Going, Going, Not Gone! Gastroparesis and How it Impacts Diabetes

Elizabeth Tursi, RN, BSN, CDE
Roberta Silber, RN, MSN, CDE
Hunterdon Medical Center
Flemington, NJ

No disclosures to report for both Elizabeth Tursi and Roberta Silber
The speakers would like to THANK and acknowledge the Friends of Nursing at Hunterdon Medical Center for supporting our trip to AADE15.

Learning Objectives

1. Describe common etiologies of GP.
2. Define gastroparesis (GP) and diabetic gastroparesis (DGP).
3. List symptoms/clinical presentation of GP.
4. Discuss diagnostic assessment techniques.
5. Recognize treatment options for GP including dietary modifications.
6. Discuss how DGP impacts glycemic control and diabetes management.

Definition of Gastroparesis

Gastro – relating to the stomach
Paresis – slight or partial paralysis

Gastroparesis is defined as a chronic, symptomatic disorder of the stomach characterized by delayed gastric emptying in the absence of mechanical obstruction.

The Stomach

- Proximal stomach – receives and stores ingested food.
- Distal stomach – grinds solids into small particles which empties into the small intestine.
**Physiology Gastric Emptying**

- The rate of gastric emptying is dependent on the accommodation ability of the proximal stomach and antral and duodenal contractions overcoming pyloric resistance.
- The rate of gastric emptying varies with the physical texture, particle size, fat, fiber and energy content of a meal.

Ma, Rayner, Jones & Horowitz, 2009

---

**Gastric dysfunction in diabetes**

- Impaired function of the proximal stomach
  - Decreased accommodation
  - Tachygastria (increased rate of gastric emptying)
- Impaired function of distal stomach
  - Infrequent or low amplitude contractions of the antrum
  - Bradygastria (decreased rate of gastric emptying)

---

**Diabetic Gastroparesis**

- Tertiary center studies
  - 40% of Type 1
  - 10-20% in Type 2
- Actual Community Prevalence
  - ~5% Type 1
  - ~1% in Type 2

Choung RS et al. Risk of gastroparesis in subjects with type 1 and 2 diabetes in the general population. American Journal of Gastroenterology 2012: 107; 82-88

---

**Effects of Glycemia**

**Hyperglycemia**
- Slows rate of gastric emptying
- Reduces post prandial antral contractions
- Elevation in blood glucose within the normal post prandial range may delay gastric emptying by 20-30% in healthy subjects

**Hypoglycemia**
- Increases the rate of gastric emptying


---

**Common Etiologies**

- Systemic viral infection
  - Rotavirus
  - Norovirus
    - Symptoms usually resolve within one year
  - Epstein-Barr, CMV, Herpes Zoster
    - May develop autonomic neuropathy
    - Symptoms may persist for years

---

**Common Etiologies**

- Drugs
  - Opiates
  - Anticholinergics
  - GLP1 analogs
  - Pramlintide (Amylin)
  - Anti rejection drugs (cyclosporine)
Etiologies - continued
- Electrolyte Imbalances
  - Hypokalemia, hypomagnesemia, hypothyroidism
- Metabolic disturbances
  - Addison’s disease
- Rare Causes
  - Parkinsonism
  - Amyloidosis
  - Paraneoplastic disease
  - Mesenteric ischemia

Symptoms
- Nausea
- Vomiting
- Early satiety
- Postprandial fullness
- Bloating
- Abdominal or epigastric pain
- Postprandial hypoglycemia with or without other symptoms
- Asymptomatic in some
  - Vagal nerve denervation

Symptoms
- Nausea
- Vomiting
- Early satiety
- Postprandial fullness
- Bloating
- Abdominal or epigastric pain
- Postprandial hypoglycemia with or without other symptoms
- Asymptomatic in some
  - Vagal nerve denervation

