UW Health
University of Wisconsin Hospital and Clinics

Division of Nuclear Medicine Procedure / Protocol

GASTRIC EMPTYING **CPT CODE: 78264**
UPDATED: FEBRUARY 2013

Indications:

This examination:

- Is indicated in patients with diabetes and those with complaints of nausea, vomiting, and early satiety
- Can demonstrate abnormal gastric emptying
- Serial imaging can demonstrate the response to drug therapy (e.g. metoclopramide)

Patient Prep:

- Patients should be fasting a minimum of 6 hours, preferably an overnight fast. For infants, the normal time between feedings will be a sufficient fast.
- Patients should avoid smoking the morning of the test and through test completion.
- Insulin may be taken as usual. Insulin-dependent diabetic patients should bring their glucose monitors and insulin with them. *The serum glucose level at the time of meal ingestion should be recorded and included in the final report*.
  - Diabetic patients should monitor their glucose level and adjust their morning dose of insulin as needed for the prescribed meal. The glucose level should be < 275 mg/dl the morning of the test. Insulin can be given before the test to lower the blood glucose level.
- Premenopausal women should ideally be studied on days 1–10 of their menstrual cycle, if possible, to avoid the effects of hormonal variation on gastrointestinal motility.
- Food sensitivities including gluten allergy are to be noted and bread exchanged. However, requested changes in test meal must be confirmed with referring and a Nuclear Medicine physician at the time of protocoling. Allergies to egg whites are very rare and this is different to egg yolks where allergies exist.
- Prokinetic agents such as metoclopramide, tegaserod, domperidone, and erythromycin are generally stopped 2 days before the test **unless** the test is done to assess the efficacy of these drugs.
- Medications that delay gastric emptying, such as opiates or antispasmodic agents, should generally also be stopped 2 days before testing. Some other medications that may have an effect on the rate of gastric emptying include atropine, nifedipine, progesterone, octreotide, theophylline, benzodiazepine, and phentolamine. The Nuclear Pharmacist will do a medication review prior to scheduled appointment and discuss with faculty any medications not stopped. Faculty will determine if the study should proceed or not. Faculty will give any additional instructions or cancel notification to a Senior Nuclear Medicine Technologist.
- If the patient is on medications for nausea and/or vomiting, then the Nuclear Medicine physician will need to determine if the medications should be continued. If not the Nuclear Medicine physician will advise how long the patient should be off the medication.
- Ondanseton can be given for nausea; this has little effect on the gastric emptying.

Scheduling:

- This study is broken up into 5 appointments and requires 4 hours total time.
  1. 45 minutes: Test explanation and eating the meal with the first set of images at about the 30 minute point
  2. Returning at 1, 2, 3, and 4 hours post-meal for additional sets of images
  3. Each imaging set will be scheduled for 15 minutes
- This study has a strict food intake for adult patients of 2 scrambled egg whites (Egg Beaters), bread, and water. If patient cannot comply, referring physician will need to contact Nuclear Medicine Faculty (reading room), but the National Standard normal ranges will not apply.

- The alternate meal uses oatmeal instead of scrambled egg whites, and can be used if needed if assessing pre- and post-medication changes. The alternate meal is not recommended.
- Infants: Do not follow the timing described above. They will be seen for about 2.5 hours with images every 15 minutes. The infant's own formula is used. Volume is same as used for a normal feeding. Try to schedule the start of the exam to be the beginning of the normal feeding interval.
- Due to the duration of this exam, Wednesday in Room B will be the routine day this exam is offered. If there is a different need, a phone message will be to be submitted to see if by chance the required times are available on another camera.

Radiopharmaceutical & Dose:

All patients: The standard adult dose is 0.5 mCi +/- 20% (0.4-0.6 mCi, Tc-99m sulfur colloid adjusted for weight per nomogram/NMIS). Minimum dose is 0.1 mCi for all patients. This will be added into the meal as described below.

