Nuclear Medicine
Gastric Emptying Scans
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Nuclear Medicine

• Is a field of radiology that uses unsealed radiation for diagnostic or therapeutic reasons
• Is a method of physiologic imaging, very different than x-ray or CT that is anatomic imaging
• Pt receives radioactive material by injection, inhalation, ingestion and then images are taken of radiation the patient then emits.

• All nuclear medicine drugs are radioactive with a half-life, and specific energy
  • Tc99m 6 hour half life, 140 KeV
Radiation Safety

- Pt receive a low dose of radiation for this study. However they become a radiation source.
- Physical half life - Decay of radiation
- Biological half life - Decay and elimination
• **Time, Distance, Shielding**
• The gamma exposure rate at 1 cm from 1 mCi is 720 mR/hr.
• Other imaging studies exposure (estimates)
  • Chest xray- 10 mR
  • Dental xray- 1.5 mR
  • Chest CT- 700 mR
RADIATION DOSE ESTIMATES FOR ORAL ADMINISTRATION OF Tc-99m SULFUR COLLOID

Estimated Radiation Dose Equivalent (mSv/MBq)

- Organ
- Lower Large Intestine Wall: 0.080
- Small Intestine: 0.058
- Stomach Wall: 0.034
- Upper Large Intestine Wall: 0.12
- Ovaries: 0.024
- Bone Surfaces: 0.0041
- Red Marrow: 0.0046
- Testes: 0.0012
- Effective Dose Equivalent: 0.025

1 mCi = 37 MBq
Gastroparesis

• Gastroparesis is a syndrome of objectively delayed gastric emptying in the absence of a mechanical obstruction. Cardinal symptoms of nausea, vomiting, early satiety, bloating, and/or upper abdominal pain

• Incidence of gastroparesis was 2.4 per 100,000 person-years for men and 9.8 per 100,000 person-years for women. The age-adjusted prevalence of definite gastroparesis was 9.6 per 100,000 persons for men and 38 per 100,000 persons for women.

Gastroparesis

• Ideopathic
• Diabetes mellitus—is the most frequently recognized systemic disease associated with gastroparesis.
• Medications-
  • Clonidine, Calcium channel blockers, Tricyclic antidepressants, Glucagon
• Postviral gastroparesis often improves
• Post surgical- vagal nerve injury
• Neurological, autoimmune,
Symptoms

- Nausea
- Vomiting
- Abdominal pain
- Early satiety
- Bloating
- postprandial fullness
• Mechanical obstruction is not gastroparesis
• Methods to exclude mechanical obstruction
  • EGD
  • Anatomical imaging
• Alternatives to Nuclear Medicine study
  • Breath testing FDA approved this year
  • Wireless capsule
Treatment

- Control blood sugar
- Diet- reduce fat and fiber, avoid carbonated beverages and alcohol
- Pharmacotherapy
  - Metoclopramide- approved by FDA for no longer than 12 weeks of treatment. Has black box warning.
  - Erythromycin- effectiveness decreases over time
  - Domperidone- Not approved by FDA can be ordered from other countries
Protocol for Study

- Standardize
- Need to have a standard meal
- Each lab ideally will report reference range for study
- Pt eats “hot” meal in a set time frame
- Imaging done of abdomen, frequently short term imaging and delayed images
- Ideally keep pt in upright position
- Delayed imaging has greater sensitivity
• Hold medications that can affect gastric emptying for 2 days before study
• Be NPO for the study
• Be at stable blood glucose levels
Time to half

Exp. Fit (Min)  106.26

Raw Data (Min) $T_{1/2}$ time is off limits
EXAM DESCRIPTION
GASTRIC EMPTYING STUDY

CLINICAL HISTORY:
Post infectious gastroparesis.

TECHNIQUE:
A period of fasting, the patient was fed a test meal consisting of 1/2 egg salad sandwich, 1 cup peaches, 3 oz low-fat milk and 4 oz of water tagged with 1 mCi of Tc-99m sulfur colloid. The patient consumed the meal within 10 minutes, and images were then obtained in the LAO projection over the abdomen for a total of 90 minutes. Images were obtained 1 min/frame throughout the study, ROI data was collected on the computer for calculation of half time of emptying and percent retention of radionuclide activity within the stomach. An image at four hours was also obtained. The decay factor for the 4 hour image is 1.587.

COMPARISON:
CT 5/20/2015.

FINDINGS
Intense activity was present the stomach, which decreased over time. Increasing activity in was noted in the intestines.

Percentage of ingested meal remaining in the stomach at 1 hr is 50 percent.

Percentage of ingested meal remaining in the stomach at 4 hr is 16.9 percent (The amount remaining in the stomach at 4 hours should be less than 10%.)

IMPRESSION:
Delayed gastric emptying at 4 hr.
**Exam Report**

- **EXAM DESCRIPTION**
  GASTRIC EMPTYING STUDY

**CLINICAL HISTORY:**
Diabetes, bloating.

**TECHNIQUE:**
A period of fasting, the patient was fed a test meal consisting of 3/4 egg salad sandwich and 6 ounces of water tagged with 1 mCi of Tc-99m sulfur colloid. The patient consumed the meal within 10 minutes, and images were then obtained in the LAO projection over the abdomen for a total of 60 minutes. An image at four hours was also obtained.

**COMPARISON:**
None

**FINDINGS**
Decreasing activity is noted in the stomach over 4 hr of imaging.

The amount remaining in the stomach at 1 hour is 92.1%.
The amount remaining in the stomach at 4 hours is 52.4%.

**IMPRESSION:**
Findings compatible with delayed gastric emptying.

**CONCURRENT SUPERVISION:**
I have reviewed the images and agree with the resident's interpretation.
Beyond basic gastric emptying

- Dual isotope studies
  - Can differentiate between solid and liquid
- Geometric mean
  - Can be done for large body habitus
- Esophageal transit
- GERD studies
Thank you