Clinical Manifestations
- Anorexia
- Weight loss
- Malmnutrition
- Phytobezoar formation
  - Solid mass of undigested material such as fiber, skin, seeds
- Poor quality of life
- Impaired glycemic control (erratic delivery to small bowel)
  - Early hypoglycemia
  - Late hyperglycemia

Diagnosis of Gastroparesis
- Clinical history
- Gastric emptying studies
- Gastroscopy
  - to rule out an obstruction

Diagnosis of Gastroparesis
- Clinical history
- Gastric emptying studies
- Gastroscopy
  - to rule out an obstruction

Rule Out Obstruction
- Abdominal x-rays
- CT Scan
- MRI
- Upper endoscopy
  - Stricture
  - Mass
  - ulcer

Rule Out Obstruction
- Abdominal x-rays
- CT Scan
- MRI
- Upper endoscopy
  - Stricture
  - Mass
  - ulcer

Gastric emptying studies (GES)
1. Gastric emptying Scintigraphy
   Considered the standard for diagnosis of gastroparesis
   Quantifies the emptying of a physiologic meal.
2. Wireless capsule motility testing
3. Breath testing

Gastric emptying studies (GES)
1. Gastric emptying Scintigraphy
   Considered the standard for diagnosis of gastroparesis
   Quantifies the emptying of a physiologic meal.
2. Wireless capsule motility testing
3. Breath testing
Gastric Emptying Scintigraphy (GES)

- Non-invasive, quantitative physiologic assessment of gastric emptying
- Exclude mechanical or structural causes first
- Overnight fast
- Discontinue all drugs that affect motility 48-72 hours prior to test
  - Prokinetics, opiates, anticholinergics, GLP 1

GES (continued)

- No Smoking day of test
- No alcohol consumption day of test
- Fasting BG at start of test should be < 275 mg/dL
- BG after consumption of meal should not exceed 275 mg/dL
  - Take insulin and meds with meal

Society of Nuclear Medicine and Molecular Imaging and American Neurogastroenterology and Motility Society

- Standardized Test meal
  - 255 kcal
  - Low fat
  - Egg Beaters (120 grams)
    - Labeled with .5 mCi technetium-99m-S colloid radiisotope
    - 2 slices of bread
    - Strawberry jam (30 grams)
    - Water (120 ml)

GES (continued)

- Stability of the radiolabel binding of this meal has been validated
  The isotope must not separate from the solid and empty with the liquid phase
  Liquids empty quicker than solids

- Must consume this meal within 10 minutes
  - Time required for consumption must be recorded by nuclear med technician
  - Prolonged time for meal ingestion may affect measurements

GES (continued)

- Standard imaging of the gastric area in standing position.
  - Baseline (after meal ingestion)
  - 1,2, and 4 hours after meal ingestion
  - Anterior and posterior images obtained
GES (continued)

- Quantification of gastric emptying is performed using computerized software
- Results are expressed as the percentage of radioactivity retained in the stomach at each time point, normalized to the baseline value
- Delayed gastric emptying
  - > 60% retention at 2 hours
  - 10% or > at 4 hours

Normal GES

Immediate 1 Hour 2 Hours

Gastroparesis GES

Immediate 1 Hour 2 Hours

Pathogenesis of Diabetic GP

- Patients often present with other gastric comorbidities such as GERD, intestinal dysmotility, fungal and bacterial infections of the GI tract.
- Gastric dysrhythmias
- Impaired coordination between antrum & duodenum
- Impairment of the meal-induced relaxation of the gastric fundus

Kuo, Rayner, Jones & Horowitz, 2007

Pathogenesis of Diabetic GP

- Impaired glycemic control
- Vagal Neuropathy (extrinsic)
  - Cranial nerve #12
  - Releases stomach acid and digestive juices
  - Controls peristalsis
- Intrinsic neuropathy of stomach nerves
- Abnormalities of interstitial cells of Cajal
  - Smooth muscle contractility
- Loss of nitric acid synthase