Meal Includes

- 118 milliliters (4 oz.) of liquid egg whites (e.g. Eggbeaters [ConAgra Foods, Inc.] or an equivalent generic liquid egg white)
- Two slices of white bread (if gluten allergy, then rice bread will be substituted)
- 30 grams of jam or jelly
- 120 milliliters of water

Meal Preparation

- Test meal should be prepared after patient arrives in the department
- Mix the 99mTc-sulfur colloid into the liquid egg whites
- Cook the liquid egg whites in a hot nonstick skillet or in a Nuclear Medicine dedicated microwave oven. Stir the liquid egg whites once or twice during cooking and cook until firm—to the consistency of an omelet.
- Bread can be toasted if a toaster is available, if the patient desires

* The liquid egg whites (e.g. Eggbeaters [ConAgra Foods, Inc.] or an equivalent generic liquid egg white) can be obtained from Nutrition Services from their bulk supply in a Styrofoam cup along with the other meal items.

Alternate Meals

Infants

Nuclear Medicine technologist will mix dose of 99mTc-sulfur colloid with ½ the volume of a normal feeding of formula or milk. A second amount of unlabeled formula or milk, ½ the volume of a normal feeding, should be in hand when feeding the infant to complete the normal volume.

For Egg Allergy or Intolerance

Instant oatmeal replaces the scrambled egg whites in the standard meal as protocoled by the Nuclear Medicine clinician. The other items remain as described above. The Nuclear Medicine Pharmacy will obtain hot water either from the tap or heated by whatever means are available in the Nuclear Pharmacy. The Tc-99m sulfur colloid will be added to the dry oatmeal* and then 100 milliliters hot water will be added with gentle stirring.

* Packets of instant oatmeal are available from Nutrition Services along with the other meal items.

The normal ranges of this test have been validated in literature **only** with scrambled egg whites only. The use of the alternate meal means the validated ranges are not applicable. However, use of the alternate meal to assess pre- and post-medication changes is possible. The alternate meal must be used for both pre- and post-assessments.

Imaging Device:

- For upright imaging: GE Infinia or GE MPS with LEHR collimation
- For supine imaging using the camera's table: GE Infinia or Millennium VG with LEHR collimation
- For supine on a bed or cart imaging: GE MPS with LEHR colllimation

Data Acquisition:

- Matrix: 256 x 256 in word mode
- Time: 1 min/image
- Start imaging at the completion of the meal
- May use predefined acquisition protocol, **Gastric Empty Upright Dual**, for sequential imaging and **Gastric Empty Supine Dual** for simultaneous imaging
- Views: See Imaging Procedure below

Imaging Procedure:

Routine Adult/Child

- Have the patient eat all of the test meal in 10 minutes or less. Record how long the patient took to eat the meal; enter this time into the HealthLink/Radiant Study notes.
  - The meal may be eaten as a sandwich to decrease the time required for ingestion; if preferred, the eggs and toast may be eaten separately.
  - If all of the food cannot be eaten, the patient should eat all of the eggs containing the radiopharmaceutical (or alternative meal), and as much of the rest of the test meal as possible. Record how much of the meal was not eaten; a visual assessment is sufficient.
  - Time zero is when the patient **finishes** eating the meal.
- The imaging set includes Posterior and Anterior views
  - Imaging should be performed upright, but can be performed supine if the patient **cannot** stand for the required time. All images are to be taken the same way.
  - Each image should contain the distal esophagus, stomach, and proximal small bowel.
  - Upright: The anterior and posterior views will be taken sequentially, NOT simultaneously, for all upright imaging. Minimal time should be taken to turn the patient between the anterior and posterior views.
  - Supine on camera table: The anterior and posterior views will be taken simultaneously on a dual head camera. Supine imaging cannot be done on a single head camera; the time to rotate the head around is too long.
  - Supine on a bed or transport cart: For patients who cannot be transferred to the imaging table, a single 45 degree LAO view will be taken for each interval.
  - Follow up studies should be performed the same as the first study.
- The first image is taken immediately after the meal is consumed.
  - Then image the patient at 1, 2, 3, and 4 hours plus or minus 10 minutes. Remember, time zero is when the patient **finished** eating the meal.
  - View names should be *projection* x minutes, *projection* 1-hour, *projection* 2-hour, *projection* 3-hour, and *projection* 4-hour.
- During the wait times, allow the patient to get up and walk about between acquisitions. They may not eat or drink anything during this time.

