Metro South Health

PRINCESS ALEXANDRA HOSPITAL
Procedure

SECTION: Clinical **Procedure No.** 01643/v1/08/2017

PROCEDURE TITLE: Gastric Emptying ^{13}C Breath Test (Substrate: ^{13}C Octanoic Acid for Solid GE)

Review Officer: Senior Scientist, Department of Gastroenterology and Hepatology

Review Summary: v1

Applicable To: Scientific and laboratory staff using the gastroenterology laboratory

Date Introduced: 08/2017

Next Review Date: 08/2020

Authority: Director, Department of Gastroenterology and Hepatology

Replaces: New procedure

Key Words: solid gastric emptying, ^{13}C, octanoic acid

PURPOSE
To ensure the test is administered correctly and efficiently

PROCEDURE
The test provides physiological non-invasive quantitative data to assess the gastric emptying of solid food. ^{13}C-octanoic acid contains a carboxyl-carbon labelled with the non-radioactive isotope ^{13}C. After oral administration of the test meal containing ^{13}C-octanoic acid, the digested food containing the ^{13}C-octanoic acid passes through the stomach and is rapidly absorbed through the intestinal mucosa. It is transported to the liver where it is metabolised and oxidised. It then enters the bicarbonate pool in the plasma and is exhaled as $^{13}CO_2$ in the breath.
The test is undertaken following overnight fast. The test meal is standardised to allow comparability of tests. It consists of a scrambled egg where the yolk has been mixed with 91 mg ^{13}C-octanoic acid. The egg is eaten with two slices of white bread and 15 g of margarine, immediately followed by 150 mL of water. Before the test, a breath sample will be taken for baseline measurements. Since an increase in detectable ^{13}C in exhaled breath is compared to the naturally occurring ^{12}C in the breath, serial samples have to be taken. In the following four hours, breath samples will be taken every 15 minutes during the first two hours and every 30 minutes for the last two hours of the test. ^{13}C enrichment in the breath is determined by Infra-Red Isotope analysis (IRIS). The kinetics of appearance of ^{13}C in breath CO_2 reflects the rate of gastric emptying of the solid phase of a meal. The emptying of the labelled egg yolk products into the duodenum is the rate-limiting step.

OUTCOME OF THE PROCEDURE
The test results provide a reliable and valid measurement of gastric emptying

AUTHORISED TO UNDERTAKE THE PROCEDURE
The Scientist and anyone else trained in the procedure at the Department of Gastroenterology and Hepatology is authorised to undertake the procedure

INDICATIONS
Symptoms suggesting gastroparesis or clinical situations where gastric emptying rate needs to be quantified

CONTRAINDICATIONS
1. Nil to patient: Test is non-invasive and utilises a stable isotope of carbon that is non–radioactive and totally safe
2. Non-fasting compromises accuracy of results
3. Relative: medications that alter gastric emptying

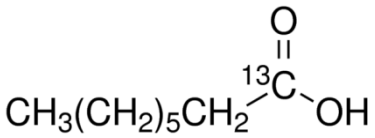
RISKS AND PRECAUTIONS
- Equipment failure
- Patient not following instructions
- Results are analysed on the IRIS instrument – instructions need to be followed as per manual in laboratory

STEPS OF THE PROCEDURE
Pre-Procedure Preparation
- Patient must present in the fasted state (10 hours)

- Smoking should be avoided the day before and the day of the test
- Food products with high concentrations of ^{13}C such as corn or pineapple should be avoided for 48 hours prior to the test

Patient Teaching
- Explain the purpose and length of time of the test, techniques used
- Provide patient with written and/or verbal instructions for conduction of the test

Substrates And Equipment



Molecular structure: ^{13}C octanoic acid
Linear Formula $CH_3(CH_2)_6{}^{13}CO_2H$

- ^{13}C Octanoic acid (Eurisotop Inc; INC610P; or 91 mg in bottles INC610P91)
- 1 extra large egg
- 2 slices white bread (Brumby's Bakery brand, approx 31.6 g each; 2.4 kcal/g = 75 kcal [may be thawed from freezer])
- 3 x 9 g (or 0.25 g per kilo body weight) Anchor butter (room temp - obtain from ward: 2 for bread, 1 for frying egg)
- 1 large serving plate
- 1 small frying pan
- 1 hotplate
- Breath Test Foil Bags (Wagner Analysen Technik) – 5 double bags, each section labeled with permanent ink with the numbers 1-13
- Breath Test mouthpieces (Wagner Analysen Technik)
- Stoppers (plugs)
- Stopwatch Timer
- Clipboard with run sheet indicating sample time intervals
- Pencil
- 1 disposable drinking cup
- 2 small dishes to separate egg yolk from white
- IRIS (^{13}C Infra-Red Isotope analysis System- Wagner Analysen)

Procedure
Breath Test sample (CO_2) collection:
1. Sample timings are indicated on the test timing sheet
2. Obtain the patients height and weight
3. Take a baseline breath sample by encouraging the patient to breathe in through the nose and gently blow into the mouthpiece

Test meal Preparation:
- Butter 2 slices of bread
- Separate egg yolk from white into small dishes
- Place frying pan onto hotplate and heat on medium. Add butter
- Mix the yolk with a fork. Pipette 91.4 µl ^{13}C Octanoic acid into the yolk. Lightly scramble the yolk and add the slightly beaten egg white and combine. Place evenly on both slices of bread
- Pour 150 mL tap water into a disposable cup

Caloric Content of meal:

egg	80 kcal
bread (2 x)	150 kcal
butter (1.5 x)	95 kcal
Total	**325 kcal**

4. Offer the test meal to the patient and advise that the meal plus water needs to be consumed within 10 minutes
5. The stopwatch is then started

Continuing Breath Test sample collection:

6. Samples are taken even 15 minutes for the first 2 hours and then 30 minutes for the next 2 hours – total of 13 bags (basal sample + 12 test samples)
7. Once the collection is complete, analyse on IRIS

Analysis Of Results

Calculation of results on IRIS:

- Results are expressed as δ values using the Pee Dee Belemite international primary standard
- The ^{13}C gastric emptying data is analysed by the IRIS software in a non-linear regression analysis for curve fitting reporting the gastric emptying half time, lag time and gastric emptying coefficient (GEC). The results incorporate for the time taken for the post gastric processes of absorption and metabolism of labeled substrate, as well as excretion of ^{13}C in the breath

EVALUATION METHOD

Assess outcomes against clinical norms. Document results in database.

SUPPORTING DOCUMENTS

01642 Protocol for Gastrointestinal & Liver Function Tests and Oesophageal pH Studies
01629 Booking Process for Gastrointestinal & Liver Function Tests and Oesophageal pH Studies

REFERENCES

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2. Perri F, Pastore MR, Annese V. ^{13}C-octanoic acid breath test for measuring gastric emptying of solids. Eur Rev Med Pharmacol Sci. 2005 Sep-Oct;9(5 Suppl 1):3-8. Review.