Treatment of Diabetic GP

Goals of Care

Mild - controlling weight and symptoms through dietary adjustments to maintain glycemic control.
Moderate – diet and lifestyle modifications to maintain nutrition and stabilize glucose levels.
Severe – may require hospitalization, enteral or parenteral nutrition may be needed.
**Treatment**

- Correction of nutritional state
- Restoration of fluids and electrolytes
- Relief of symptoms
- Optimization of glycemic control
- Medications (prokinetic & antiemetic)
- Non-pharmacological

Camilleri et al., 2012

---

**TREATMENT ALGORITHM FOR GASTROPARESIS**

- Suspected Gastroparesis
- Confirm diagnosis, testing for cause
- Restoration of fluids and electrolytes
  - Dietary modifications
  - Glucose control
- Prokinetic therapy q AC
  - Antiemetics prn
- Consider feeding jejunostomy
- Decompressive gastrostomy
- Electrical stimulation OR
- Surgical Therapy

Camilleri et al., 2012, p. 32

---

**Nutrition – At risk patients**

1. Are < 80% of ideal weight.
2. Have a BMI < 20 kg/m²
3. Have lost 5 lbs or 2.5% of baseline weight in one month
4. Have lost 10 lbs or 10% of usual body weight in 6 months.


---

**Nutrition**

- Eat smaller, more frequent meals.
- Chew food well before swallowing
- Eat soft and liquid foods.
- Avoid large, high-fat meals.
- Avoid late-evening snacks.
- Avoid CATS: caffeine, alcohol, tobacco and stress
- Eat slower (30 minute meals)
- Do not lie down immediately after eating
- Sit up after meals for 1 hour.


---

**Food to avoid**

- Carbonated drinks
- High fiber foods
- High fat foods
- Avoid foods that lower esophageal sphincter pressure: peppermint, chocolate, fat and caffeine.

---

**Nutrition – improving glucose control**

- Eat smaller, more frequent meals that are as consistent as possible in carbohydrate count.
- About 2-3 carb choices per meal.
- Plan 3 meals and snacks with appropriate carb content.
Pharmacological Interventions

Prokinetic agents
- Increases antral contractions
- Correction of gastric dysrhythmias
- Improving antroduodenal coordination.
- Attempts to accelerate expulsion from the stomach.

Prokinetic Agents
• Metoclopramide (Reglan)
  - Dopamine D2 receptor agonist
  - Only US FDA approved medication for treatment of GP
  - No longer than 12 weeks
  - FDA black box warning
    • Extrapyramidal side effects
    • Motor restlessness
    • Tardive dyskinesia

• Domperidone (Motillium, Nomit, Molax)
  - T2 dopamine antagonist
  - Lower risk of CNS side effects (EPS)
  - Can prolong QT interval
    • Baseline EKG recommended
  - Not approved in US
  - May quality through expanded Access to Investigational drugs Program

Antibiotic
• Erythomycin
  - Antibiotic
  - Short term use
  - Not effective after several weeks
  - Risk with long term antibiotic use

Antiemetics - help alleviate symptoms
- Phenothiazines
- Prochlorperazine
- Thiethylperazine
- Antihistamine agents (including promethazine)
- Tricyclic Antidepressants (TCA)

Glycemic Control
Glycemic Control Type 1

• Major consideration
  – Coordination of the absorption of food with timing of insulin
  – This is true even in the absence of GP
  – With normal or accelerated gastric emptying, our fastest acting insulins are not fast enough!

Glycemic Control

• With no GP
  – Sharp rise in PP sugar
  – Ideally rapid analogs are taken 15-20 minutes before eating
  – Or use
    • Pramlintide
    • GLP1 (off label with Type 1)

Glycemic Control

• With Gastroparesis
  – A delayed rise in blood sugar that may last many hours
  – Early postprandial hypoglycemia with use of rapid analogs

What happens to blood sugar in GP?

