid phase. Unbound conjugate is then removed by a centrifugal wash, after which luminogenic substrate is added, and the reaction tube is incubated for an additional 5 minutes. The chemiluminescent substrate, a phosphate ester of adamantyl dioxetane, undergoes hydrolysis in the presence of alkaline phosphatase to yield an unstable intermediate. The continuous production of the intermediate results in the sustained emission of light. The bound complex and, thus, also the photon output, as measured by the luminometer is proportional to the concentration of gastrin in the sample.(Instruction manual: Immulite 2000 Gastrin. Siemens Medical Solutions Diagnostics; PIL2KGA-15, 08/2020)

PDF Report

No

Day(s) Performed

Monday through Saturday

Report Available

1 to 3 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

82941

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
GAST	Gastrin, S	2333-3

Result ID	Test Result Name	Result LOINC® Value
GAST	Gastrin, S	2333-3