Gastric Emptying Scintigraphy

- The protocol for gastric emptying scintigraphy at Mass General has been updated to conform to internationally recognized standards

- Patients consume a standard low-fat meal labeled with $^{99m}$Tc-sulfur colloid and are then imaged immediately after the meal is consumed, and at 1, 2, and 4 hours

- Results are reported as a percentage of gastric emptying at each time and compared to validated standard values

- Gastric emptying scintigraphy is available as an outpatient procedure only

**Figure 1.** Selected images from a gastric emptying study immediately after administration of the labeled meal and at 1 and 2 hours demonstrate rapid emptying of the stomach (arrows), with accumulation of tracer in small bowel inferiorly.

Gastrointestinal symptoms such as abdominal pain or discomfort, nausea, vomiting, and early satiation are common complaints that precipitate patient visits to their doctors. These symptoms are associated with multiple diagnoses, both structural and physiological. Tests such as an upper GI series, CT, or endoscopy are typically chosen initially to evaluate these symptoms and are valuable for the diagnosis of ulcers, cancer, gastrointestinal blockage, or inflammation. If these tests are negative and the patient continues to experience symptoms, and especially if the patient is losing weight, gastric emptying scintigraphy may be considered to determine whether the patient has accelerated or delayed gastric emptying of a meal.

The epidemiology of delayed gastric emptying (gastroparesis) has not been extensively studied. However, one large population-based study has estimated that the age-adjusted incidence of gastroparesis per 100,000 was 2.4 for men and 9.8 for women, while the age-adjusted prevalence per 100,000 was 9.6 for men and 38 for women. Gastroparesis is common in diabetic patients (both those with Type 1 and Type 2) although the majority do not complain of symptoms. Gastroparesis is also associated with scleroderma and other connective tissue diseases, prior viral infection (Norwalk virus and rotavirus), certain medications, and prior gastric or thoracic surgery.
Scintigraphy is the gold standard for evaluating gastric emptying and is a widely available test. It is a physiological measure that provides data on the amount of food or liquid that is retained in the stomach over time. Retention of solid food is regarded as more relevant to the symptoms of post-prandial distress. There has been considerable variation from center to center in many aspects of the test protocols, including the composition of the meal and in the timing of image acquisition. This has made it difficult to interpret the results of the tests. In 2000, Tougas et al. determined the normal range of gastric emptying rates in healthy individuals who ate a standard low-fat meal and were imaged scintigraphically immediately after meal completion and at 1, 2, and 4 hours later. Normal values for food retention in the stomach of an adult were found to be 37-90% at 1 hour, 30-60% at 2 hours, and 0-10% at 4 hours.

More recently, evidence has emerged that measuring gastric retention at 4 hours is more sensitive for the diagnosis of gastroparesis than that measured at 2 hours. Therefore, in order to maximize the diagnostic confidence and to reduce variation amongst different test sites, the American Neurogastroenterology and Motility Society and the Society of Nuclear Medicine have issued consensus recommendations on conducting gastric emptying scintigraphy, including the composition of the meal and the timing of image acquisition.

**Gastric-Emptying Scintigraphy Protocol**

The patient should take nothing by mouth for at least 4 hours before the start of the examination. In most cases, the examination is scheduled in the morning, in which case the patient should consume nothing after midnight. Depending on the reason for conducting the test, medications that affect gastric motility may be stopped 2 days before testing, provided that medication withdrawal is unlikely to affect the patient’s ability to complete the examination.

The patient will be asked to consume a meal of 4 oz. cooked egg white product (e.g. Egg-Beaters, ConAgra Foods Inc) labeled with 0.25-0.5 mCi (9.25-18.5 MBq) 99mTc sulfur colloid, 2 slices of (toasted) white bread, jam or jelly, and 120 mL water. The meal should be ingested as quickly as possible, optimally within 10 minutes. Immediately after completion of the meal, the first scintigraphic images are obtained during a period of 1 minute while the patient is in an upright position. Repeated images are obtained in the same projections for 1 minute after 1, 2, and 4 hours. Representative images of rapid and slow gastric emptying are shown in Figure 1 and Figure 2, respectively. Note that for gastric emptying scintigraphy studies in children, images will be acquired immediately after meal consumption, then at 1 and 2 hours afterwards. There are no established values for gastric emptying rates in children. Therefore, the value of prolonging the test to 4 hours is unknown and cannot be justified in those under the age of 16 years.

In between imaging acquisitions, the patient is expected to remain in the waiting area and may not consume anything by mouth. Note that if the patient vomits at any time before the completion of the test, the results are invalid. The radiation exposure associated with the gastric emptying scintigraphy protocol is very low (0.006-0.012 mSv) and is comparable to that from natural background radiation exposure in one month.
Scheduling

Gastric emptying scintigraphy examinations are available for outpatients only and are performed on the main Mass General campus and at MassGeneral West Imaging, Waltham. They may be scheduled online through Radiology Order Entry (http://mghroe) or by calling 617-724-9729 (4-XRAY). Mass General Imaging no longer has the capacity to perform immediate on-demand gastric emptying scintigraphy.

Gastric emptying scintigraphy will no longer be available for inpatients for several reasons. Patients who are in the hospital may have multiple factors that could affect gastric motility, including pain medications and post-surgical effects. In addition, patients who are suspected of suffering from an attack of gastroparesis while in hospital may not benefit from an immediate confirmation of that diagnosis. Rather, more useful data for clinical management may be acquired by conducting gastric emptying scintigraphy after the patient has stabilized and has a more typical outpatient pattern of symptoms.

Further Information

For further questions on the diagnosis of gastric emptying scintigraphy, please contact Edwin L. Palmer, MD, Director of Clinical Nuclear Medicine, Massachusetts General Hospital, at 617-726-8350.

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References


