

# **GASTRIC EMPTYING STUDY**

## **(Tc-99m-Sulfur Colloid in Instant Oatmeal)**

### **Overview**

- The Gastric Emptying Study demonstrates the movement of an ingested bolus of solid and/or liquid from the stomach into the small intestine. Various physiologic parameters may be quantified.

### **Indications**

- Diagnosis of functional gastric dysmotility (1-4).

### **Examination Time**

- Variable, ranges from 1 hour to several hours.

### **Patient Preparation**

- Overnight fast.
- The study should be done in the morning because the gastric emptying time varies with the time of day (5).

### **Equipment & Energy Windows**

- Gamma camera: Large or small field of view.
- Collimator: Low energy, high resolution, parallel hole.
- Energy window: 20% window centered at 140 keV.
- Computer.

### **Radiopharmaceutical, Dose, & Technique of Administration**

- Radiopharmaceutical: A wide variety of Tc-99m-sulfur colloid labeled solid foods have been used (1,6-9). One that is easily prepared is Tc-99m-sulfur colloid labeled instant oatmeal (1 package) reconstituted with water (2,8,10-12).
- Dose: 1 mCi (37 MBq).
- Technique of administration: Oral over 5 minutes or less.

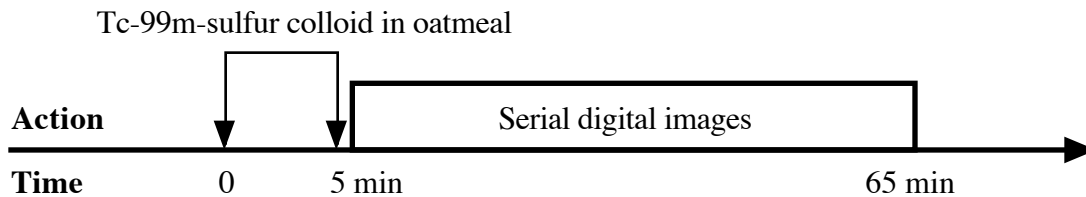
### **Patient Position & Imaging Field**

- Patient position:
  - > Adults: Sitting.
  - > Infants: Supine (13).
- Imaging field: Upper abdomen.

### Acquisition Protocol (14)

- Place the patient in a sitting position, LAO to the camera (15,16).
- Have the patient ingest the test meal in 5 minutes or less time.
- Acquire serial 1 minute digital images every 15 minutes beginning immediately after the patient finishes ingesting the meal:
  1. The patient should remain quiescent between image acquisitions because exercise decreases gastric emptying times (17).
- Acquire images until the counts in the gastric region of interest have fallen by more than 1/2, but at least for 1 hour. (Gastric counts can be determined for each image while waiting to begin the next acquisition.)

### Protocol Summary Diagram



### Data Processing

- Draw a region of interest around the entire stomach, but exclude as much small intestine as possible in each image. Record the gastric counts for each image (see Gastric Emptying Worksheet below).
- Correct the counts at each time period for radioactive decay.
- Plot the results on linear-linear graph paper with “Time” on the X-axis and “Gastric counts” on the Y-axis. Determine the gastric emptying half-time (18):
  1. Connect the data points with straight lines.
  2. Draw a horizontal line through the Y-axis at a point corresponding to half the maximum (initial) counts.
  3. Draw a vertical line through the time-activity curve at the point where it is intersected by the horizontal line.
  4. Read the half-time of gastric emptying from the X-axis at the point where it is crossed by the vertical line.
- Normal range for Tc-99m-sulfur colloid labeled instant oatmeal is up to approximately 1 hour (11). It should be remembered that gastric emptying is affected by meal composition, volume, calorie content, and proportions of fat, carbohydrate and protein as well as gender and patient age (19-21).

### Optional Maneuvers

- Solid and liquid meal (22):
  1. Collimator: Medium energy, parallel hole.

2. Energy window (1-4,6):
  - > Tc-99m: 10% window centered at 140 keV.
  - > In-111: 10% window centered at 171 keV.
3. Radiopharmaceutical:
  - > Solid: Same as for solid meal only (see above).
  - > Liquid: 150 mL of water mixed with In-111-DTPA is added to the meal (6).
4. Dose:
  - > Solid meal: 1 mCi (37 MBq).
  - > Liquid meal: 250  $\mu$ Ci (9.25 MBq).
5. Technique of administration: Oral.
6. Acquisition protocol: Same as for the solid meal except acquire 2 digital images at each time period, 1 at the Tc-99m energy window and 1 at the In-111 energy window.
7. Data processing: Same as for the solid meal except that two curves are generated: 1 for the solid meal and 1 for the liquid meal. The counts for both solid and liquid meals must be corrected for scatter. There is approximately 8% scatter from Tc-99m into the In-111 window and 23% scatter from In-111 into the Tc-99m window (1).

- Gastric emptying can be analyzed by methods other than determining the halftime of emptying (23-26).
- Diagnosis and treatment of gastric emptying dysfunction can be performed at one sitting (27).
- Evaluation of antral contractions: Serial 1 second images for 4 minutes are obtained after each static image. The images are analyzed to produce a record of the frequency and amplitude of antral contraction (28,29).

### Principle Radiation Emission Data - Tc-99m (30)

- Physical half-life = 6.01 hours.

Radiation	Mean % per disintegration	Mean energy (keV)
Gamma-2	89.07	140.5

### Dosimetry - Tc-99m-Sulfur Colloid Solid Meal (31)

Organ	rads/1 mCi	mGy/37 MBq
Large intestine	0.46	4.6
Small intestine	0.24	2.4
Stomach	0.24	2.4
Ovaries	0.08	0.8
Whole body	0.02	0.2
Testes	0.004	0.04

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#### Normal Findings

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**GASTRIC EMPTYING WORKSHEET**  
**Nuclear Medicine Department**  
**Institution** \_\_\_\_\_

Name \_\_\_\_\_ ID \_\_\_\_\_ Age \_\_\_\_\_ Sex \_\_\_\_\_

Referring physician \_\_\_\_\_ Date \_\_\_\_\_

TECHNOLOGIST TO COMPLETE

Is the patient a diabetic? Yes\_\_\_ No\_\_\_

Has the patient had any gastrointestinal surgery? Yes\_\_\_ No\_\_\_

If so, describe \_\_\_\_\_

Does the patient take any medications to stimulate gastric emptying? Yes\_\_\_ No\_\_\_

If so, which \_\_\_\_\_

IMAGE ANALYSIS

<u>Time to image</u>	<u>Time post ingestion</u>	<u>cpm/gastric ROI</u>	<u>Decay correction factor</u>	<u>Corrected cpm/gastric ROI</u>
_____	0 min	_____	1.00	_____
_____	15 min	_____	1.03	_____
_____	30 min	_____	1.06	_____
_____	45 min	_____	1.09	_____
_____	60 min (1 hr)	_____	1.12	_____
_____	75 min	_____	1.16	_____
_____	90 min	_____	1.19	_____
_____	105 min	_____	1.22	_____
_____	120 min (2 hr)	_____	1.26	_____
_____	135 min	_____	1.30	_____
_____	150 min	_____	1.33	_____

Technologist \_\_\_\_\_