• Expectation: a delayed rise in blood sugar that may last many hours.
• Earlier slide: The rate of gastric emptying varies with the physical texture, particle size, fat, fiber, and energy content of the meal. So all persons with diabetes have delayed emptying SOMETIMES

Pizza, Chinese food, pasta?

• What do we typically recommend for these foods?
  – Giving injection after the meal
  – Extended or square wave bolus
  – Dual bolus
  – Temp basal rate increase
  – Don’t eat these foods :) (Just kidding)

What insulin is best?

Need to be “creative” – evidence base for insulin regimens for patients with GP is lacking.

Morrison & Weston, 2013
What insulin is best?

- Regular Insulin?
  - Onset: 45-60 minutes
  - Peak: 2-3 hours
  - Duration: 6-8 hours
- Rapid acting analogs?
  - Onset: 10-20 minutes
  - Peak: 45-90 minutes
  - Duration: 4 hours

Use of CGMS Can be Helpful

- The exact timing of the rise in blood sugar can be seen
- Coordinate with fingersticks (lag time)
- Insulin type and timing of dose can be matched to start of the rise and peak blood sugar.

Dietary Recommendations

- Smaller, more frequent meals
  - Not a feasible recommendation for people using MDI
  - You say you want me to take How many injections per day?
  - Stacking boluses
  - Pump therapy

Pramlintide (Amylin) and GLP 1s

- Are we not inducing gastroparesis in an attempt to IMPROVE BG control when we use these agents?

Use of CGMS and Keep Notes

- Eat meal
- Take no bolus/injection
- When does BG start to rise?
- When is highest blood sugar?
  Correct the high and use the information obtained the next time food is eaten.
Yes, and it works! But we have to alter our insulin delivery, both dose and timing to be successful (reduce hyperglycemia and prevent hypoglycemia).

Pramlintide and GLP1s
These drugs are useful tools in improving control but cannot or will not be used in a client who has been diagnosed with gastroparesis. Misdiagnosis has implications and if gastroparesis is related to chronic hyperglycemia, it may not be a permanent condition so reevaluation should occur at intervals.

If a client says “I have Gastroparesis”
- Did they have a gastric emptying study?
- How was it performed?
- When was it performed?
- Were the results positive?
- Did they test your blood sugars when you had the test?
- Were your sugars high when you had the test?
- Do you still have symptoms?
- How did it or does it affect blood sugars?

CASE STUDY 1
- DAVE age 33
  - Type 1 since age 11
  - 2011 first seen; A1C 11.4%
  - Skipping meal injections
  - No follow up until 2014
  - Chose Omni pod pump
  - Cancelled visits because he was sick

- Three week period of nausea and poor appetite
- 9 lb weight loss in 4 week period
- Loose stool with mucus
- Constant bloating, gastric discomfort, gassy feeling, LUQ pain
• A1c 11.4
• Previously diagnosed with SIBO (Xifaxin)
• Treatment
  – Restarted Xifaxin
  – Nexium started
  – Dietary changes as noted previously
  – Gastric emptying study was performed and was noted to be the top end of normal; sugars not tested during study

Gastric Emptying Study
• Was it performed?
• How?
• Were the results positive?
• Did they test your blood sugars when you had the test.
• Were your sugars high when you had the test

Case Study 2
• Grace age 50 Type 1 since age 35
• On a pump; came for help with improving control and starting on CGMS
• Download showed constant snacking
• Suggested she talk to MD about Pramlintide
• Stated she had gastroparesis

Case Study 3
• Sharon – Type 1 since age 12 (age 39)
• Diagnosed with GP ~5 years ago
• Positive Emptying study
• BGs not tested during study
• Treated with Domperidone (Canada)
• She noted improvement with blood sugars after treatment started but did not understand why
Summary

- Ask questions if gastroparesis has been diagnosed
- Determine if and how glycemic control is being affected
- Evaluate insulin regimen being used and its effectiveness
- Remember reevaluation may be advised.

Bibliography