Infant

- Have the infant drink labeled formula or milk. When the infant is done with the labeled formula or milk, give them the unlabeled portion to drink. The unlabeled portion is used to wash down residual esophageal activity.
  - Feed the patient in an upright position.
  - If infant is unable to drink, have the ward or clinic personnel insert an NG tube, if directed to by the Nuclear Medicine Faculty. This tube is pulled after feeding before imaging is completed by whomever inserted it.
- The first image is taken immediately after the infant finishes the unlabeled portion.
- Imaging thereafter per 15 minutes obtaining anterior and posterior images, as above.
- The scan is complete by the next normal feeding (to prevent crying from hunger)
  - Total scan time is approximately 2.5 hours depending on the current feeding schedule

Imaging Variations

- Alternate scan termination points –
  - Bring any concerns about timing to the Nuclear Medicine Faculty
  - Patient vomiting after the meal is consumed ends the study
- Other alternate meals and times not defined here will be defined by the protocoling MD prior to scheduling

Data Analysis: Use "**Gastric Emptying**" protocol on GE Xeleris workstation. Follow on-screen instructions for ROI placement.

- The ROI should include any visualized activity in the fundic (proximal) and antral (distal) regions of the stomach. Adjust the ROI with care to avoid including activity from adjacent small bowel, if possible.
- The processing protocol uses a **geometric mean** when two views, anterior and posterior, are used. The geometric calculation is the square root of the product of the anterior and posterior counts, SQRT(A * P). Time decay must be taken into account back to time zero, GE processing protocol accounts for decay.

Create a save screen using the color mode of the competed processed data and curve.

The final results, each time point, are expressed as a percent of counts remaining in the stomach with the total corrected counts at time zero being 100%.

PACS: Create a save screen using the B/W mode of the five images with ROI's and curves. Annotation includes orientation and image timing if the image labels are not used.

Send all save screens and raw data to PACS.

Interpretation: The final results are expressed as the percentage remaining in the stomach at each time point with the total gastric counts taken from the time zero image as 100%.

This protocol is based on the SNM Procedure Guideline for Adult Solid-Meal Gastric-Emptying Study 3.0*, 2/8/2009, the normal limits are shown in the table below from the SNM procedure.

The normal ranges of this test, described in Table 2 below, have been validated in literature with scrambled egg whites only. The normal range should be dictated along with the final results. The use of the alternate meal means the validated ranges are **not** valid. However, use of the alternate meal to assess pre- and post-medication changes is possible. The alternate meal must be used for both pre- and post-assessments

TABLE 2
Normal Limits for Gastric Retention

Time point	Lower limit (a lower value suggests abnormally rapid gastric emptying)	Upper limit (a greater value suggests abnormally delayed gastric emptying)
0.5 h	70%	
1.0 h	30%	90%
2.0 h		60%
3.0 h		30%
4.0 h		10%

Data are from *Am J Gastroenterol.* 2007;102:1–11.

Comments: A Nuclear Medicine staff or resident physician should be consulted to determine if additional views are indicated, or if the patient cannot ingest test meal.

Bibliography: Procedure Guideline for Adult Solid-Meal Gastric-Emptying Study 3.0*, 2/8/2009 from the Society of Nuclear Medicine.

Reviewed By: S. Perlman, D. Fuerbringer, S. Knishka

Scott B. Perlman, MD, MS Chief, Nuclear Medicine	Derek Fuerbringer, CNMT Manager, Nuclear Medicine	Scott Knishka, RPh, BCNP Radiopharmacist